5-2024

Examining the Relationship Between Mobile Phone Utilization on Self-Directed Online Professional Development Among Early Childhood Practitioners: A Preregistered Study

Jennifer Bowman
University of Arkansas-Fayetteville

Examining the Relationship Between Mobile Phone Utilization on Self-Directed Online Professional Development Among Early Childhood Practitioners: A Preregistered Study

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Education in Adult and Lifelong Learning

by

Jennifer Lynn Bowman
University of Arkansas
Bachelor of Science in Human Development and Family Sciences, 1996
University of Arkansas
Master of Science in Human Development and Family Sciences, 2013

May 2024
University of Arkansas

This dissertation is approved for recommendation to the Graduate Council.

_____
Michael T. Miller, Ed.D.
Dissertation Director

_____
Kit Kacirek, Ed.D.
Committee Member

_____
Kenda S. Grover, Ed.D.
Committee Member

Abstract

This study examines Arkansas early childhood practitioners' propensity for self-directed learning when using mobile phones to participate in self-paced online professional development. Further, the activity system model provides context for understanding practitioners' willingness to use technology, like smartphones, to adopt new information when interacting in online learning formats. The problem is that although we must offer professional development to ensure we have competent early childhood practitioners statewide, we are uncertain whether those practitioners have the propensity to use mobile phones to direct their online learning.

The purpose of this cross-sectional regression study is to examine the relationship between early childhood practitioners' mobile phone usage and their self-directed learning while considering the moderating influence of technology readiness when participating in asynchronous online professional development. This study aims to go beyond simply looking at the effect of mobile phone use on practitioners' propensity for self-directed learning. It also examines the potential for technology readiness to moderate the relationship between these factors through a multiple linear regression analysis utilizing survey data. The study's implications regarding practitioners' self-directed online learning when using mobile phones may provide insights for professional development stakeholders who govern, develop, and implement early childhood practitioner continuing education and workforce training.

Acknowledgments

First and foremost, I thank God for His guidance, grace, and blessings throughout this journey. My husband and family are among the greatest of those blessings and a constant source of love, support, and encouragement. John Bowman, thank you for being my rock and source of constant strength and inspiration; I am so grateful for you.

I want to express my deepest gratitude to my chairpersons, Dr. Kevin Roessger and Dr. Mike Miller, for their guidance and support throughout this dissertation. Dr. Roessger, your wisdom, patience, and encouragement have been instrumental in shaping the direction of my research and refining my ideas. I am also immensely thankful to the members of my dissertation committee, Dr. Kit Kacirek and Dr. Kenda Grover, for their contributions and support throughout my academic journey. Your expertise and insights have significantly enriched my educational experience and the quality of this work.

I would like to thank my friends and colleagues for their support and encouragement, both in times of triumph and adversity. To my cohort, your friendship has made this academic endeavor even more worthwhile. A special thanks to my dear cohort friends, Anna Amos and Becky Warren, for the countless late-night study sessions and steadfast encouragement. You not only made this journey possible but also fun and rewarding. To Larra Rucker, thank you for the last-minute insights and support when I was stuck or needed a sounding board. To my editor, friend, and early childhood colleague, Dr. Cathy McAuliffe, thank you for your keen eye and the insights you provided in this work. I also express my profound gratitude to Dr. Nikki Edge for her support and generously contributing access to data and resources for this study.

To all those who have contributed to this journey in various ways, your support and encouragement have been invaluable.

Table of Contents

Chapter One 1

Background of Study 5

The Value of a Skilled Early Childhood Workforce 5

Wicked Problems Facing the Early Childhood Workforce 9

The Child Care and Workforce Crisis 10

Digital Access Barriers and Opportunities 12

Mobile Learning Meets Professional Learning 13

Readiness for Online Learning 15

Need and Purpose 16

The Culture of Early Childhood Professional Development 16

Effective Early Childhood Practitioner Professional Learning 18

Early Childhood Practitioner Qualifications 20

Arkansas Early Childhood Systems 22

Arkansas Early Childhood Collaborative Partnerships 25

Arkansas Early Childhood Professional Development 27

Definitions 30

Research Questions 34

Scope and Limitations 34

Summary 35

Chapter Two 36

Conceptual Framework 37

Mobile Phone Use for Learning 37

Professional Development 51

Self-Directed Learning 58
Technology Readiness 70
Theoretical Framework 79
Activity Theory 79
Hypotheses 83
Summary 85
Chapter Three 87
Research Questions and Hypotheses 87
Methods 89
Study Design 89
Study Setting 90
Participants 91
Materials 94
Measures 102
Dependent Variable: Self-Directed Learning 102
Independent Variable: Mobile Phone Usage 103
Independent Variable: Technology Readiness 103
Control Variable: Age 104
Control Variable: Educational Attainment 104
Control Variable: Race/Ethnicity 104
Control Variable: Household Income 105

Control Variable: Urban/Rural Status 105
Data Collection 106
Data Analysis 107
Model 1 110
Model 2 110
Internal and External Validity 111
Summary 113
References 114
Appendices 135
Appendix A: Survey 135
Appendix B: Technology Readiness Index 2.0: Instructions 137
Appendix C: Technology Readiness Index 2.0 License and permission for use 138
Appendix D: Research Associates Transition to College Self Directed Learning Scale 139
Appendix E: Solicitation Email and Consent Form 140

List of Tables

Table 1: Arkansas Professional Development Registry Practitioner Levels 23

List of Figures

Figure 1: Educational and Technological Influences in Online Professional Learning 30
Figure 2: Activity Theory Framework for Mobile Learning 80
Figure 3: Statistical Model Illustrating the Interaction Analysis 111

Chapter 1: Introduction to the Study

The COVID-19 pandemic caused a sudden shift from traditional in-person learning and teaching to multiple online learning modalities (Scherer et al., 2021). For many early childhood practitioners caring for children from birth to age five, this was the first time they were responsible for navigating digital systems to find online professional development opportunities rather than the traditional in-person, pre-arranged, and group-oriented approach (Poole et al., 2020). Ongoing professional development is widely viewed as an effective approach to helping early childhood practitioners improve their teaching practice (Poole et al., 2020). As such, significant federal and state financial investments and resources are poured into developing effective practitioner training programs (Darling-Hammond et al., 2017). However, research yields mixed findings regarding effective, high-quality professional development approaches. For decades, effective and high-quality practitioner training has been considered a program that leads to changes in early childhood practitioners' teaching practice and positive outcomes for young children's development and learning (Brandisauskiene et al., 2020; Darling-Hammond et al., 2017; Sheridan et al., 2009; Welch-Ross et al., 2006.).

Traditionally, early childhood practitioners have attended in person mandated or state-approved professional development opportunities as a group or individually (Poole et al., 2020). Since the pandemic, the digital boom of virtual and technology-mediated learning has magnified existing gaps in the research literature regarding the effectiveness of online professional development programs (Bragg et al., 2021; Fitzgerald, 2023). Online professional development refers to many different learning modalities, such as asynchronous, synchronous, or a blended approach involving face-to-face interaction with an online component (Geng et al., 2019). Online learning typically involves educational activities requiring internet connectivity and various

digital devices, including computers, laptops, and smartphones, enabling learning experiences through multiple delivery modes (Jalongo, 2021). With technological advancements expanding the online delivery mode of training in formal and informal learning experiences, the need for understanding what constitutes meaningful and effective online professional development has never been more critical (Poole et al., 2020). A greater focus on online learning fails to recognize those practitioners lacking access to essential resources or the readiness to succeed in online learning formats (Jalongo, 2021).

Readiness is described as being prepared or willing to do something (Oxford University Press, 2023). Engaging in online learning requires a learner to be willing to explore new and varying technologies and learning modalities (Geng et al., 2019). Parasuraman (2000) describes technology readiness as the "propensity to embrace and use new technologies for accomplishing goals in home life and at work" (p. 308). Further, Parasuraman and Colby (2015) regard technology readiness as a mindset, not a measure of competence or knowledge, that has proven to be a stable characteristic that does not change easily for many people. For this reason, teachers' attitudes and beliefs about technology use may explain individual differences in technology readiness (Pozas et al., 2022). As technology advances, the use and implementation of Information and Communications Technology (ICT) becomes more prevalent. Information and Communications Technology refers to how information and communication are "created, sent, received, viewed, stored, and experienced through technological tools" (Nolan, 2019, p. 5). As technology evolves, ICT becomes more ingrained into the everyday practices of businesses, organizations, and learning settings. Practitioners in early childhood learning settings use ICT to communicate with parents through websites, apps, and social media. Cameras are also used for video and sound recording for observation and assessment purposes (Nolan, 2019). Many early

childhood practitioners engage in reflective practice by video and image recording of their teaching approaches that can be replayed and discussed with a mentor or coach to improve their techniques. Accordingly, abundant online information and resources for self-directed professional development aim to improve these teaching practices (Nolan, 2019). Blogs and social media sites for learning, communicating with colleagues, and gathering resources are ways early childhood practitioners have documented as preferences for engaging with ICT (Ibieta et al., 2017; McMeans, 2015). Practitioners worldwide have reported using mobile phones when participating in professional learning experiences, stating that phones are devices they already own, are affordable, and provide greater mobility (Fritschi & Wolf, 2012). Mobile phones also allow practitioners to move away from the one-size-fits-all approach to a more personalized and self-directed learning experience in small increments through professional learning communities or communities of practice (Fritischi & Wolf, 2012).

In 2012, the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center issued a joint position statement regarding best practices for media and technology use in early childhood programs (Pila et al., 2019). Since issuing the position statement, a 2014 survey found a two-fold increase in early childhood practitioners' tablet use in the classroom (55%), compared to 29% when surveyed in 2012 (Blackwell et al., 2015). When repeated in 2018, study findings revealed practitioners' increased use of technology in early-learning classrooms associated with increased access to mobile devices. Although practitioners stated they felt supported in using technology to communicate with parents, they reported feeling less supported in locating and navigating digital media sources for their own professional development needs (Pila et al., 2019). Key findings from early childhood practitioners demonstrate that their access to technology has increased since the 2014 survey, with

advancements in newer technologies like tablet computers, interactive whiteboards, and e-readers. Despite a lack of professional development geared toward educational technology, early childhood practitioners' attitudes toward technology were mainly favorable or neutral. Even so, the frequency of practitioners using these technologies varied significantly by the early childhood program type, practitioner occupation status, and age of children served (Pila et al., 2019). Blake et al. (2011) explain that Developmentally Appropriate Practice (DAP) is an underlying construct that significantly influences early childhood practitioners' attitudes toward technology. These beliefs are primarily centered around use in early learning settings. Developmentally appropriate practice is a term used to describe age-appropriate teaching practices (Blake et al., 2011). Many early childhood practitioners still hold firmly to the belief that technology, computers specifically, has no place in the early learning curriculum (Blake et al., 2011). Blake et al. (2011) stressed the need to reassess how technology's increasing use and role influences early childhood professionals' perceptions of technology use.

The field of early childhood is at a pivotal juncture where practitioners' online professional growth requires a deeper theoretical and empirical understanding of the *how* behind their engagement in digital learning contexts. In that regard, self-directed online learning is a significant concept to explore further when seeking holistic, sustainable approaches to professional learning. Self-directed online learning involves learners taking the initiative to plan, manage, and engage in their own learning activities using digital technologies without needing a classroom setting or instructor-led guidance. (Beach et al., 2022; Song & Hill, 2007). Mobile learning research suggests that mobile devices, like smartphones, can facilitate self-directed online professional development (Curran et al., 2019). However, to foster competence in autonomous learning, practitioners must have the opportunities to use these technologies for

learning in meaningful ways (Beach et al., 2022). Gaining insights into how early childhood practitioners engage with technology in self-directed online learning experiences can lead to improvements in the development of online professional development programs that foster the implementation of professional knowledge into their teaching practices (Hamre et al., 2017).

In this study, I aim to determine if early childhood practitioners' propensity for using technology influences the relationship between mobile phone usage and self-directed online learning when participating in asynchronous (self-paced) professional development programs. In this chapter, I provide a historical background describing early childhood practitioners' challenges and barriers when participating in online professional development, including those in rural or underserved areas. I then provide the widely documented need for high-quality early childhood online professional development designed with mobile users in mind. I further explain how technology readiness levels may hinder or facilitate the online self-directedness of mobile users when participating in asynchronous professional development courses. I then theoretically define concepts related to early childhood practitioners' mobile phone usage, self-directed online learning, and technology readiness, followed by the questions guiding the study. Lastly, I conclude this chapter by discussing the proposed study's scope and limitations.

Background of Study

The Value of a Skilled Early Childhood Workforce

Approximately 2 million workers comprise the early childhood workforce responsible for caring for 10 million of our nation's youngest learners, from birth to age five (Whitebook et al., 2018). Early childhood practitioners make up a vital subset of the early childhood workforce. For decades, empirical research literature suggested positive correlations between practitioners' educational attainment and teaching qualifications that have been directly associated with the

quality of learning outcomes for young children (Burchinal et al., 2002; Rucker et al., 2023; Vu et al., 2008). Specifically, continuing professional development is widely recognized as one of the most valuable means of education, thus enhancing early childhood practitioners' knowledge, skills, and competencies to provide positive learning experiences for young children (Brunsek et al., 2020; Hamre et al., 2017; Sheridan et al., 2009). Current educational policy initiatives heavily influence the increasing expectations of early childhood practitioners to have the knowledge and skills to provide meaningful learning outcomes for children (Sheridan et al., 2009).

The national policy initiative to advance early childhood practitioners' professional development is evident in the 2.8 billion comprehensive spending package that significantly increased investments in early care and education initiatives in 2023 (Fortner, 2023). Included in this package is increased funding to support the reauthorization of the Child Care and Development Block Grant (CCDBG) Act that originated in 1990 to enhance quality care options for infants, toddlers, and at-risk children from low-income families (CCDBG Reauthorization Act of 2014, Section 1086). In addition, the Preschool Development Grant Birth through Five (PDG B-5) was established in 2015 through the bipartisan Every Student Succeeds Act (ESSA), which reauthorized the Elementary and Secondary Education Act (ESEA) that was passed by Congress in 1965. The ESEA's purpose was to provide state funding to improve educational opportunities for at-risk children (Skinner, 2022). The ESEA funds were authorized to enhance professional development, educational instructional materials and resources, and promote family engagement (Skinner, 2022).

The Every Student Succeeds Act amended the ESEA to continue requiring states and public school systems to monitor and improve student achievement outcomes, particularly for

disadvantaged students (Skinner, 2022). The PDG B-5 grant builds upon these initiatives and existing federal, state, and local early learning investments. It focuses on five main activities: aligning existing programs, maximizing parental choice, building on successful programs, advancing stakeholder partnerships, and leveraging data for continuous improvement to enhance states' early childhood systems (The First Five Years Fund [FFYF], 2023). Currently, the PDG B-5 is divided into two types of funding sources. The first source includes the initial grants awarded to states to support a comprehensive statewide needs assessment and strategic planning efforts. The second funding source is renewal grants that provide funds to carry out the activities designated in states' strategic plans (FFYF, 2023). The 2023 PDG B-5 competitive grant is $315 million, $25 million above the FY2022 renewal amount to continue these improvement efforts (FFYF, 2023). The incremental increases in these initiatives attest to the significance of the early childhood field and illustrate the national need for a competent, well-trained early childhood workforce.

Increased funding mechanisms are instrumental in advancing accessible, effective, and quality early childhood professional development efforts. Offering accessible and quality professional development opportunities to early childhood practitioners has been an evidenced-based strategy for enhancing practitioners' skills and the level of care and education they provide young children (Fukkink & Lont, 2007). High-quality professional development consists of training opportunities that target specialized skills that enable early childhood practitioners to support and promote positive learning outcomes for young children (Zaslow et al., 2010). However, access to quality online training is sparse for many early childhood practitioners (Gomez et al.,2015). Although research suggests that early childhood practitioners prefer online learning modalities for convenience, accessibility, and self-paced learning options (Dede et al.,

2009), not all professional learners possess the learning skills needed to make these experiences worthwhile (Taskin, 2019). Those who do not possess the ability to organize their own learning processes may experience challenges and fall behind in a rapidly changing digital world (Bozkurt et al., 2022; Taskin, 2019). Some may also face digital access barriers and lack digital competence to participate in online learning experiences, especially for those in remote areas (Stone-MacDonald & Douglass, 2015). Due to the sudden shift to remote learning, many practitioners were expected to have or acquire the information and digital literacy skills necessary to successfully engage in self-directed online learning activities (Bozkurt & Sharma, 2020; Kim, 2020). Although some practitioners struggled to adapt to online learning due to a lack of skills, others struggled because they did not have access to household computers or the Internet (Leacock & Warrican, 2020). Some early childhood practitioners were particularly vulnerable due to digital access barriers associated with online learning (Dwyer et al., 2019). DiMaggio et al. (2004) describe digital access barriers as obstacles or limitations that prevent people or communities from effectively using and benefiting from digital technologies, such as the Internet, computers, and mobile devices.

The pandemic exposed challenges that exist in online learning for many practitioners, arising from the sudden shift to remote teaching and learning (Bozkurt & Sharma, 2020). Some of the most noted obstacles were inadequate mentoring and support, inequitable access to high-quality online professional development, and concerns about practitioners' competencies when engaging in digital learning formats (Bragg et al., 2021). These same issues impacted the training and education of prospective early childhood practitioners as they completed teacher preparation programs (Callaway-Cole & Kimble, 2021). Data from these prospective teachers during the pandemic revealed they felt underprepared to enter the early childhood workforce, citing the

need for increased teaching practice and continuous skill enhancement (Callaway-Cole & Kimble, 2021).

Wicked Problems Facing the Early Childhood Workforce

These issues illustrate the complex and wicked problems related to early childhood practitioners' qualifications, preparation, and adequate training that are not easily understood or resolved (Bird & Charteris, 2021; Rucker et al., 2023). Wicked problems are social or cultural problems without a clear solution or endpoint (Rittel & Webber, 1973). Historically, policy leaders have overlooked the problems ingrained in recruiting and retaining a highly skilled early childhood workforce (Bird & Charteris, 2021; McLean et al., 2021). For decades, barriers related to early childhood practitioners' educational and professional qualifications have plagued the early childhood workforce, thus creating disparities in their working conditions and the quality of care provided to children in various early learning programs (Bird & Charteris, 2021; McLean et al., 2021). Undervaluing the role of the early childhood workforce is rooted in decades of viewing early childhood practitioners as nothing more than babysitters (Gomez et al., 2015). This disparaging attitude minimizing the early childhood profession and practitioners' attributes regarding workforce competencies has led to inconsistencies across the workforce and variations in their qualifications (Gomez et al., 2015; Rucker et al., 2023).

These differences also impact the accessibility of quality professional development opportunities (Gardner-Neblett et al., 2021; Rucker et al., 2023; Schachter, 2015). A lack of consensus in standards and requirements for early childhood practitioners' professional preparation has resulted in low educational attainment and a lack of specialized training as the norm in many early childhood programs (Zaslow et al., 2010). Discrepancies in defining quality care and education and clear definitions of what specific educator qualifications and professional

development approaches lead to positive child outcomes are a concern across different sectors and states in the early childhood field (Buysse et al., 2009; Gardner-Neblett et al., 2021; Rucker et al., 2023; Zaslow et al., 2010). These variations contribute to inconsistencies within the early childhood education system that trickle down to creating an inadequately prepared early childhood workforce (Buysse et al., 2009; McLean et al., 2021; Gardner-Neblett et al., 2021; Rucker et al., 2023). A meta-analysis and systematic review of research literature suggests positive associations between early childhood educator professional development and advances in child learning outcomes (Brunsek et al., 2020). Still, there is a gap in the research regarding the effectiveness of online teacher professional development and the impact of the pandemic on online modes of teaching and learning (Bozkurt et al., 2022). Some pandemic-related literature highlighted the need for flexibility, human connection, child outcome-aligned content, cost-effective approaches, and technology as some essential elements of effective online professional development (Bozkurt et al., 2022; Poole et al., 2020), but all research note more empirical evidence is needed.

The Child Care and Workforce Crisis

Research identifying effective features, design, and delivery of online professional development for practitioners has never been more critical (Bragg et al., 2021). Since the pandemic started, the United States has experienced a childcare crisis resulting in the closures of approximately 16,000 childcare centers and licensed family childcare homes due to increased operating costs, decreased profit margins, and fewer children enrolled or regularly attending (Child Care Aware of America, 2022; McLean et al., 2021). Along with pandemic-related issues, the increased labor costs resulting from inflation led to a massive shortage of early childhood practitioners in the workforce (Child Care Aware of America, 2022; McLean et al., 2021). Since

the pandemic, the absence of available childcare and willing workers to fill these roles has led to global efforts to recruit and retain a competent and capable early childhood workforce (Fonsén et al., 2023; McLean et al., 2021). These workforce gaps have left early childhood administrators struggling to hire and train new teachers while simultaneously trying to provide quality care and education to the children and families they serve (Child Care Aware of America, 2022; Fonsén et al., 2023). In today's post-pandemic world, early childhood leaders and advocates are calling for reforming the early childhood educational landscape and professionalizing the field. Early childhood practitioners' qualifications and accessible, practical approaches to early childhood professional development are considered vital to the reform and rebuilding of the workforce (McLean et al., 2021; Rucker et al., 2023).

As early childhood education is trying to pick up the pieces of a broken system, it is doing so with poverty-level wages and novice early childhood practitioners trying to fill essential and specialized teaching roles (McLean et al., 2021; Pölzl-Stefanec et al., 2021). Hence, it is another wicked problem with no clear answer in sight. Bragg et al. (2021) suggest that the surge of online learning since the pandemic has magnified questions regarding effective practices and design elements in online professional development for early childhood practitioners. Additionally, Beach et al. (2022) suggest that research examining practitioners' learning experiences when navigating online learning environments can improve the design and implementation of these online programs. Further, online learning can be developed to enhance practitioners' ability to learn independently and provide content in relevant and meaningful ways (Beach et al., 2022). Evidence of the effectiveness of online learning may include "increased teacher capacity to collaborate with co-workers; increased ability to reflect on their practice; increased confidence in their teaching practice; or the implementation of teaching practices

learned from online professional development and their effect on student outcomes" (Bragg et al., 2021, p. 2). Therefore, additional research is needed to identify practical, applicable, and accessible design and delivery approaches to create high-quality online professional development opportunities. Furthering this knowledge is imperative to stabilizing and elevating the early childhood profession, workforce, and, most importantly, young children's educational and developmental outcomes (Brunseck et al., 2020; Bragg et al., 2021).

Digital Access Barriers and Opportunities

The pandemic not only highlighted the need for innovative approaches to professional learning, but it also called attention to the inequities that exist in available and accessible teaching supports provided to lower-wage earning early childhood practitioners when compared to their K-12 counterparts (McLean et al., 2021). The *Early Childhood Workforce Index 2020* emphasized that although K-12 educators had to adjust to online teaching and learning, they had the advantage of school district support to help them when facing these barriers (McLean et al., 2021). Early childhood practitioners lacked the same access to online professional development resources, especially in rural areas. Fewer resources and built-in support mechanisms exist geared toward helping early childhood practitioners be successful in this transition (McLean et al., 2021). Comparatively, early childhood practitioners were also disproportionately more likely to live in poverty, contributing to even greater digital access barriers and socioeconomic disparities (Ford et al., 2021; McLean et al., 2021). These issues draw attention to problems surrounding remote learning and work in rural communities for those impacted by the digital divide (Gallardo, 2022).

The digital divide gained prominence in the late 1990s, coinciding with the rise of the Internet and excessive investments in internet-related business and technology companies

(Warschauer, 2003). This technological boom first revealed various groups' educational, economic, and social disparities in digital access (Warschauer, 2003). Today, a global collaborative study evaluating the impact of COVID-19 on teaching and learning uncovered additional inequalities among those already marginalized and a part of the digital divide (Bozkurt, 2020). Across the globe, these digital access barriers provided significant contrasts, revealing that disparities persist in bandwidth distribution, data costs, and internet speed in places where Internet access is available. In a recent household affordability gap survey focused on those with incomes at or below the federal poverty guidelines, digital access barriers were reportedly a primary concern for many in rural areas (Education Superhighway, 2021). Rural respondents specifically noted concerns about the rising cost of cell phone bills because smartphones were their sole means of internet connectivity at home. According to a Pew Research study, 37% of Americans reported only using a smartphone when going online and cited this as a reason for not having household high-speed internet (Perrin, 2021). These barriers are influenced by various pre-existing socioeconomic factors, including age, employment status, educational history, locality, and household income, furthering the brunt of the impact of social exclusion for some learners in online learning contexts (Bozkurt et al., 2020; Rohs & Ganz, 2015).

Mobile Learning Meets Professional Learning

The availability, accessibility, and increasing affordability of smartphones have made these devices a staple in adult learning environments in the past decade, with learners spending several hours per day using smartphones (Graves et al., 2021). The accessibility of 5G devices has led to 4.4 billion people using mobile devices to access the Internet for some form of information attainment in 2022 (Global System for Mobile Communications Association

[GSMA], 2023). The smartphone adoption rate in 2022 for Americans was 89%, with a projected 91% by 2030. The rise in mobile technology adoption triggered many professional learners to incorporate digital, social, and mobile technologies (DSMTs) into their learning approaches to stay current on the latest information for their profession (Curran et al., 2019). The use of smartphones to direct their own learning and increase knowledge and expertise among online learners, including early childhood practitioners, is also rising (Haleem et al., 2022; Dwyer et al., 2019).

As the adoption of mobile devices and the Internet continues to rise, integrating these tools into education and training is becoming a universal practice (Curran et al., 2019). Mobile phones enable opportunities where users can learn in real-life contexts while accessing information to enhance their online experiences (Cheon et al., 2012; Domingo & Garganté, 2016; Gikas & Grant, 2013). They also allow personalized learning experiences that vary depending on people's unique preferences, skill levels, interests, or needs (Lam & Duan, 2012; McQuiggan et al., 2015; Nedungadi & Raman, 2012). Examining mobile phone characteristics used in learning tasks and assessing the barriers and influences involved in online learning is critical for improving professional learners' mobile learning experiences (Sophonhiranrak, 2021). Personalized online learning experiences provide greater autonomy and independence, supporting professionals' self-directed learning through readily available mobile technologies, like smartphones (Curran et al., 2019). Brockett and Hiemstra (2012) explain self-directed learning as a concept that involves two distinct dimensions consisting of personal learner characteristics and instructional transaction characteristics that are deeply connected to personal responsibility which serves as the foundation to self-direction in learning and learner self-direction.

Readiness for Online Learning

Additional research has shown that a contextual factor significantly impacting learners' self-directed online learning is technology readiness (Hong et al., 2014). Low technology readiness levels and evidenced digital inequities leave many practitioners siloed in their online learning experiences (Pozas et al., 2022). Technology readiness encompasses more than accessibility and affordability issues; it also encompasses a learners' sense of digital agency (Passey et al., 2018). Digital agency consists of three integral components consisting of competence, confidence, and accountability with technology that relate to one's ability to interact and adapt in a digital society (Passey et al., 2018). These components are essential to empower learners when engaging in mobile learning professional experiences (Koole, 2009). For early childhood practitioners, their attitudes and beliefs around the use of technology in early childhood curricula are also a critical aspect of their readiness to use technology in work and life (Pila et al., 2019).

Over half of early childhood educators with access to computers reported never using them for instructional purposes, according to a 2018 technology access survey of early childhood practitioners who worked in childcare centers, public school-based care, Head Start, and home-based programs. However, 52% reported using smartphones at least once a month for instructional purposes (Pila et al., 2019). These variances also were dependent on the type of early learning program in which practitioners worked. Practitioners who worked in school-based early learning programs in public schools used computers, the Internet, and smartphones more than practitioners in other early learning programs (Pila et al., 2019). Geng et al. (2019) argues that learners' technological readiness impacts their motivation, with increased motivation leading to better attainment of their learning goals. More specifically, Geng et al. (2019) found that self-

directed learners who embrace technology show greater motivation for online learning. These findings highlight the need for the current study to understand the influence of technology readiness on Arkansas early childhood practitioners' propensity for self-directed learning when seeking online professional development opportunities. This issue is particularly significant for those using mobile devices in rural areas to engage in asynchronous formats that do not offer immediate assistance or support. A lack of built-in support and resources may hinder their motivation to persist in online professional development learning opportunities (Karatas & Arpaci, 2021).

Motivation in learning is a central premise of Leont'ev's (1972) activity systems theory, which suggests that purposeful and transformative activity creates an interaction between subjects, such as early childhood practitioners, and objects, such as mobile phones. The conceptual framework for this study examines how practitioners' propensity for self-directed learning influences their ability to achieve learning goals when participating in self-paced online professional development. Further, the activity systems model provides context for understanding practitioners' willingness to use technology, like smartphones, to adopt new information when interacting in online learning formats. The problem is that although we must offer professional development to ensure we have competent early childhood practitioners statewide, we are uncertain whether those practitioners have the propensity to use mobile phones to direct their online learning.

Need and Purpose

The Culture of Early Childhood Professional Development

Even before the pandemic, a gap in the current literature existed concerning implementing and accepting mobile technologies in standard online teaching and learning

approaches (Karatas & Arpaci, 2021). As such, the outcomes for adult learners engaging in these online modalities are still not fully understood (Hao et al., 2017). According to a world report on mobile learning, the number of early childhood practitioners using mobile phones to access professional development opportunities is rising because of their flexibility and autonomy (Fritschi & Wolf, 2012). Mobile phones are a useful tool that facilitates practitioners professional learning and growth according to their schedules and preferences (Fritschi & Wolf, 2012). Throughout the United States and Canada, early childhood practitioners are required to receive continuing education credits or points for credential certification. Some states have reduced or eliminated these requirements due to the expense of sending practitioners to professional development activities (Fritschi & Wolf, 2012). Mobile technologies allow practitioners to get the training they need through various delivery methods, online courses, professional learning communities, or communities of practice, either alone or blended with face-to-face instruction (Fritschi & Wolf, 2012; Gunter & Reeves, 2016).

The advances in mobile technologies and increased online professional development offerings have shifted the culture of how, when, and why early childhood practitioners participate in professional development training (Gunter & Reeves, 2016; Poole et al., 2020). The pandemic spurred an increased availability of asynchronous online professional development offerings, creating more opportunities for practitioners to be self-directed in their professional learning pursuits (Bozkurt et al., 2022). Asynchronous learning experiences allow practitioners the freedom to participate in continuing professional development without being bound by place and time constraints. Asynchronous courses also allow practitioners to leverage mobile technologies, like smartphones, to facilitate online self-directed learning and potentially enhance their digital technical skills when support is included (Bozkurt et al., 2022; Kenny et al.,

2009). This literature presents an even greater need for future research to examine the effectiveness of asynchronous professional development formats and mobile delivery methods. The current study adds insights into the understanding of practitioners' propensity to be self-directed, autonomous, and independent in their online learning despite varying degrees of technology readiness. Creators of online professional development and other key professional development stakeholders may find the current study helpful in determining what types of built-in supports and resources can advance practitioners' self-directed online professional learning opportunities.

Effective Early Childhood Practitioner Professional Learning

Despite the delivery methods, effective professional development creates a shift in teaching philosophies (Fritschi & Wolf, 2012). One-shot workshops and short-duration training have shown to be ineffective, yet these types of training are still the norm for most teachers' professional development (Gunter & Reeves, 2016). Historically, many early childhood studies are inconclusive regarding the essential professional development features associated with early childhood practitioners' preparation that leads to positive child outcomes and children's school readiness (Burchinal et al., 2002; Herzenberg et al., 2005; McDonald et al., 2013). According to a meta-analysis and systematic review by Brunsek et al. (2020), the associations between early childhood practitioners' professional development and children's outcomes suggest that early childhood practitioners' professional development positively influences gains in children's learning. Ten out of 13 meta-analyses showed significant positive associations between child outcomes and early childhood professional development content across 48 different programs, with 402 unique child outcome measures used to assess program effectiveness. This review found additional positive associations between child outcomes and professional development

content when longer-duration training included coaching for early childhood practitioners. Conversely, professional development programs of shorter duration were more positively associated with positive child outcomes only when aimed at teaching a specialized skill (Brunsek et al., 2020).

Brunsek et al. (2020) emphasized that this research can inform educators, administrators, and policymakers about professional development programs that should be accessible or mandatory for early childhood practitioners as a quality assurance model for improving child outcomes. The authors suggest that ongoing research should investigate the specific training components and delivery methods of various online professional development programs to ensure that evidence-based professional development outcomes remain a quality indicator of enhancing the overall welfare of children's developmental trajectories. This recommendation presents a critical need for the current study to examine how practitioners' use of mobile phones influences their propensity for self-directed learning, particularly in self-paced professional development courses. It also emphasized the need to better understand how practitioners' willingness to use these technologies in novel ways influences this relationship in an evolving technology-meditated professional development landscape.

In a globalized society with constantly evolving technologies, the sustainability of teacher professional development programs is a focus of many current educational policies, curricula, and practices (Brandisauskiene et al., 2020). Leveraging these technologies to advance practitioner knowledge and competencies through sustainable practices requires specific skills that involve critical thinking, problem-solving, collaboration, and new ways of learning (Brandisauskiene et al., 2020). Self-directed practitioner learning is suggested as a sustainable approach to improving teachers' knowledge and practice in a way that moves them towards being

active creators rather than passive recipients of knowledge (Makovec, 2018; Sumaryanta et al., 2019). Even so, the variations in educator preparation programs and ongoing professional development requirements across the United States make it difficult to create consistency and sustainability in professional development and teacher preparation programs (McLean et al., 2021; Rucker et al., 2023; Whitebook et al., 2016). Although each state has a certification and licensure system that dictates initial teacher preparation and ongoing professional development requirements for K-12 practitioners, a cohesive model for early childhood practitioners' qualifications still does not exist (Early Educator Investment Collaborative [EEIC], 2020). The qualification requirements among various states differ according to state-level licensing and quality rating and improvement systems (QRIS) requirements (McLean et al., 2021). As of 2020, only 33 of the 50 states in the United States require some form of preservice training or certification for early childhood practitioners (McLean et al., 2021).

Early Childhood Practitioner Qualifications

A national movement by the National Association of Education of Young Children (NAEYC) seeks to professionalize the early childhood profession by developing a unifying framework of recommendations for enhancing practitioners' qualifications by establishing aligned preparation and career pathways (Bass, 2020). The Council for Professional Recognition (CPR), the governing organization for the Child Development Associate (CDA) credential, formed collaborative partnerships with numerous states and community colleges to create a task force committee to implement the national Career Pathways initiative (Washington, 2017). The initiative seeks to make the CDA credential a national requirement for aspiring early childhood practitioners through professional development training, practical experience, observation, and testing (EEIC, 2020). The CDA credential entails completing 120 clock hours of professional

development training in eight early childhood competency areas, which can be pursued through local community colleges or online through the Council for Professional Recognition (Washington, 2017).

In Arkansas, the Arkansas Professional Standards Committee presented the *Arkansas Workforce Knowledge and Competencies for Early Care and Education Professionals* to the Arkansas Early Childhood Commission for approval in 2017. Arkansas adopted these core knowledge and competencies to support statewide early childhood education programs and practitioners. The Arkansas Workforce Knowledge and Competencies (WKC) was revised in 2018 to contain the most recent knowledge, skills, and abilities essential for Arkansas practitioners caring for children from birth to age five. The Arkansas WKC (2018) contains a progression and range of knowledge, skills, and abilities that early childhood practitioners should know and be able to do in specific licensure areas within three competency levels (foundation, intermediate, and advanced). According to the Arkansas WKC (2018):

> Progression from one level of professional competency to the next is achieved through increasing amounts of professional development and education in the field. Educating and caring for young children requires a holistic approach and the skills to support them are intertwined. The WKC identifies specific skills in each competency to provide clear and focused guidance (p. 3).

According to The National Workforce Registry Alliance (NWRA; 2023), many state and local institutions of higher education and other early childhood education organizations provide free early childhood professional development training, both online and in person. These entities develop professional development programs to assist early childhood education programs and practitioners in achieving quality care and education to ensure school readiness. To effectively engage and assure accountability of the early childhood workforce, many states rely on practitioners' participation in early childhood education professional development registries

(NWRA, 2023). These registries connect practitioners to program licensing and professional development, as well as tracking and reporting professional development and career progression (NWRA, 2023).

Arkansas Early Childhood Systems

The Arkansas early childhood practitioner registry system, also known as the Arkansas Professional Development Registry (PDR), provides access to all state-approved professional development training (NWRA, 2023). According to Arkansas's Office of Early Childhood and current childcare licensing requirements, the minimum requirement to work in a licensed childcare center is the attainment of a high school or general education diploma. However, depending on the type of program, these requirements vary. Accordingly, all personnel who work directly with children must register with the Arkansas PDR and obtain at least 15 hours of continuing early childhood education training each year for the age group of children where practitioners spend most of their time (Division of Child Care and Early Childhood Education [DCCECE], Child Care Licensing Unit, 2020). Statewide funding is distributed to Arkansas higher education institutions and other early childhood organizations to develop various professional development training and resources. A major accomplishment of the 2019 Preschool Development Grant awarded to the Arkansas Division of Child Care and Early Childhood Education was strengthening the early childhood workforce through professional scholarships and targeted professional development (United States Department of Education, 2019). The 2023 PDG renewal grant will allow the state to continue this effort and enhance other essential strategic priorities. These priorities include accessible training and support for infant and toddler teaching staff and coaches, family engagement, and trauma-informed care facilitated through the

professional development registry system (National Institute for Early Education Research [NIEER], 2022).

All early childhood education training in the Arkansas PDR is verified and offered in collaboration with the Arkansas Department of Education or Department of Higher Education (DCCECE, n.d.). The Arkansas PDR serves as a repository for tracking the professional development training taken by early childhood practitioners throughout their careers. This compilation of professional development serves the dual purpose of fulfilling licensing prerequisites and assisting early childhood practitioners in recognizing career paths and shaping their own career trajectories within the early childhood education sector (DCCECE, n.d.). Table 1 details the requirements for each of the three professional development practitioner levels in the Arkansas PDR.

Table 1

Arkansas Professional Development Registry Practitioner Levels

Basic	Intermediate	Advanced
Practitioners who are developing an understanding and/or beginning to seek knowledge and skills	Practitioners who are frequently and/or consistently seeking knowledge and skills	Practitioners who have knowledge, ability to modify, evaluate and synthesize; and/or are fostering growth, exercising leadership and promoting advocacy

Note. The Arkansas Professional Development Registry is the tracking component of Arkansas' Early Childhood Education and Care Professional Development System (Arkansas Department of Human Services, 2004).

Despite states like Arkansas' efforts to ensure a highly trained and competent early childhood workforce, the lack of universally accepted standards and competencies for early childhood practitioners' educational requirements and qualifications creates inconsistencies and variations in practitioners' experience and education (Rucker et al., 2023). For many early

childhood practitioners, evidence-based, high-quality professional development training fills an essential gap in providing consistent and relevant knowledge and competencies (Brunsek et al., 2020). Additionally, the National Survey of Children's Health (2012) revealed that 22% of Arkansas children ages 2-8 had a diagnosed mental, behavioral, or developmental disorder. Unfortunately, this is one of the highest rates in the nation (Bitsko et al., 2016). Without the proper training and resources, early childhood practitioners are not equipped to help children with emotional, social, and developmental needs, putting them at risk for suspension, expulsion, and many other problems that will continue later into childhood and adulthood (Duran et al., 2009).

To equip practitioners with specialized skills, knowledge, and competencies, Arkansas has implemented an array of professional development, coaching, and technical assistance programs developed by early childhood experts across all state regions (Arkansas Department of Human Services [DHS], DCCECE; 2019). Arkansas's early childhood education landscape has received national recognition for its dedication and strategic efforts to improve the quality of early childhood education statewide (Alliance for Early Success, 2021). Arkansas was one of 21 states to receive a 2023 renewal PDG B-5 grant in December 2022 for $12,000,000 for investing in strategies to support and strengthen early childhood education and practitioners in the workforce (First Five Years Fund, 2023). As part of this work, the Office of Early Childhood prioritized developing effective and accessible training programs for early childhood practitioners (NIEER, 2022).

The emphasis on prioritizing accessible professional development training provides significance for the current study. Understanding how practitioners' readiness for online professional development influences their learning of critical knowledge and skills addressed

within these training programs will provide stakeholders with valuable information when creating and delivering these types of training. It will also provide insights for instructors and administrators at Arkansas two-year colleges when offering essential early childhood courses in online formats, particularly courses that qualify prospective early childhood practitioners for credentials such as a CDA.

Arkansas Early Childhood Collaborative Partnerships

The state-level distribution of the CDA credential through community colleges is crucial for professionalizing the early childhood workforce (CPR, n.d.). According to Roessger et al. (2022), proximity to a local community college is a primary predictor of enrollment for adult students despite the rise of online programs. This finding is relevant to the Arkansas early learning educational landscape since current or prospective early childhood practitioners must take all CDA coursework through an approved Arkansas college to earn college credit (CPR, n.d.). The T.E.A.C.H (Teacher Education and Compensation Helps) Early Childhood ® Arkansas Scholarship Program, a licensed Arkansas Early Childhood Association (AECA) program, developed partnerships with local community colleges and leverages almost all costs for current early childhood practitioners to obtain an associate degree. The scholarship will cover 90% of the cost of the CDA assessment (AECA, n.d.), and many community colleges have workforce grants that offer vouchers that can supplement the outstanding costs for any registration and assessment fees (Northwest Arkansas Community College, n.d.).

Since the pandemic, many CDA coursework, credit-bearing, and non-credit professional development training courses offered through Arkansas community colleges are delivered through synchronous or asynchronous online formats (CPR, n.d.). Northwest Arkansas Community College (NWACC) is one of many local two-year colleges that provide early

childhood education courses through a combination of options to meet early childhood practitioners' individualized learning needs (NWACC, n.d.). Practitioners can enroll in the early childhood degree program to earn an associate degree and take courses that make them eligible for the CDA assessment and credential. The credit-bearing courses are offered online and face-to-face (NWACC, n.d.). Some credit-bearing courses have professional development training courses embedded into the course so practitioners can earn both degree and continuing education credits that are applied in the Arkansas PDR system. On-demand professional development courses are also offered through the workforce and economic development departments at many of the two-year colleges in Arkansas (NWACC, n.d.). At NWACC, both courses have technology requirements, including a PC with Windows 10 or later and Microsoft Office 365, that may not be included in course enrollment (NWACC, n.d.). The online course offerings through local colleges provide greater accessibility and support for early childhood practitioners receiving the T.E.A.C.H Early Childhood ® Scholarship since they must work 20 hours per week at a participating early childhood education program (AECA, n.d.). Instructors facilitate both course options to help students navigate technical and learning challenges. Programs and resources are available through the college for enrolled students, such as information and digital literacy sessions through the library, that contribute notable skill gains for students navigating digitized learning modalities (C. McAuliffe, personal communication, November 5, 2023).

The flexibility of these online learning programs provides an accessible way for practitioners to obtain their degrees and professional development while continuing to work in the field (Weisenfeld & Connors-Tadros, 2020). Hands-on, interactive, and authentic approaches, such as those offered through community colleges, provide practitioners with valuable skills that will help them be successful in future online professional learning (Gunter &

Reeves, 2016). The support included in early childhood preparation programs through community colleges plays a pivotal role in helping practitioners obtain the necessary skills for participating in an increasingly more technologically advanced educational landscape. However, this begs the question, what implications does this have for early childhood practitioners seeking online professional development without these types of built-in supports that are essentially navigating this new way of learning on their own?

Arkansas Early Childhood Professional Development

In my previous role as an Early Childhood Training Advisor during the pandemic, I was responsible for creating and delivering online professional development training to Arkansas early childhood practitioners. During this time, I observed that many practitioners experienced technological challenges when participating in synchronous and asynchronous courses. The expectation that they have the required technology and software at their homes and possess the necessary digital skills to navigate these varying online formats often led to frustration and, in some cases, withdrawal from training programs. When providing technical assistance to these practitioners, I realized many were trying to complete training on mobile phones. However, they did not have the knowledge, skills, or essential applications on their phones to comply with even some of the most basic course requirements, such as downloading and uploading a document.

Additionally, the broadband gap in Arkansas further magnified these challenges for practitioners lacking essential skills and resources by creating unequal access to the Internet in underserved areas (BDG, 2022). The broadband infrastructure gaps were so problematic that Arkansas Governor Asa Hutchinson contracted with the Broadband Development Group (BDG) to find solutions to this problem through research and community outreach from October 2021 to March 2022. The efforts identified 210,000 Arkansas households lacking proper broadband

access, with insufficient broadband defined as having less than 100+ Mbps access (BDG, 2022). An additional 100,000 households received coverage through various state and federal programs, but 110,000 remain unserved. The estimated cost of covering these areas is approximately $500 million (BDG, 2022).

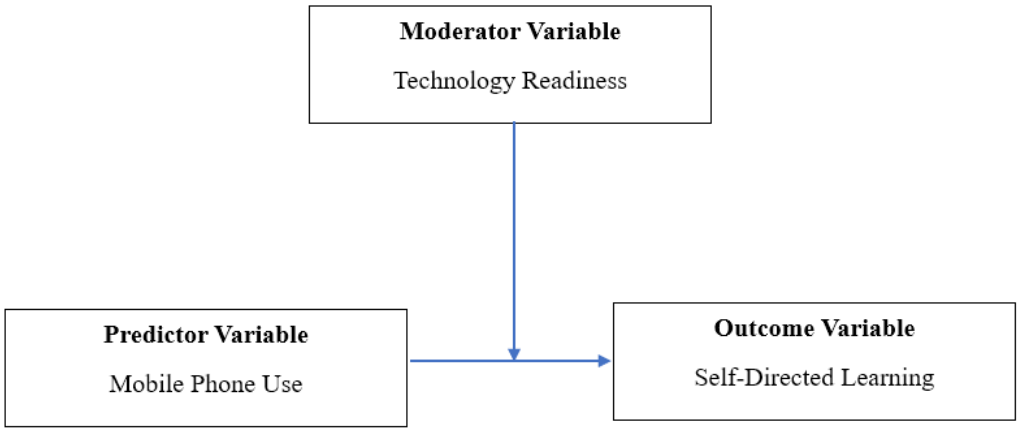
Addressing the barriers associated with online learning is particularly important for understanding the needs of Arkansas early childhood practitioners in technology-limited rural or remote areas. For many practitioners, online learning experiences vary due to differences in their digital skills, available technology, quality of resources, and geographical limitations (Bozkurt et al., 2020; Dwyer et al., 2019; McLean et al., 2021). Creating individualized and readily accessible professional development opportunities that support all early childhood practitioners' educational and technological needs further complicates the wicked problem of adequately preparing and training the early childhood workforce (Pölzl-Stefanec, 2021; McLean et al., 2021). This issue highlights the need for tailored professional development plans that include built-in support services to address the specific training needs of early childhood practitioners, including 21st-century digital and information literacy skills. In Arkansas, the Arkansas Early Childhood Individual Professional Development Plan (IPDP) is aligned with the Key Content Areas included in the Arkansas Workforce Knowledge and Competencies (WKC) for Early Care and Education Professionals. This resource serves as a guide for practitioners to create a plan for increasing their knowledge and skills for what they should know and be able to do as professionals in their early childhood roles (Lindblom & Pounds, 2016). The Arkansas IPDP can serve as a valuable tool for identifying and implementing essential educator competencies for successful online learning. However, not all practitioners utilize this tool because it is not a requirement of the childcare minimum licensing regulations (DCCECE, Child Care Licensing

Units, 2020). This study can provide stakeholders with insights regarding the need for training and support that could be implemented in the Arkansas IPDP to foster early childhood practitioners' self-directed online learning endeavors.

It is critical to understand the relationship between early childhood practitioners' online professional learning tendencies and their willingness to use technology to effectively engage in autonomous learning (Worth & Van den Brande, 2020). The purpose of this cross-sectional regression study is to examine the relationship between Arkansas early childhood practitioners' mobile phone usage and their self-directed learning while considering the moderating influence of technology readiness when participating in asynchronous online professional development. This study will enhance the understanding of early childhood practitioners' needs and preferences for online learning. It will also highlight the factors that positively influence their choice to use mobile phones to enhance their knowledge and skills. Gaining insights into the predictability of variables involved in early childhood practitioners individualized professional learning is fundamental in identifying what features, barriers, and factors of online professional development influence their propensity for self-directed online learning. A conceptual model in Figure 1 illustrates the relationships between the predictor and outcome variables involved in the study's concepts.

Figure 1

Educational and Technological Influences in Online Professional Learning



***Note**:* Two constructs of the current study are hypothesized to influence early childhood practitioners' propensity for being self-directed in their learning when participating in asynchronous professional development courses. The first construct, mobile phone use, directly influences practitioners' tendencies for being self-directed in their learning. The second construct, technology readiness, directly affects their propensity for self-directed learning and moderates (strengthens or weakens) the relationship between mobile phone use and self-directed learning.

Definitions

There are several prominent concepts in this study. The theoretical definitions and how they are situated in the study are as follows:

Asynchronous online learning: A mode of online learning in which students access and interact with course content at different times, rather than attending a live, real-time virtual class. This means that students can complete assignments, view lectures, and participate in discussions at their own pace and on their own schedule (Simonson et al., 2019).

Blended learning approaches: A combination of online training with face-to-face training that enables the use of various technology-mediated communication modes in the educational learning environment (Geng et al., 2019).

Broadband internet access: The transmission of wide bandwidth data over a high-speed internet connection (Consumer and Governmental Affairs, 2022).

Continuing Professional Development: "The intentional maintenance and development of the knowledge and skills needed to perform in a professional context" (The Continuing Professional Development Standards Office, 2023, para. 1).

Digital access barriers: Obstacles or limitations that prevent people or communities from effectively using and benefiting from digital technologies, such as the Internet, computers, and mobile devices (DiMaggio et al., 2004).

Digital agency: Consists of three integral components— competence, confidence, and accountability with technology that relate to one's ability to interact and adapt in a digital society (Passey, 2018).

Digital literacy: The ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills." (American Library Association, n.d., para. 1).

Digitization: The technical process of creating digital artifacts (information, resources, and processes) through converting, representing, and enhancing analog information (Gradillas & Thomas, 2023).

Early childhood education: The developmental definition of educating children from birth through approximately age 8, regardless of the type of program or learning environment (NAEYC, 2019).

Early childhood educator: A professional who works with young children, typically from birth to around eight years old, in a variety of settings, including preschools, childcare centers, and elementary schools (NAEYC, 2019).

Early childhood practitioner: Those who teach or who are administrators in early care and education programs serving children from birth to age five (Huss-Keeler, 2020).

Electronic Learning (e-learning): The use of digital technologies to deliver educational content and facilitate learning. It encompasses a wide range of activities, including online courses, virtual classrooms, webinars, and other digital tools and resources that enable learners to access educational content and interact with instructors and peers remotely (Ally, 2004).

Formal learning: Learning characterized by a predetermined schedule facilitated by a trainer or instructor leading to the attainment of a certificate upon completion. A governing body such as a school district or university typically oversees this type of learning (Levenberg & Caspi, 2010).

Informal learning: A form of learning that is controlled by the learner and occurs organically throughout their daily activities. It is unstructured and does not lead to the accruement of certificates for completion (Levenberg & Caspi, 2010).

Information literacy: Essential inquiry skills involving the ability to identify and effectively use appropriate learning resources and critically evaluate information from those resources to successfully achieve one's self-directed learning goals and objectives (Morris & Rohs, 2021).

Mobile learning (m-learning): A process comprised of social, cognitive, environmental, and technological factors in which learners consume and produce information when equipped with a mobile device (Koole, 2009).

Mobile phone usage: The use of a smartphone with the goal of accessing the internet (Graben et al., 2020).

Online professional development: The use of digital technology to provide practitioners with opportunities for learning and growth in their profession. This can include online courses, webinars, virtual conferences, and other forms of distance education that allow practitioners to engage with content, resources, and colleagues from anywhere with an internet connection (EdSurge, 2021).

Professional development: "Professional development in early childhood programs refers to a number of experiences that promote education, training, and development opportunities for early childhood practitioners who do or will work with young children aged birth to 8 years and their families" (Sheridan et al., 2009, p. 379).

Self-directed learning: Refers to learner self-direction as a personality trait characterized by the ability to take responsibility for planning, implementing, and evaluating their learning experience (Lounsbury et al., 2009; Brockett, 1983).

Self-directed online learning: A person's decision-making processes and learning behaviors that occur during informal online navigations (Beach et al., 2022).

Self-directed learning readiness: A person's perceptions of the attitudes and skills associated with self-directed learning (Guglielmino, 2008).

Synchronous online learning: A form of learning that consists of live facilitated virtual sessions that offer participants opportunities to interact with peers in the online learning environment (Fitzgerald, 2023).

Technology readiness: Refers to "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (Parasuraman, 2000, p. 308).

Research Questions

Three research questions guiding this study aim to evaluate Arkansas early childhood practitioners' mobile phone usage when engaging in self-directed learning experiences in asynchronous online formats. Further, this study seeks to understand how practitioners' technology readiness can potentially affect the strength of those relationships.

For early childhood practitioners in an asynchronous online professional development course:

RQ1: Is mobile phone usage positively associated with self-directed learning, after controlling for relevant participant variables?

RQ2: Is technology readiness positively associated with self-directed learning, after controlling for relevant participant variables?

RQ3: Does technology readiness influence the relationship between mobile phone usage and self-directed learning, after controlling for relevant participant variables?

Scope and Limitations

This study explicitly focuses on understanding how practitioners, with varying levels of readiness for technology integration, navigate and benefit from using mobile phones for self-directed learning when engaging in asynchronous online professional development. This study acknowledges that certain limitations and delimitations exist. The COVID-19 pandemic and the abrupt transition to online learning introduced a significant history effect that disrupted the existing educational landscape. This disruption might have influenced outcomes in ways unrelated to the effectiveness of the chosen online learning format and delivery modes. Further, generalizations of the study's sample are only representative of early childhood practitioners who participated in the specified asynchronous course and are not representative of a larger population. Limiting the sample to only one state, one specific population group and one delivery

method creates threats to external validity such as limited generalizability and limited diversity that could create extrapolation of the findings (Findley et al., 2021). The limited population diversity may also not allow for meaningful comparisons between different subgroups, making it difficult to identify unique or varying characteristics in other populations or locations. The study is delimited to one form of mobile technology, smartphones, so the data does not take into consideration the relationship if they had used a mix of devices (desktop computer, tablet, laptop), participated in longer duration training, or engaged in synchronous trainings.

Lastly, the proposed study will use multiple regression analysis to determine the statistical significance of the predictor variables on the outcome variable for Arkansas early childhood practitioners in an asynchronous online professional development course. However, the narrow focus of mobile phone users in one state and in one asynchronous course could pose a threat to external validity since each subcategory must have a sufficient number of respondents to achieve statistical significance in the results (Field, 2018).

Summary

This chapter provides an overview of the ways mobile phone usage and technology readiness influence early childhood practitioners' propensity for self-directed learning in online professional development. I present the need and purpose of the study and provide definitions of key concepts related to the study. Furthermore, I discuss how early practitioners' increased levels of technology readiness may lead to more self-directed learning after controlling for relevant participant variables and conclude this chapter with a discussion of the proposed study's scope and limitations.

Chapter 2: Review of Related Literature

Little research exists regarding early childhood practitioners' use of mobile phones as a predictor of their self-directed learning in online learning experiences. A growing amount of literature explores the concepts of mobile learning and self-directed learning. Still, there is little empirical research regarding how mobile phone use is associated with learners' propensity for self-directed learning. The absence of empirical research regarding early childhood practitioners' technology readiness and willingness to use mobile devices for online professional learning demonstrates a gap in the literature, particularly concerning asynchronous (self-paced) courses. In this review of relevant literature, I explore the study's key concepts and the relationships between those concepts within the context of the research problem. The first section of the literature review summarizes each concept's historical and conceptual underpinnings while examining the empirical and theoretical research surrounding each concept. Next, a discussion of how the theoretical framework informs the study is presented, along with the study's research questions and hypotheses. A compilation of existing literature revealed a gap, demonstrating a need for the current study.

The research strategy used to obtain literature that was less than ten years old began with an initial search within the University of Arkansas Libraries OneSearch databases of peer-reviewed literature and dissertations. The databases included ERIC, JSTOR, Sage Journals, Elsevier Science Direct, and ProQuest Central. Google Scholar was used to discover open-access articles. ProQuest Dissertation and Theses database was used to search for dissertations with a similar topic using a comparable methodological framework. The following search terms provided the foundation of articles and model dissertations for the study: Mobile learning, mobile devices, continuing professional development, self-directed learning, technology

readiness, digital divide, information literacy, digital literacy, and asynchronous online learning. Upon discovering the initial literature, a review of the references within those articles provided additional sources related to key concepts within the study.

Conceptual Framework

A review of the literature about early childhood practitioners' online professional development activities revealed that many educators and other early childhood professionals interact with information in digital formats using mobile phones. This mobile learning approach allows practitioners to participate in professional learning activities without time or location constraints. It also provides opportunities for early childhood practitioners to take initiative in their own learning process and foster learner self-direction. Through a complex interplay of digital and information literacy skills, mobile phones have the potential to facilitate practitioners in consuming, navigating, and managing information in meaningful ways (Koole, 2009).

Mobile Phone Use for Learning

Mobile learning (m-learning) is referred to as anytime, anywhere learning because of the capabilities of learning without the constraints of time or place (Attewell & Savill-Smith, 2005). An educational perspective for understanding the concepts of mobile phone use and m-learning is the Framework for the Rational Analysis of Mobile Education (FRAME) developed by Koole (2009). This m-learning framework offers insights for unpacking the complexity of mobile phone use, self-directed learning, and technology readiness related to social and personal aspects of early childhood practitioners' online professional development activities. The FRAME model provides a basis for evaluating the characteristics of mobile devices, such as smartphones, within post-secondary distance education and learning. Koole (2009) describes this process as mobile learning involving mobile technologies, human learning capacities, and the social aspects of

learning. Traxler (2007) previously suggested the need for a theoretical framework, a conceptualized definition of mobile learning, and corresponding evaluating methodologies. He emphasized how some m-learning supporters attempt to define this process by focusing on the technologies and devices involved. In contrast, others regard m-learning as centered around the users' experiences when interacting with these devices (Traxler, 2007). Lan and Sie (2010) elaborated on the concept of mobile learning by defining it as a model of learning that enables learners to access educational materials anywhere and anytime using mobile and internet technologies, most often smartphones.

The emergence of mobile and wireless technologies in the 1980s led to the development of fundamental mobile networks that opened the door for mobile learning opportunities (Qualcomm, 2014). The history of the mobile phone evolved with 1G services that existed from established frequencies with licensed telephones and cell towers. However, limited coverage and scalability issues plagued this era, laden with expensive technology (Qualcomm, 2014). The 1990s birthed the 2G revolution, leading to "more people in more places" using smartphones and supporting more scalable educational opportunities (Qualcomm, 2014, p. 10). In the early 2000s, resolutions for issues with the 2G networks and 3G paved the way for mobile broadband and smartphones as a new way of learning that was more experiential and contextualized within specific areas. This advancement generated the creation and use of current mobile learning content (Qualcomm, 2014; Jacott, 2010). By 2010, smartphones and the 4G wireless Long-Term Evolution (LTE) broadband made location-dependent learning a thing of the past. As such, e-learning took on a new context with global access to instructors and peers anywhere and anytime (Qualcomm, 2014).

Due to the transformative effects of mobile learning on adults' approaches to learning, Jacott (2010) suggested the need for a comprehensive framework for the emerging field of m-learning in teaching and learning for both formal and informal contexts. Although scholarly literature has recognized m-learning as an emerging field since the beginning of the 2000s, advances in mobile technology and increased publications still regard this as an emerging field of study (Pedro et al., 2018). According to Vavoula and Sharples (2009), the availability to access and learn from nonconventional situations has created an educational freedom that attracts many learners. Kukulska-Hulme (2007) suggested that fully understanding the effectiveness of mobile learning depends upon human factors such as users experience and behaviors and technological proficiency. Czaja et al. (2006) added that cognitive abilities are also factors that determine learners' capacity for learning when using novel mobile and wireless technologies. Kukulska-Hulme (2007) suggested that mobile technologies are becoming more favorably used for virtual learning but that many online learning opportunities lack a conceptualized framework with mobile users in mind. This research suggests that many educational applications were designed for computer users, not those using mobile technologies. Although this research is from the early 2000s, Weichbroth (2020) conducted a systematic literature study and found there still tends to be a large discrepancy in the features of various mobile devices and components within online formats, leading to usability issues. This also brings forth concern about how these usability issues may impact users online learning. A systematic review of usability studies related to mobile applications found that since the introduction of the first mobile devices, mobile applications need to be user-friendly for learning contexts to be effective and engaging (Weichbroth, 2020). The academic community's contributions highlighted confusion and inconsistency in the methodologies used in existing research. The involvement of academia

spurred a desire to bring clarity to the conceptual foundations and practices in the field of mobile learning. This interest also prompted the need for a comprehensive examination of usability studies focused on mobile applications for educational purposes (Weichbroth, 2020). Although Weichbroth's (2020) review of the literature indicates a need to understand how mobile devices impact learning, Hashim et al. (2011) developed a conceptual framework for mobile learning management systems targeting this need. This effort was spurred by the introduction of communication technologies, referring to mobile and wireless technologies as new learning modalities. A review of six mobile learning system frameworks made way for developing a proposed generic conceptual framework for a customized mobile learning management system to solve issues of compatibility and limited use with existing frameworks for mobile users (Hashim et al., 2011).

A significant number of studies examining mobile phone use in various learning contexts focus on student acceptance within secondary and postsecondary education. However, in a mixed methods study by Mohammadi et al. (2020), higher education instructors' use and acceptance of mobile learning in their teaching methods were evaluated in four dimensions through a mobile learning acceptance scale. The quantitative findings are consistent with a previous study by Brown (2018) investigating faculty perceptions of mobile learning that suggested that mobile phone use alone is insufficient for learning. Instructors scored above average in most dimensions—Ease of use, Self-efficacy, and Barriers, and scored only moderate in the Usefulness dimension. The above-average findings in the Barriers dimension suggest they believe many challenges and obstacles accompany mobile learning. This finding is consistent with results from a systematic review of mobile learning initiatives by Kaliisa and Picard (2017), citing the need for technical support to make the learning process beneficial for learners and

faculty. The study also found significant barriers similar to Brown (2018) and Mohammadi et al. (2020), indicating substantial challenges in mobile learning integration within higher education due to a lack of accessible mobile learning pedagogical skills among faculty and poor attitudes among students and faculty. Other challenges were related to the incompatibility of mobile devices with online learning management systems, poor technological infrastructure, and access to modern mobile technologies (Kaliisa & Picard, 2017). These findings emphasize the need for learning management systems to be compatible with mobile devices. This literature further illustrates a gap in existing mobile learning frameworks and the need for a comprehensive and streamlined framework geared towards instructional designers and online course developers to ensure equitable learning experiences for mobile users.

Qualitative findings of Mohammadi et al. (2020) regarding instructors' mobile learning lived experiences revealed three relevant themes: "benefits of using mobile devices in education, barriers and limitations of using mobile phones in education, and necessary infrastructure for facilitating mobile learning in education" (Mohammadi et al., 2020, p. 6). These themes confirmed the quantitative findings regarding the benefits of using a mobile phone, such as increased student participation, engagement, ease of management, and planning. However, qualitative findings weakened the effectiveness of mobile phone use in online learning, citing substantial barriers and challenges suggesting that mobile learning is still evolving, and a conceptual understanding of this concept is unclear (Mohammadi et al., 2020). Other studies by Thomas et al. (2014) and Coşkun Çelik and Karayaman (2018) corroborated these findings, referencing barriers and challenges with mobile phone use in specific learning contexts. The most significant takeaway between all of the studies citing barriers to mobile learning is the attitudes and perceptions of educators in adopting a mobile learning mindset. A great deal of

uncertainty still surrounds the usefulness of mobile phones across various learning experiences. This literature supports the need for the present study to gain insights into early childhood practitioners' attitudes and personality characteristics that can be a potential barrier when using mobile phones in their professional learning endeavors. Additionally, these studies support examining practitioners' technology readiness mindset to better understand how this could impact their online learning attitudes and experiences.

Despite hesitancy in adopting mobile phones into online learning, innovations in programs and software using technologies for accessing blogs, wikis, Twitter, YouTube, and other social networking sites have pivoted mobile devices to the forefront of formal and informal online learning environments (Park, 2011). Although mobile learning acceptance continues to grow, there are few instructional design guidelines based on a theoretical framework that exist or are widely accepted (Park, 2011). For this reason, Park (2011) compared three common approaches to digital learning. The first approach, mobile learning or m-learning involves the use of mobile or wireless devices that allows learners to engage in learning on the move. The second approach, electronic learning or e-learning includes the use of digital technologies to deliver educational content and facilitate learning. The third approach, ubiquitous learning or u-learning is described as learning that encompasses accessibility to a variety of digital devices to obtain information from anywhere at any time. The comparison of these learning approaches illustrated the technological attributes and pedagogical affordances of mobile learning, particularly regarding its use in distance education (Park, 2011). To provide a better understanding of the characteristics associated with m-learning in distance education, Park (2011) modified transactional distance theory to inform a pedagogical framework suitable for integrating mobile technologies into teaching and learning experiences. Characteristics of mobile device use for

various learning activities from previous studies were categorized into four types of mobile learning: 1) high transactional distance socialized m-learning, 2) high transactional distance individualized m-learning, 3) low transactional distance socialized m-learning, 4) low transactional distance individualized m-learning (Park, 2011). These four categories comprised a classification scheme within the mobile learning framework to inform instructors and instructional designers of best practices when designing online learning activities for mobile users (Park, 2011). This research is integral to the current study in understanding how asynchronous learning with mobile technologies can support learners in directing their learning in meaningful ways. The contributions of a mobile learning framework that considers users' personal characteristics are significant for course developers when designing online learning experiences. This framework serves as a valuable reminder for designers of online content to consider the information and digital literacy skills and overall technology readiness of users who will be engaging with the content and learning management systems using mobile phones.

Karimi (2016) examines the characteristics of existing research focused on motivating learners to use mobile technologies in virtual learning experiences. This study examines a mobile learning adoption model that accounts for mobile platform characteristics and learner characteristics, including learning styles and personal innovativeness. It also provides a mobile learning framework that has been empirically tested in formal and informal contexts (Karimi, 2016). Results suggest that individuals' learning styles and the perceived playfulness factor in the UTAUT model influence mobile learning usage in both contexts. Other factors from the UTAUT model, performance expectancy and personal innovativeness, were found to be only influential in specific learning contexts (Karimi, 2016). This study illustrates the role of learners'

characteristics in using mobile devices for online learning and emphasizes the importance of distinguishing between m-learning contexts.

This multidisciplinary research can inform developers of virtual learning platforms of specific needs for mobile phone users in online courses (Karimi, 2016). The research findings are highly relevant to the current study involving early childhood practitioners because they provide a mobile learning framework that has been empirically tested and could provide context for practitioners' future online learning experiences when using mobile phones. It also fills a gap in the existing literature by suggesting that learner characteristics are a significant predictor variable for determining how mobile devices may influence self-directed learning in online learning environments.

Mobile technologies have increased the ability to share knowledge without the confines of space and time, leading to increased critical thinking, collaborative learning, problem-solving, and improved communication skills (Abidin & Tho, 2018). Specifically, mobile phones can replace costly equipment that is limited to specific sites and does not have the flexibility of being portable. In a study examining the influence of mobile phones, particularly smartphones, to provide hands-on experiential online learning, an important concept addressed was the use of the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) instructional model. The ADDIE model is considered a systematic approach for an online instructional design methodology (Abidin & Tho, 2018). The researchers in the study used ADDIE principles to construct an engaging mobile learning experience using multimedia integration, flexible delivery options, and a learner-centric approach (Abin & Tho, 2018). Although the study's focus was not on adult learning, the framework presented can inform the future design of innovative mobile learning experiences for formal and informal learning contexts.

Empirical research of a five-month mobile learning project examined the peer-learning community aspects of using mobile phones to support the professional development needs of 40 educators and academic support staff (Kukulska-Hulme et al., 2008). The peer learning community aspects of the project consisted of workshops, clubs, a buddy system, and online learning modules. Findings revealed that participants engaged in familiar behaviors with mobile phones but did not try novel activities when using these devices within the online learning environments (Kukulska-Hulme et al., 2008). The researchers suggest that lack of ownership of the phones may have contributed to participants' limited desire to engage in new ways with the phones. Participants also reported negative responses about the smartphone's look and feel, adding to the barriers of successful use (Kukulska-Hulme et al., 2008). This study provides relevant insight for the current study regarding practitioners' use of mobile phones in novel ways as a challenge some may experience. It also highlights the importance of participants' readiness to engage with technology and online learning formats as context for the implications of mobile learning within the digitized transformation of both formal and informal educational landscapes.

Peng et al. (2009) expanded on the adult and lifelong learning aspect of mobile learning through a constructivist approach in formulating a framework that can be applied in various educational contexts. He explicitly addresses how mobile devices can be valuable tools in supporting workplace learning and activities. To do so, the researchers attempted to resolve the ambiguity involved in defining lifelong learning and separated this definition from adult education. In this effort, Peng et al. (2009) conclude that lifelong learning is a mindset that involves "learning in a natural, adaptive human process in the course of life" (p. 179). This resolution draws from Sharples's (2000) suggestions that technology supports this lifelong process by offering an individualized, learner-centered approach to learning that is collaborative

and universal. Additionally, Fischer (2001) contributed to the personal mobile technology construct of lifelong learning by offering reasons why novel technology is central to new ways of learning. The reasons include the relevancy of the information to current tasks, fidelity, and consistency of methods across diverse representations. Fischer (2001) explains that within a system, complex internal structures and relationships that connect information remain constant despite changes in the evolving nature of the system. As such, linking practical activities and spaces to reflective opportunities that can elicit improvements or changes in learning is crucial in mobile learning approaches. Fischer's (2001) contributions to this mobile learning framework are critical when considering mobile device use in practitioners' professional development contexts. Peng et al. (2009) suggest that pertinent to the successful implementation of this framework, stakeholders need to be on the same page regarding guidance and resources for integrating mobile technology into educational contexts.

A systems model for organizing the various factors involved in the adoption and use of mobile devices examined continuing professional development for health and human service workers in a study by Curran et al. (2019). This study utilized a mixed-methods case study design to explore the use of DSMTs to promote learning and workplace performance among health professionals. The quantitative findings revealed that most respondents (53.8%) used smartphones to participate in continuing professional development. They reported the benefits of mobile learning via phones, including better access to information, the potential for more significant knowledge gain, staying current in the field, and the ability to validate information. The most significant barriers included the expense of applications and resources, insufficient functionality of websites or programs on mobile phones, access to digital resources, and negative perceptions of social media use in the workplace (Curran et al., 2019).

Qualitative interview responses highlighted the flexibility and convenience of mobile learning, the independence it provided, and the benefits of self-paced learning to foster learners' self-direction. Rural and remote practitioners faced technical issues, and professional conduct in online spaces was a concern (Curran et al., 2019). However, the researchers suggest that empirical research on learners' self-directed learning experiences using mobile technologies in the digital age is underdeveloped (Curran et al., 2019). Throughout the article, the authors emphasize the need for a better understanding of the role and use of mobile technologies to support working professionals' continuing professional development needs in an evolving digital age (Curran et al., 2019). The use of mobile phones for continuing professional development is of considerable importance to the healthcare profession. The parallels between healthcare and early education professionals' use of mobile phones to satisfy their continuing professional development requirements provide insights that can be applied to the current study to optimize online learning experiences for early childhood practitioners.

Ching-Jung et al. (2019) systematically reviewed experimental mobile learning studies to examine mobile learning trends. Sixty-three papers published between 2010 and 2016 were evaluated according to the activity theory framework regarding six essential factors: context, tools, control, communication, subject, and objective. The analysis of the mobile learning context factor included four items: independent, formalized, physical, and socializing contexts. The independent context considered that learners' environment is not always specifically designed for their learning tasks. The review of studies related to this context demonstrated that personalized learning approaches could enhance students' motivation and persistence in learning. Formalized context learning approaches such as context mapping helped students learn concepts, and gaming (augmented reality) aided students' satisfaction and effectiveness in the learning

experience. However, these benefits focused only on in-class learning. Authentic learning environments were the focus of the physical context for providing meaningful learning experiences. These environments were associated with better knowledge recall, better concept connections, and improved learning outcomes. Students also experienced a reduction in their cognitive load with an inquiry-based mobile learning approach that linked learning tasks to real-world contexts. However, findings revealed that this approach can be too complex for novice learners. This research demonstrates the importance of intentionally crafting guidelines and implementing built-in supports in mobile learning activities (Ching-Jung et al., 2019). Most studies were instructor-controlled rather than learner-controlled for the factors related to tools and control.

Nevertheless, some studies used mobile learning as a tool for guided reflection that engaged students in higher-level thinking activities. This approach to learning was an area that the researchers deemed as an upcoming trend in mobile learning. They also suggested a need for future mobile learning researchers to shift from the mindset of a mobile learning competency-based approach to more of a critical thinking approach that involves synthesizing and analyzing information. Although the study focuses on students, the activity theory framework in assessing online content for mobile users is also applicable to formal and informal adult learning contexts. The researchers' recommendations provide relevant information for designing and delivering online professional development, particularly self-paced formats, without instructor facilitation.

To better understand the complexities of online continuing education and mobile technologies, Burden et al. (2019) addressed principles for designing innovative mobile learning experiences by introducing mobile pedagogies that illustrate the characteristics and benefits of mobile phones to enhance learning. A survey capturing the responses of professional

development providers and teachers indicated that providers of professional development most valued principles related to design authenticity when creating online training designed for mobile learning. In contrast, teachers emphasized that personalization and customization of the learning experiences were most significant to their learning experiences (Burden et al., 2019). This study adds to our understanding of critical factors when developing online professional development by examining the foundational principles used in effective mobile pedagogies. It also sheds light on the perceptions of the teaching professionals engaged in mobile learning activities and the creators of professional development responsible for designing and delivering continuing education opportunities.

More recently, Moya and Camacho (2023) conducted a systematic review of research literature from 2009 to 2018 to examine the characteristics of a sustainable mobile learning framework. Their meta-analysis of mobile learning research literature highlights that a significant amount of research yielded positive results in mobile learning. The most positive results included gamification, with the most frequent outcomes being gains in knowledge, content understanding, and affective and motivational outcomes. Although the findings from the meta-analysis are substantially positive, a gap exists in the pedagogical use of technological devices and digital resources to change educational patterns. This review demonstrated an absence of theoretical frameworks that produce sustainable and effective mobile learning adoption (Alsaadat, 2017; Ng & Nicholas, 2013). Barriers to embracing mobile learning were associated with technology resources, pedagogical factors, digital literacy, leadership, and personal characteristics related to attitudes and ethics. Moya and Camacho (2023) suggest that even though more than 60% of all jobs require workers to have a high level of skills related to an unprecedented growth in Information and Communication Technologies, sustainability for

adopting technology in education is complex. There has been limited research regarding technology integration for educational purposes, demonstrating the need to understand the characteristics involved in a practical mobile learning framework. Formulating a mobile learning framework to improve 21st-century competencies of creativity, collaboration, critical thinking, and communication is based on existing evidence-based pedagogical and technological strategies. The framework, borrowing from strategic management principles, considers learners' needs and evaluation indicators centered around five roles and responsibilities. These responsibilities focus on leadership, learning and development, central roles in learning, facilitation of learning, and strategy development. Moya and Camacho (2023) suggest the facilitation and design of professional development is a responsibility included in learning and development. The stakeholders chosen to implement the framework were leaders, teachers, learners, families, and community members. A literature review related to the framework's impact on each stakeholder revealed that teachers are responsible for developing and facilitating learning designs and their own professional development. The most significant limitation of Moya and Camacho's (2023) study is that the mobile learning framework needs empirical testing. The researchers suggest studying the framework in diverse educational contexts to determine if there are areas for omission or if critical components are missing.

Despite a systematic review of the literature and increasing demand for online professional learning opportunities since the COVID-19 pandemic, there has yet to be a widely accepted mobile learning framework that represents the diverse needs of today's mobile learners (Koole, 2009; Moya & Camacho, 2023; Park, 2011). The use of mobile phones, particularly smartphones, and the capability of mobile learning to make learning accessible anywhere and anytime has been the focus of many empirical studies since the 2000s. While much of the

literature reviewed supports mobile learning as a valuable way of accessing online resources and participating in collaborative partnerships with others, research is lacking to better understand the barriers centered on the usability and functionality of smartphones in both formal and informal learning experiences. However, no widely accepted comprehensive mobile learning framework exists. More important than a reliance on a mobile learning framework was the implication from Peng et al. (2009) that the work is futile without leadership agreeing on implementing mobile technology in educational contexts. The literature revealed an interesting perspective for future research. It supported the current study regarding how learner characteristics influence mobile learning experiences and provided considerations for implementing this approach into a mobile learning framework geared toward users with various online learning competencies and attitudes. An important discovery within the literature was the Analysis, Design, Development, Implementation, and Evaluation instructional (ADDIE) model as a systematic approach for an online instructional design methodology used to construct mobile learning experiences. This framework has the potential to inform the future design of innovative mobile learning experiences critical for ensuring early childhood practitioners can effectively engage with online professional development using mobile phones.

Professional Development

Although an accumulating body of research on professional development has existed for decades, there is still no widely accepted definition. However, researchers and scholars have agreed that professional development is an ongoing process and sometimes refer to this process as continuing or ongoing professional development (Scales, 2011). Continuing professional development is a life-long learning process whereby employees gain knowledge, skills, and experience above and beyond the knowledge they have obtained throughout their profession

(Scales, 2011). Continuing professional development can range from formal courses to informal approaches consisting of practical knowledge of everyday practices, such as communities of practice (Trentin, 2001). Communities of practice are information forums where practitioners share knowledge, have opportunities for self-determined learning, and seek more knowledge outside a specified professional development workshop (Blaschke, 2012).

More broadly, teacher professional development refers to the activities that develop educators' skills, knowledge, expertise, and other characteristics as a professional (Grimmett, 2014). One important aspect in defining professional development is identifying what is ineffective in traditional professional development efforts. Traditional teacher professional development is characterized by a predetermined one-size-fits-all approach that assumes all educators have the same learning goals, the same level of competence, and the same skill level (Prestridge, 2017). These type of experiences prove ineffective, with most educators finding little value in applying what they have learned to their teaching practice (Prestridge, 2017). This unsuccessful training method has brought about the need for a more customizable, intimate approach to teacher professional development in the form of instructional coaching. It has also increased the demand for individualized online learning opportunities (Gallucci et al., 2010; Kao et al., 2014).

Yen (2020) provides a historical account of teachers' professional development, crediting the most notable contribution of Horace Mann, which occurred as early as the 1800s. Mann introduced the systematic training of educators to improve their professional practice so they could provide students with a better education. Mann suggested this would lead to a more robust economy for the United States. Yen (2020) states that Mann was one of the first to set up a formal system of schools to provide teachers with professional development. From this, a

substantial amount of research has evolved to determine the outcomes of teacher professional development on student and teacher performance.

Previous literature has positively correlated successful professional development with better student outcomes and educator performance (Beach, 2022; Burchinal, 2002; Jaquith et al., 2011). Accordingly, effective teacher professional development consists of several elements, including a strong content focus, flexibility tailored to educators' needs, and active engagement in the learning experiences. Other influential elements include collaborative peer experiences, alignment with educators' knowledge and beliefs, and adequate training duration (Desimone, 2009; Dingle et al., 2011; Jaquith et al., 2011). However, the research lacks information on whether the factors leading to effective face-to-face professional development exist in online learning environments. Bragg et al. (2021) systematically reviewed the critical components that previous literature identified as effective in teacher professional development and presented these as necessary components in online learning experiences. Content knowledge, interactive learning, and discussion activities aligned with adult learning principles are associated with successful online professional development experiences when teachers have opportunities to share knowledge and collaborate with each other to achieve their goals (Bragg et al., 2021).

A review of relevant literature by Brandisauskiene (2020) examining successful, sustainable professional development opportunities within the 21st century discussed how the quality of the professional development experience significantly influences teachers’ success. This study examined characteristics of successful professional development consisting of teachers from four different countries. The findings revealed that there are two instrumental factors of effective professional development. The first essential factor is collaboration with other educators. The second critical factor was duration of the training. Long-term, job-

embedded, sustained teacher training was shown to produce more benefits than short one-stop shop sessions (Brandisauskiene, 2020).

The National Professional Development Center on Inclusion (2008) examined a growing body of literature suggesting that early childhood educators' teaching practice influences the quality of the classroom and child outcomes. However, little empirical evidence demonstrates a causal link between early childhood workforce qualifications and child outcomes or the methods that most effectively improve teacher practices (Buysse et al., 2009). To develop and validate a definition of professional development through a systematic review process, three core components of professional development evolved. The who, how, and what of professional development are critical to the level of engagement in ongoing professional development activities (Buysse et al., 2009).

Hamre et al. (2017) reviewed the latest research on the most effective methods for training and supporting early educators and ways research can improve and inform practice in early childhood programs. A well-trained early childhood workforce requires continuing professional development opportunities that are accessible, equitable, and relevant to the knowledge and skills needed to support the development and learning of young children (Hamre et al., 2017). A model for the delivery of effective professional development is outlined with elements that "target specific, focused teaching practices, is sufficiently intense to change practice, and uses strategies documented as most likely to change classroom behavior" (Hamre et al., 2017, p. 3). Several effective professional development models are designed around the Classroom Assessment Scoring System (CLASS; Pianta et al., 2008), which consists of a coaching model that has demonstrated positive impacts on educators' teaching practice and child outcomes. While research has suggested that online professional development offerings provide

a more efficient method for scaling professional development with high levels of fidelity, more research is needed to support policies that inform high standards for best practices and online learning frameworks (Hamre et al., 2017).

Accordingly, a review of thirty-five methodological studies on teacher professional development by Darling-Hammond et al. (2017) identified seven central aspects of effective asynchronous online professional development. The review revealed seven features of effective online professional development that can inform policy and practices centered on teacher continuing education. Effective online professional development must be content-focused, incorporate active learning, support collaboration, use models of effective practice, provide coaching and expert support, offer feedback and reflection, and be of sustained duration (Darling-Hammond et al., 2017).

In an empirical study conducted by Dwyer et al. (2019), early childhood service professionals and educators in Australia reported on their personal and professional use of technology to engage in self-directed learning to access online teaching resources. Findings indicated that practitioners use technology to inform their professional practice and knowledge base but mostly use it to engage in discussion groups and access informal resources. Technology allows early childhood practitioners to connect with others, particularly in in geographically limited areas and be autonomous in seeking ideas and practical information relevant to their teaching practice. The purpose and use of technology vary by years of professional experience, age, and socioeconomic context with which they work. The results bring to light early childhood practitioners' desires for collaborative professional development and learning and the value of mobile learning to make learning accessible in rural or remote areas (Dwyer et al., 2019).

An empirical research study consisting of a cluster-randomized trial by Yoshikawa et al. (2015) assessed the influence of a two-year professional development program consisting of workshops and in-classroom coaching on early childhood teachers emotional and instructional support, classroom quality, and child outcomes across sixty-four schools in Chile. Findings suggest a moderate to large positive influence on teachers' emotional and instructional support and classroom organization. However, post-test results showed no significant influence on child outcomes except a marginal effect on self-regulation and low problem behaviors. This finding contradicts studies in North America in which coaching and specific-content professional development have yielded significant positive effects on child outcomes and children's early skill development (Zaslow et al., 2010).

Study findings by Justice et al. (2009) also showed significant gains in children's early literacy outcomes after teachers participated in a 1-day workshop and committed to engaging in a 30-week book reading program. Educators then attended an additional 3-hour workshop midway into the program that included additional coaching. Several explanations could have accounted for the discrepancies in findings in Chile compared to North America, such as pre-school attendance being drastically lower in Chile than in North America and the dosage and prescribed frequency of strategies being inconsistent across each study (Justice et al., 2009).

A preliminary investigation of descriptive analyses revealed several factors involved in effective professional development training for the early childhood workforce from a convenience sample of aggregate data from nationwide online childcare training providers. The first factor is aligning staff knowledge and practice needs within their specific work context (Ackerman, 2017). Program elements such as the curriculum and the availability of onsite mentoring or coaching following any training are important factors in effective professional

development for training providers to consider (Fuglini et al., 2009; Howes et al., 2003; Vu et al., 2008). A second factor involves matching training with learning goals (Ackerman, 2017). The intensity and duration of training are critical components to support the content being distributed and mastered (Zaslow et al., 2010). Single training can help advance early educators' knowledge about a specific concept. However, consecutive training is often necessary to support educators in building on prior knowledge and improving their practice through engaging in higher-order activities (Minor et al., 2016). Thus, to expand early educators' knowledge and practice that lead to improvements in quality child-teacher interactions, intensive, extended duration training with a combination of coaching can be beneficial and is often necessary to influence positive child outcomes (Bagawan et al., 2023; Fabiano et al., 2018; Hamre et al., 2012).

Training delivery methods are the third critical factor in quality professional development training for early educators (Winton et al., 2016). Before the advent of online learning, early educators would participate in pre-determined on-site training. This approach would involve traveling to a location where the training was conducted and may consist of a follow-up with a coach or technical assistance provider at their school (Snell et al., 2013). Since the growth in online access, many community colleges, universities, and for-profit and non-profit organizations have offered online training targeted to early educators (Ackerman, 2017). However, research is inconsistent concerning the efficacy of these online trainings regarding educator's age, ethnicity, years of experience, program structure, and geographic location (Ackerman, 2017).

The design and delivery of effective professional development is foundational to a well-trained and prepared workforce (Winton, 2016). In the early childhood workforce, the characteristics that make quality, effective professional development are multi-factored,

consisting of training, coursework, and coaching to support educators' teaching practice (Ackerman, 2017; Early et al., 2017; Zaslow et al., 2010). This review of professional development literature cited a growing body of research regarding how effective professional development translates to online learning (Bragg et al., 2021; Dwyer et al., 2019; Darling-Hammond et al., 2017; Hamre et al., 2017). Nevertheless, gaps still exist in providing accessible, equitable, and meaningful online learning experiences that affect change in practitioners' practice. The crucial element for effective early childhood professional development is centered on evidence-based teaching practices that lead to positive child outcomes and school readiness (Buysse et al., 2009). Existing literature provides insights into efforts already in place to support meaningful and effective professional development programs (Bragg et al., 2020; Brandisauskiene, 2020). However, with the explosion of online professional development offerings readily available to early childhood practitioners, additional research is needed to develop frameworks and best practices for online design and delivery methods that support knowledge transfer to teaching practice.

Self-Directed Learning

From the onset of self-education in the 1800s, adult education emerged in the 1920s. As the adult education field progressed, teachers of adult learners began to find fault with the existing pedagogical model of childhood learning. Pole (1814) proposed a need for specific methods to teach adults in ways that treat them as equals of the teacher. The idea of adult learning or adult schools is believed to have originated in North Wales as far back as 1754 when adult parents started coming to a Welsh Charity School alongside their children to learn how to read the bible (Pole, 1814). The first record of a school exclusively for adults was opened in 1811 by an Episcopal Minister, Thomas Charles. He noted the need for a separate learning

institution for illiterate adults because of their reluctance to be associated with the children when coming to learn at the children's Sunday Schools. The school's success spread throughout the country, paving the way for a call for instruction intended specifically for adult learners (Pole, 1814). Since this new conceptualization of learning for adults evolved, there has been much ambiguity in research literature surrounding the idea of self-directed learning.

Snedden (1930) implied that this concept involved learners' social class and educational experience and suggested that these constructs were responsible for the differences in one's ability and willingness to take on self-education. This concept of self-directed learning emerged within the construct of adult learning, also known as andragogy, in the 1960s. Andragogy appeared as "a new label and new technology" of adult learning (Knowles, 1968, p. 351). Knowles (1975) described self-directed learning as "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" (p.18). Previously, Tough (1966) had characterized this concept as self-teaching and then expanded upon his idea to include self-planned learning. Tough (1978) described self-directed learning as the time spent on learning efforts for "acquiring and maintaining specific characteristics and skills or changing in one way or another" (p. 250). Throughout education literature, the concept of self-directed learning is associated with diverse terms, such as "open education, individualised instruction, discovery learning, student-centered instruction, independent study, and collaborative learning" (Candy, 1987, p.1). Candy (1991) suggests that the learner's moral, emotional, and intellectual autonomy characterizes their ability to be self-directed in their learning. This characterization portrays learners as self-managing and accepting responsibility

for administering their own learning. The lack of a cohesive understanding of self-directed learning divides scholars on what the term actually encompasses. Scholars committed to open education may regard individualized instruction as limiting and too narrow, whereas those vested in collaborative learning may posit independent study as too isolated and lacking interpersonal contact with a more experienced learner or facilitator of learning (Candy, 1987). Guglielmino (1978) introduced the concept of readiness for self-directed learning by proposing an instrument for measuring the attitudes and skills that lead to self-direction in the learning process called the Self-Directed Learning Readiness Scale (SDLRS).

In defining self-directed learning, Houle (1981) suggested that a lifetime of learning is necessary to sustain professional competence after formal learning. Houle (1981) proposed that this fundamental form of learning must be self-directed. In this view, Houle (1981) advocates that professionals must have an enthusiasm for learning that prompts them to continue learning throughout their careers. Oddi (1984) built upon Houle's (1981) continuing learning potential and challenged other claims that viewed self-directed learning as merely an instructional process. Oddi (1984) gleaned new perspectives that regarded self-directed learning as a fundamental personality construct in learning behavior characterized by initiative and persistence over time. From these formulations, Oddi (1984) harnessed the personality characteristics mainly instrumental in professional learning to coin a new term referred to as self-directed continuing learning. She also devised an instrument to measure this construct called the Oddi Continuing Learning Inventory (OCLI).

Long (1989) also focused on learners' personal traits by offering that self-directed learning consists of three dimensions: sociological, pedagogical, and psychological. Long (1989) proposed that in the psychological dimension, self-directed learning revolves around the degree

to which the learner actively maintains control of the learning process. In this dimension, the learner must take responsibility for the content and the learning situation for self-directed learning to occur (Long, 1989). In the pedagogical dimension, self-directed learning is defined by the extent to which one has freedom in determining learning goals and control of planning, implementation, and evaluation associated with the instructive or educational components of learning activities. The sociological dimension involves the independence of the learner in the learning situation. Long (1989) specifies that much of the self-directed learning literature is focused on the sociological and pedagogical dimensions of self-directed learning, ignoring the psychological dimension. However, when control is equally distributed in the psychological and pedagogical dimensions, a learner's psychological factors play a more significant role when compared to pedagogical factors (Long, 1989).

Grow (1991) expanded on these perspectives by proposing a Staged Self-Directed Learning Model. This model suggests that learners pass through stages of increasing self-direction that help them achieve greater self-direction. Grow (1991) further explains that mismatches between teacher style and the learners' stage of self-direction may hinder this process.

Brockett and Hiemstra (1991) expanded the concept of self-directed learning by proposing two essential characteristics of self-direction: 1) an ongoing effort of the learner to maintain control over learning decisions and 2) the learner's ability to access and make decisions from various suitable resources. As such, Brockett and Hiemstra (1991) proposed a Personal Responsibility Orientation (PRO) model of self-directed learning, suggesting that human nature is "basically good, accepting responsibility for one's own learning" and asserts that being proactive in one's learning is foundational to their model (p. 26). They suggested that self-

directed learners can maintain control over their learning regarding its purpose, content, and form. Garrison (1997) further elaborated on the personal responsibility of self-directed learning by explaining it as an approach where learners are motivated to assume responsibility and collaborative control of the cognitive (self-monitoring) and contextual (self-management) processes in constructing meaningful and worthwhile learning outcomes. Furthermore, Gibbons (2002) suggested that self-directed learning requires learners to take control of their learning journey by actively choosing what and how they learn. Gibbons (2002) specifies that this learning occurs through any gains in knowledge, skill, accomplishment, or personal development they select or bring about through their own effort.

A foundational qualitative study by Scott (2006) explored the perspectives of self-directed learners over age 50 to understand how they employ congruous autonomy to accomplish their self-directed learning endeavors. In this context, congruous autonomy occurs when learners achieve a balance between their personal autonomy and the external expectations imposed on them. Findings from a re-analysis of structured interviews in Scott's (2002) study and thematic analysis suggest that the learner's approach to learning had many commonalities. For example, reliance on a solid system of beliefs and values, identifying a strategy, and maintaining a commitment to the endeavor when encountering barriers were synonymous among the interviewees. Three principles emerged from their responses: "an ability to adapt, obstacles are part of the process, and a progressive realization of worthwhile goals" (Scott, 2006, p. 11).

Similarly, Guglielmino et al. (2008) noted that highly self-directed learners indicate "persistence and conscious redirection of learning projects to meet learner's needs" (p. 90) when facing challenges or barriers, experiencing interruptions, and having to restart in adult learning pursuits. Further, drawings from Candy (1991) support Scott's (2006) findings, suggesting that

self-directed learners acting upon intrinsically motivated choices propelled their learning pursuits. Scott's (2006) findings highlight the significance of congruous (harmonious) autonomy and efficacious (constructive) beliefs as critical factors in learning competence and one's commitment to the learning endeavor. The fact that age was a motivating factor in Scott's (2006) study is also instrumental in how these findings may be implicated in learners' online self-directed learning pursuits, particularly regarding their technology readiness.

Exploring motivation as a factor in self-directed learning, Lounsbury et al. (2009) conducted a study to determine the construct validity of self-directed learning measured as a personality trait. The personality traits being measured consisted of the Big Five and narrow personality traits. The Big Five traits are extraversion, agreeableness, openness, conscientiousness, and neuroticism, and the narrow traits are aggression, optimism, tough-mindedness, and work drive. Lounsbury et al. (2009) examined samples of 398 middle school students, 568 high school students, and 1159 college students to assess self-directed learning in relation to students' grade-point-average (GPA). Self-directed learning was related to all student levels of GPA and the Big Five personality traits of openness, conscientiousness, emotional stability (an alternative term for neuroticism), and extraversion. The narrow traits included optimism, career-decidedness, work drive, self-actualization, vocational interests, cognitive aptitudes, and life and college satisfaction. The study’s findings support the study's hypothesis that self-directed learning is a personality trait and that based on prior research, personality traits are stable across different periods of the lifespan. This hypothesized construct is evident in the sample of student outcomes that remained consistent from sixth grade to their junior year in college. A confirmatory factor analysis revealed a relatively high level of internal consistency, supporting their hypothesis that the Resource Associates Transition to College Self-Directed

Learning Scale (RATTC SDLS) scale consistently measured the same underlying construct. Although this finding is what the researchers expected, it does not imply that the underlying construct actually being measured is self-directed learning. Still, this study and further studies by Kirwan et al. (2010) provide empirical evidence that personality traits are associated with self-directed learning and that their inventory is a valid and reliable measure of self-directed learning. The findings of these studies are significant to the present study since they indicate that the RATTC SDLS is a valuable tool for assessing self-directed learning capacities since this is the instrument used to evaluate early childhood practitioners self-directed learning. It also provides a salient perspective for understanding how early childhood practitioners' goal-setting and online learning behaviors can be associated with specific personality traits.

Sumuer (2018) conducted a study examining predictors of self-directed learning with technology in an online learning environment of undergraduate students in Turkey. The hypothesized predictors consisted of self-directed learning readiness, using Web 2.0 tools for learning, and self-efficacy. Web 2.0 technologies refer to Information and Communication Technology that offer learners opportunities to engage in informal conversation and allow online learners to share, create, and collaborate on content in real-time. Web 2.0 technologies support online learners' self-directed learning by enabling them to explore content independently and interact with peers and instructors to further their learning (Sumuer, 2018). Self-directed learning readiness and Web 2.0 tools were significant predictors in the study, with self-directed learning readiness being the most significant predictor of self-directed learning with technology. Online communication and computer self-efficacy had a statistically significant indirect contribution to self-directed learning with technology using Web 2.0 tools for learning. This finding is instrumental for stakeholders and supporters of online learning formats regarding the multi-

faceted aspects of readiness in self-directed online learning. It begs future research to explore the readiness factor that proved to be the most significant predictor of self-directed learning with technology.

Karatas and Arpaci (2021) examined the mediating role of readiness for self-directed learning in the relationship between pre-service teachers' teaching-learning approach and lifelong learning skills. The study consisted of 800 pre-service teachers. Three scales were used to collect data on the relationship between self-directed learning and learning-teaching approaches. According to the mediation analysis results, the readiness of self-directed learning in the relationship between constructivist teaching-learning and lifelong learning tendencies had a fully mediating role. Constructivist teaching-learning approaches allow participants to actively construct their own understanding (Karatas & Arpaci, 2021). This finding means that readiness is an intermediary factor that helps explain this relationship. On the other hand, no significant relationship was found between the traditional teaching-learning approach and lifelong learning tendencies and readiness for self-directed learning. Their study findings indicate that the learning-teaching approach significantly affects readiness for self-directed learning and subsequently impacts their lifelong learning skills.

Beach et al. (2022) conducted a longitudinal study examining teachers' self-directed online learning strategies and experiences to provide insights into self-directed online learning. This study of 12 elementary teachers suggests that three strategies are a practical approach to learning for informal online professional development. The study first utilized screen recording software to capture teacher's online browsing. Then, educators verbalized their thoughts in a virtual think-aloud program while viewing the recording of their online activity. Interviews were conducted and analyzed both qualitatively and quantitatively. Findings suggest that elementary

teachers used the following strategies during self-directed online learning: metacognitive awareness, monitoring of their learning, evaluating, and self-efficacy. Metacognition, also referred to as metacognitive awareness, is described as thinking about one's own thinking involving the monitoring and consequent regulation of cognitive processes (Flavell, 1979). Monitoring learning refers to the educator's ability to pay detailed attention to personal goals (Garrison, 1997), whereas evaluating encompasses constructing meaning through critical reflection and managing incoming information (Beach et al., 2022). Self-efficacy refers to a person's confidence in completing a task or achieving a goal (Beach et al., 2022). The study's findings suggest that incorporating self-directed learning tasks into online professional development opportunities can increase engagement and learning in online learning experiences (Beach et al., 2022). The study by Beach et al. (2022) supports the findings from Karatas and Arpaci (2021) regarding the significance of readiness in online self-directed learning. It emphasizes the importance of incorporating constructivist teaching-learning approaches by implementing self-directed learning tasks in online professional development learning modalities. These studies highlight the need to examine early childhood practitioners' propensity for self-directed learning to better understand the nuances and effectiveness of online learning for their continuing professional development learning goals.

With the digitization of society, Morris and Rohs (2021) expand the concept of self-direction as a learning form that adults often need and utilize to meet the increasing demands of globalization. Digitization refers to the technical process of creating digital artifacts (information, resources, and processes) through converting, representing, and enhancing analog information (Gradillas & Thomas, 2023). Morris and Rohs (2021) suggest that digitization and the COVID-19 pandemic have transformed opportunities for self-directed learning. They also

specify the need for digital problem-solving skills and digital media as increasingly important in 21st-century workplace settings. Over the past decades, it has been well-established throughout the research literature that self-directed learning is a fundamental competence that allows people to continuously learn new knowledge and skills to meet increasing workplace demands.

For this reason, Morris and Rhos (2021) conducted a systematic review of the research literature examining the capability of the digitization of learning materials to boost self-directed learning. In this literature review, a key theme emerged demonstrating the significance of digital technologies and real-world-based experiences to enhance professional development learning experiences. More importantly, this review of 97 empirical studies indicated that some learners lack the necessary information literacy skills needed to sift through all the available information afforded to them through digital technologies and the Internet to be successful in self-directed professional learning pursuits. Information literacy skills involve locating and utilizing the most valuable and pertinent resources and having the propensity to think critically about the information found within those resources to meet learners' self-directed learning goals (Morris & Rohs, 2021). Motivations for self-directed learning most notably came from learners' knowledge or skill gaps, highlighting the significance for deepening our understanding of what features contribute to success in online learning.

Most of the studies in Morris and Roh's (2021) review consisted of workplace-related learning in fields where information is constantly evolving, such as nursing, teaching, business, and other related health professions. Several studies noted that the self-directed learning process involves learners taking responsibility for their learning to solve real-world problems. Digital technologies supported this learning approach through digital resources, including virtual reality. Other studies included in Morris and Roh's (2021) literature review emphasized the benefits of

digital technologies to support practitioners learning through access to valuable professional development resources (Beach et al., 2022). However, Cooper (2018) warns that not all adult learners have the capacity or the necessary competence to engage in self-directed learning without the facilitation of an educator. Garcia Botero et al. (2019) found similar results demonstrated by the declining retention rates in Massive Open Online Courses (MOOCs), especially for those without higher education qualifications. In learning situations where support is minimal or no support is provided, the progression of self-directed learning is slower and can lead to learners dropping out of learning programs (Garcia Botero et al., 2019). Kim et al. (2019) noted similar findings, stating that learners were not always competent in knowing where to start or how to make learning meaningful when navigating an extensive array of resources. Similarly, Horn et al. (2018) described challenges for adult learners when using open educational resources for competency-based higher educational learning due to the laborious efforts of evaluating sources for relevance and organizing information to support their learning in meaningful ways.

Cronin-Golomb and Bauer (2023) suggest that self-directed learning works with self-motivated learning and personality traits to foster lifelong learning through motivational and cognitive processes. This review of self-motivated and directed learning adds novel insights into the existing construct of self-directed learning by looking at when learners' self-initiate information-seeking behavior through motivational processes and personal motivators. Further, they examine how the process of self-motivated and directed learning continues across the lifespan. Like Horn et al. (2018), Cronin-Golomb and Bauer (2023) discuss the extensive effort required for self-directed online learning and propose that learners only self-initiate and self-maintain these information-seeking behaviors under specific conditions due to the effort required of this process. The personal and situational motivators involved in this process are examined to

explain that self-motivated and directed learning is not a continuous process in which all learners willingly engage. Instead, situational contexts and personality traits contribute to understanding how individuals accumulate knowledge over their lifetime. Cronin-Golomb and Bauer (2023) use the Big Five grouping of broad personality traits to measure the tendencies of individual learners to engage in self-motivated and directed learning willingly. In addition, their study provides a timely perspective on the cognitive processes, such as executive functions, that influence self-motivated and directed learning in an age of advancing technology and digital learning. Other studies by Abe (2020) and Audet et al. (2021) corroborate the association of the Big Five personality traits to predict learners' ability to learn online, particularly regarding the openness and conscientiousness dimensions. Cronin-Golomb and Bauer (2023) suggest these personality traits also influence learners' propensity to self-initiate information-seeking behavior but declare that research on personality and self-directed learning is limited.

The literature suggests that providing autonomy, access to resources, strategies for increasing motivation, and collaboration opportunities in online professional development learning experiences can foster early childhood practitioners' self-directed online learning. However, the literature also revealed that the quality of online professional development is critical to supporting the self-directed learning readiness of online learners. Some of the key components found to increase self-directed learning in online formats are opportunities for self-directed learning tasks, meaningful feedback, tracking of progress, and the ability to practice knowledge and skills that build learners' confidence and increase motivation and engagement. Additionally, online learning experiences provide opportunities for building shared knowledge and increasing learners' self-directed learning readiness. More research is needed to understand how practitioners can optimize online learning formats based on their personality traits and

current self-directed learning competence. Nonetheless, ongoing research is needed to improve online professional development's effectiveness in supporting autonomous, self-directed learning experiences, particularly for early childhood practitioners with limited digital competence, low self-direction, and lack of information literacy skills.

Technology Readiness

NASA first introduced the term technology readiness in the 1970s, which refers to the skills needed by administrators to ensure that the new space travel technologies are functional and ready for use. The term technology readiness has been adapted by Parasuraman and Colby (2015) to describe "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (p.60).

The Theory of Planned Behavior (TBD), which originated with Ajzen (1991), has been adopted to explain individuals' success with technology, dependent upon their technology readiness. The Theory of Planned Behavior suggests that individuals will be more motivated to perform behaviors they perceive to be positive (Ajzen, 1991). Attitude, subjective norms, and perceived control of behavior influence the intention to perform the behavior. This theory applies to a wide variety of research that focuses on the role of intention in changing individuals' behavior regarding their willingness to embrace new technologies. The theory of planned behavior has been widely applied in the literature as a sound model to illustrate the intentions of individuals to interact and engage with technology (Ajzen, 1991).

Another conceptual theory used to understand users' intentions with technology is the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003). This framework utilizes four central constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs are direct determinants

of behavioral intention; subsequently, behavior is moderated by gender, age, experience, and voluntariness of use. The UTAUT framework proposes that the presence of these constructs in a real-world environment will enable researchers and practitioners to assess an individual's intention to use a form of technology and provide ways to identify the main influences on acceptance in any given context (Venkatesh et al., 2003).

Several other studies and conceptual frameworks have been developed to address the concept of technology readiness, such as The Technology Acceptance Model (TAM) by Davis (1985). The TAM model proposes two elements that influence individuals' intentions for using technology. First, this model seeks to explain the use of technology by looking at individuals' technology acceptance. It proposes that perceived usefulness and ease of use influence attitudes about technology usage (Davis, 1985). The TAM model is widely used in empirical research to explore factors related to the adoption and usage of technology.

More recently, the Technology Readiness Index (TRI) developed by Parasuraman (2000) to measure technology readiness included four dimensions: Optimism, innovativeness, discomfort, and insecurity. It was then adapted and renamed TRI 2.0 by Parasuraman and Colby (2015) to include technological innovations such as mobile technologies, social media, and cloud computing. One of the first technology adoption studies to examine the effects of new technologies on society originated from telecommunications research in the 1970's. Researchers were interested in investigating the social aspect of people's readiness to use a telephone in their homes (Parasuraman, 2000). Today, TRI 2.0 is a valuable tool for assessing people's propensity for using 21st-century technologies, such as smartphones, to engage in professional online learning experiences. The TRI 2.0 has been used in various contexts worldwide to evaluate how innovative technologies and the evolving technology landscape impact people's lives

(Parasuraman and Colby, 2015). Parasuraman and Colby (2015) conducted a two-phase research project that demonstrated the tool's reliability and validity. Qualitative findings resulted in technology inhibitors that comprised people's lack of confidence in technology and concerns about the dependency, security, and safety of using new technologies.

Additionally, a risk of early adoption for fear of flaws of new technologies and cost barriers also contributed to factors in the technology inhibitor dimension. However, factors in the technology motivators dimension included improved quality of life, social influence, staying connected, feeling empowered, and being entertained and amused (Parasuraman & Colby, 2015). The study showed that TRI 2.0's motivating dimensions, innovativeness, and optimism readily assessed learner attributes as inherent traits (Parasuraman & Colby, 2015). However, the inhibiting dimensions of discomfort and insecurity are more complex and pose more significant challenges in measuring these constructs. An essential finding of the study suggests that demographic characteristics such as age, education, and occupation correlate with technology readiness (Parasuraman & Colby, 2015). It also recommends future research seek to understand the interaction between technology readiness and inherent individual-level traits when adopting and using technology (Parasuraman & Colby, 2015).

Significant empirical and theoretical research has extensively investigated the concept of technology readiness. For example, Hung et al. (2010) created a scale to address learners' online learning readiness within three dimensions: computer self-efficacy, internet self-efficacy, and self-learning. Self-efficacy refers to learners' judgment about their abilities to conduct activities to demonstrate competence (Hung et al., 2010). Further, Hung et al. (2010) describe learner readiness as having the knowledge and ability to initiate a behavior change that leads to

successful learning outcomes. Findings suggest that learners' technology readiness indicates success in online learning experiences (Hung et al., 2010).

To examine educator readiness in online teacher professional development, Reeves and Pedulla (2011) studied evidence from USA's e-Learning for Educators (EfE) initiative, suggesting that some online professional development participants never completed their courses. Accordingly, 3,998 teachers' satisfaction with online professional development was analyzed by a secondary analysis of EfE evaluation data. This study emphasizes the relevance of certain variables (ease of content transferability, adequacy of compensation, and benefits of discussion topics) to understand teacher satisfaction with online professional development. A blockwise ordinary least squares regression model was used to explain the large share of the variance (48.1%) in participants' satisfaction with online professional development, highlighting the significance of course design and facilitator actions. This study provided critical implications for designing and implementing online professional development and demonstrated the importance of adequately training online facilitators to increase satisfaction (Reeves & Pedulla, 2011).

In a related study, Reeves and Li (2012) focused on teachers' beliefs and attitudes regarding online teacher professional development and their perceived technology-ready behaviors. While the study findings indicated that teachers found online professional development helpful and many teachers deemed themselves to be technology-ready, they also found that low technology readiness was a barrier for some teachers that hindered their success and completion of online formats (Reeves & Li, 2012). The online professional development data source was *e-Learning for Educators,* an initiative implemented between 2006 and 2011 in the United States. The data show that most teachers in the study reported that online professional

development is as effective as face-to-face professional development. In addition, they reported the following reasons for the effectiveness of online professional development: easy access to the required technology, obtaining the required computer/technical skills, and experiencing gains in technical skills through course participation. However, the authors of this study urge that a critical factor that came to light and needed further investigation was identifying specific design features associated with effective online professional development to determine best practices for designing online professional development (Reeves & Li, 2012).

Asghar et al. (2021) further examined the relationships between mobile learning acceptance and readiness among pre-service teachers through questionnaires based on the UTAUT model. Questionnaires were distributed to 429 pre-service teachers from universities in Pakistan to assess their attitudes and motivations toward using m-learning technology. The findings suggest that mobile phones and the Internet were easily accessible to most pre-service teachers, but some teachers struggled to access information online using mobile phones. Certain factors, such as personal innovation, quality of services, and social influence, significantly influenced teachers' behavioral intention to use mobile phones and m-learning technology. Furthermore, an indirect effect of personal innovation and quality of services was found regarding m-learning readiness (Asghar et al., 2021). Personal innovation refers to people's behavioral intention, the degree to which they autonomously make decisions, and their willingness to accept new ideas (Venkatesh et al., 2012). Asghar et al. (2021) relate the Quality of Service factor to people's perceptions about the quality of facilities or products. Regarding m-learning technology, this factor refers to users' expectations about the mobile technology service. Social influence refers to the factor that makes a person believe that using new technology increases their connectivity with other people (Venkatesh et al., 2003). These factors illustrate

that the type of mobile phone plays a critical role in learners' feelings towards mobile learning, and users' personal characteristics impact their readiness and negatively affect future learning experiences. Furthermore, Asghar et al. (2021) highlight that other mobile learning research has shown that mobile phones with small memory and insufficient battery life led to dissatisfaction and deterred students from mobile learning experiences (Crompton & Burke, 2018).

Despite the barriers when using mobile phones, some teachers reported that they are easy to use and enhance their learning experiences. This research showed the importance of pre-service teachers' intentions toward mobile learning and readiness to use mobile phones for learning. Although situated in Pakistan, Asghar et al.'s (2021) findings bring an interesting perspective for consideration when examining Arkansas early childhood practitioners' readiness to use mobile phones for online learning (Asghar et al., 2021). Similar study findings for pre-service teachers in Turkey demonstrated that high scores on teachers' personal characteristics, such as agreeableness of performance and effort expectancy for mobile learning, indicated greater acceptance of mobile phone use for learning. Asghar et al.'s (2021) findings regarding the willingness of educators in Pakistan to embrace mobile phones and have greater acceptance of mobile learning experiences point to underlying factors that could be relevant to Arkansas early childhood practitioners' propensity for using mobile phones for online professional learning experiences. An important factor impacting Arkansas early childhood practitioners' intentions for mobile phones could also be geographical location since many Arkansans live in remote, rural areas described by the Arkansas State Broadband Office as digital deserts. Unfortunately, affordable access to high-speed internet is not equitably available in these areas (Arkansas State Broadband Office, 2023). According to the Federal Communications Commission (2021), when not considering 4G LTE connections, 46% of Arkansans do not have access to a wired

broadband connection capable of 25 Mbps or faster, and only 22.8% of Arkansans have equitable broadband access capable of 100Mpbs or more. BroadbandNow (2023) reports that 20% of Arkansas households are without internet access, and 18% only have cellular data access. Limited technology, lack of broadband coverage, and low digital literacy skills have been noted as barriers for those in rural areas (Arkansas Broadband Office, 2023). These barriers likely contribute to rural early childhood practitioners' use of mobile phones and their propensity to use technology at home and work. Due to accessibility issues, mobile devices may be the only option for some early childhood practitioners working and residing in these digital deserts.

Moreover, Passey et al. (2018) offered a unique theoretical perspective on the issue of technology readiness and the future of equity in education by highlighting learners' need for digital agency (DA). Digital agency consists of three integral components—digital competence, digital confidence, and digital accountability that relate to one's ability to interact and adapt in a digital society. The researchers suggest that DA is a fundamental concept that impacts all citizens but is extremely important in the education landscape due to ever-changing digital practices and technologies. This research confirms the need for all educators to receive quality training on using all forms of technology to improve and enhance their learning experiences. A person's technological readiness can influence their ability to use technology, including mobile phones, and thereby impact their willingness to be self-directed in their learning (Parasuraman, 2000; Koole, 2009). Those who are more comfortable and familiar with technology may be likelier to have a greater sense of digital agency. As such, those with better access to technology may be more likely to engage in self-directed learning activities using mobile phones. Several recent studies suggest that technology readiness is important in online learning outcomes, satisfaction, and engagement (Geng et al., 2019; Hong et al., 2014). More technologically-ready

learners are more likely to be better prepared to navigate and succeed in online learning environments (Asghar et al., 2021; Geng et al., 2019; Hong et al., 2014).

The nuanced factors involved in early childhood practitioners' technology readiness could depend on their familiarity with technology, technology self-efficacy, access to technology, and the necessary infrastructure to participate in online learning formats. In Arkansas, inequalities in available broadband internet service magnify these issues, creating an even greater digital divide for some early educators. Now more than ever, a multidisciplinary approach to self-directed learning in a digital world is critical for learners and developers of virtual learning platforms.

Additionally, Ringkamp (2022) conducted a quantitative correlational study that examined the relationship between technology readiness and grades, the number of attempts taken, or the time it took to complete an online professional development course. The study consisted of 73 local educational agency (LEA) staff who were administered the Technology Readiness Index 2.0 scale to examine this relationship. The results indicated no significant relationship between technology readiness and grades or the number of attempts. The correlation between technology readiness and days to completion resulted in a small to moderate negative correlation. The only difference noted was that those with lower technology readiness might take longer to complete the online professional development. This study's findings are instrumental to the current study and provide insight into existing research on the relationship between technology readiness and self-directed learning readiness. The current study will seek to understand how lower levels of technology readiness influence early childhood practitioners' propensity for learner self-direction when using mobile phones in asynchronous online professional development. The significance of lower levels of technology readiness resulting in taking longer to complete online professional development training in Ringkamp's (2022) study

could be a significant predictor for early childhood practitioners' readiness to engage in self-directed online learning in the current study.

Lastly, a study conducted by Chau et al. (2021) investigates the correlations between technology readiness and self-directed learning to understand the potential effects on instructor presence when participating in synchronous learning environments. This study provides empirical evidence for educators regarding future learning trends and effective instructional strategies for online teaching. It examined students' perceptions of synchronous e-learning experiences during the COVID-19 pandemic. They found that smartphone use significantly positively affects individual impact, student engagement, and self-directed learning readiness. The researchers suggest these findings will inform the design of e-learning teaching pedagogies and help determine how fundamental factors of e-learning perception are inter-correlated. In addition, the study has important implications for student readiness in educational technology, which is critical to implementing online learning (Chau et al., 2021). Although this study's focus consists of a different population, and the use of mobile phones is geared toward synchronous learning environments as opposed to asynchronous learning formats, the use of these technologies to engage in online learning and how technology readiness influences self-directed learning provides salient implications for the current study.

Although there is a growing body of literature on online learning, significant knowledge gaps remain concerning how it facilitates self-directed learning. More research is needed to understand how technology readiness and mobile phone usage influence learners' ability to achieve their educational objectives. Because early childhood practitioners in Arkansas are such a unique population based on the diversity of their educational attainment and variety of professional preparation, they make for an even more complex sample in an already multifaceted

research problem. Given the current landscape of online professional development geared towards early childhood practitioners in the childcare workforce, findings from the existing literature and the current study should inform the design, content, and best practices implemented in online training courses. Further investigation into the efficacy of these online professional development opportunities in enhancing the early childhood workforce's knowledge and skills is also of significant importance.

Theoretical Framework

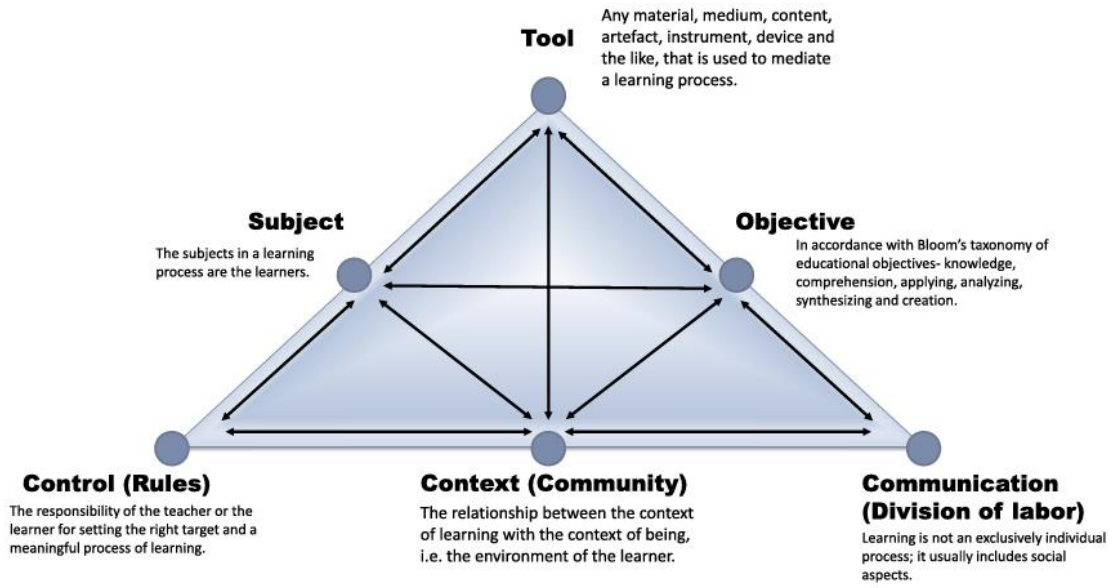
Activity Theory

Activity theory is a valuable theoretical framework for understanding how people interact with the environment and how available tools and resources are used to achieve their goals. Leont'ev (1978) first introduced the concept of activity as a significant interpretation of how human consciousness is determined in his work. The meaning and purpose behind the activities focused on the role of activities as coordinated systems of actions powered by a motive and subordinated to a particular goal. Vygotsky (1978) provided the groundwork for activity theory through his emphasis on the role of culture in forming mental processes and specified that learning was social and situated. Moreover, he proposed that social interactions influence meaningful activities and are mediated by cultural tools critical to shaping behavior, learning, and cognition (Vygotsky, 1978). Activity theory assumes that people's actions are shaped by their goals, tools, resources, and the social and cultural context in which they live, learn, and function daily. In addition, these actions are stimulated by a need and a motivation that gives meaning to the actions used for performing the activity (Leont'ev, 1978).

A premise of activity theory suggests that a purposeful and transformative activity creates an interaction between subjects and objects to achieve a goal. The activity system consists of a

set of actions to meet a need. The motivation behind the activity provides context and meaning for each action, while tools mediate its operation (Engeström, 2014). Tools presented within various constructs can be cultural or symbolic, involving mental processes such as motivation and learning or objects such as digital technologies and media (Vygotsky, 1978). This framework has since been adapted for mobile learning and is illustrated in Figure 2.

Figure 2
Activity Theory Framework for Mobile Learning



Note. From "A Review of Experimental Mobile Learning Research in 2010–2016 Based on the Activity Theory Framework", by C. Ching-Jung et al., 2019, *Computers & Education*, p.3 (https://doi.org/10.1016/j.compedu.2018.10.010). Copyright 2019 by Elsevier.

The major works and assumptions of activity theory can be applied to the research problem to understand the concept of self-directed learning when learners use mobile phones to engage in asynchronous professional development courses. For example, an early childhood practitioner's goal for taking an online course may consist of acquiring new knowledge or skills, and a smartphone may be an accessible tool to support this goal. Moreover, the capability of mobile phones to support learning anywhere and at any time may increase a learner's motivation

and engagement in the learning process. According to activity theory (Leont'ev, 1978), the early childhood practitioners' purposeful activity in using mobile phones to participate in an asynchronous online professional development course creates an interaction that consists of a set of actions using tools to obtain a specified learning goal. However, a critical aspect concerning how the practitioner engages in the learning experience and the tools they use to facilitate their learning may depend on their technology readiness. Early childhood practitioners' ability and willingness to use mobile phones for self-directed learning may be influenced by their comfort level, skills, and knowledge in using mobile phones to effectively navigate digital tools, resources, and components of an asynchronous online course.

For the present study, the activity system consists of the early childhood practitioner, the mobile phone, and the resources and tools available online using the device. The practitioner's engagement with the mobile phone may be influenced by their technology readiness, self-directed learning, and the social and cultural contexts in which they use the mobile device. Practitioners who demonstrate high levels of technology-ready behaviors and are highly self-directed in their learning might successfully use their mobile phones to participate in online courses, search for valuable resources, and engage in online discussions to foster their learning goals. Additionally, they may interact with social media and other communication tools to connect with others and collaborate on learning projects using their mobile phones. However, those who are less technology-ready may be comfortable using a mobile phone to interact with others on social media but have difficulty accessing and navigating online courses and resources and completing the basic requirements of the course.

A critical tenant within activity theory represented in the research problem regarding mobile phone usage and self-directed learning is the habitual collective set of operations

comprising actions to accomplish specific tasks necessary to fulfill the designated goal (Engeström et al., 1999). For early childhood practitioners engaging in asynchronous professional development learning formats using mobile phones, the habitual course of these operations interacting with the phone implies that they are automated and performed routinely and subconsciously. However, conscious and deliberate actions are required when engaging in a novel learning process. The novel actions transform into a routine operation upon assimilating new information (Sannino et al., 2009).

In essence, when early childhood practitioners interact in an asynchronous online learning platform using a mobile phone, the task of typing on the phone's keyboard to respond in a discussion forum could be an action (requiring thought and attention to the task) or a routine operation (automized and performed unconsciously) depending on the users' familiarity with the phone, the phone's keyboard, and the frequency with which they engage in the task of typing on the specified phone's keyboard. In this type of learning interaction, the learner and user of the mobile phone act as social agents or members of society with a designated task to achieve a specified learning goal. The sociocultural aspects of the user's environment will dictate the tools used and the approach taken to complete the task and ultimately determine if they successfully accomplish the learning goal. In addition, each person's available resources, tools, and learning abilities are mediated by their technological competency and readiness to learn. Within this theoretical framework and situated learning context, the learner's sense of digital agency could be a critical component linking actions and motivation to accomplish a goal (Leont'ev, 1978).

The activities involved in asynchronous online learning can be particularly challenging for early childhood practitioners with limited technology, low digital literacy skills, and a lack of broadband infrastructure to support online learning. The relationship between technology

readiness and a propensity for self-directed learning reflects the historical and sociocultural underpinnings of activity theory involving Vygotsky's (1978) work on developing mental functions to execute deliberate, external actions. Leont'ev (1978) proposed that the execution of an action can be influenced by a specified limitation linking action to motivation. Early childhood practitioners' technology readiness could determine their motivation and self-directedness when engaging in asynchronous online learning contexts. Furthermore, limitations of the types of technological devices available, the accessibility of broadband infrastructure, and the necessary skills to use technology to participate in the learning experience could hinder their self-directed learning, particularly concerning online asynchronous, self-directed learning.

Hypotheses

A review of the literature and the foundation provided by activity theory led to several hypotheses associated with the study's research questions. These hypotheses will be used to examine the relationship between early childhood practitioners' mobile phone use and their self-directed learning. In addition, these hypotheses examine the potential influence technology readiness may have on this relationship.

For early childhood practitioners in an asynchronous online professional development course:

RQ1. Is mobile phone usage positively associated with self-directed learning, after controlling for relevant participant variables?

H1. Early childhood practitioners who use mobile phones will exhibit a greater propensity for self-directed learning than those who do not use a mobile phone.

Theoretical rationale: A premise of activity theory suggests that a purposeful and transformative activity creates an interaction between subjects and objects to achieve a goal (Leont'ev, 1978). The activity consists of a set of actions to meet a need, and the motivation

behind the activity provides context and meaning for each action while tools mediate its operation. Tools presented within various constructs can be cultural or symbolic, involving mental processes such as motivation and learning or objects such as digital technologies and media (Vygotsky, 1978).

RQ2. Is technology readiness positively associated with self-directed learning, after controlling for relevant participant variables?

H2. Early childhood practitioners who exhibit greater levels of technology readiness will exhibit a greater propensity for self-directed learning.

Theoretical rationale: Within activity theory, a person's actions are shaped by their goals, tools, resources, and the social and cultural context in which they live, learn, and function daily. In addition, these actions are stimulated by a need and a motivation that gives meaning to the actions used for performing the activity (Leont'ev, 1978).

RQ3. Does technology readiness influence the relationship between mobile phone usage and self-directed learning, after controlling for relevant participant variables?

H3. When technology readiness is low, mobile phone usage decreases practitioners' propensity for self-directed learning, but when technology readiness is high, mobile phone usage increases their propensity for self-directed learning.

Theoretical rationale: According to activity theory (Leont'ev, 1978), early childhood practitioners' purposeful activity in using mobile phones to participate in an asynchronous online professional development course creates an interaction consisting of actions using tools to obtain a specified learning goal. However, a critical aspect concerning how practitioners engage in the learning experience and the tools they use to facilitate their learning may depend on their technology readiness.

Summary

The COVID-19 pandemic pivoted all learning online, including teacher professional development. While extensive resources focused on the needs of students thrust into virtual learning formats, teachers' professional development needs fell by the wayside. Before the pandemic, early childhood practitioners either attended pre-designated, on-site, or in-person professional development training at their schools or other geographically close and easily accessible locations. Professional development strictly offered online created shifts in the culture of how and why early childhood practitioners accessed professional development opportunities. The subsequent explosion of online professional development opened opportunities that never existed before and, in many cases, put the responsibility of identifying learning needs and what types of professional development to attend in the hands of the practitioners themselves.

While a review of the related literature discusses the vast history of e-learning over the past decades, a gap exists in how today's emerging technological advances have influenced self-directed online learning experiences, mobile learning, and the technology readiness of learners. In addition, current literature examining the effectiveness of online teacher professional development widely focuses on educators in the K-12 public school system. However, the shift to online professional development significantly impacted early childhood practitioners, who often needed more resources and training than educators in public school systems. To meet state and national professional development standards, many early childhood practitioners had to use new technologies or engage with technology in novel ways. Unfortunately, some early childhood practitioners lacked the technology and other necessary skills to do so effectively. For some, smartphones were the only technology available, and many virtual offerings did not cater to the needs of mobile users. Low levels of self-directed learning and technology readiness may present

additional barriers and challenges for early childhood practitioners to succeed in online professional development without additional support. Existing literature regarding how self-directed learning or technology readiness relates to the effectiveness of asynchronous online professional development is lacking. Understanding what works well for early childhood practitioners' diverse learning needs and what aspects of online professional development create challenges or barriers to success can inform administrators and program designers of additional support needed for inclusive and equitable online professional development experiences. Additionally, literature suggests that individualized professional development plans focused on building practitioners' digital and information literacy skills could help bridge the gap for those lacking essential skills to benefit fully from self-directed online professional development experiences. This review of literature provided additional variables for consideration that will be addressed in chapter three.

Chapter 3: Research Methods

This cross-sectional regression study examines the relationship between mobile phone use and self-directed learning of early childhood practitioners participating in an online asynchronous (self-paced) professional development course. This chapter explains the methods and procedures used to examine the potential interaction effects of technology readiness on the relationship between mobile phone use and self-directed learning. The chapter begins with an overview of the research methodology, then explains the research design and the origin of the data, followed by a description of the study participants and the variables intended for measurement. The chapter concludes by describing the data analysis and addressing the study's limitations.

Research Questions and Hypotheses

Literature suggests that there is potential for mobile phones to support professionals' self-directed learning experiences when engaging in online learning (Curran et al., 2019). Research literature also indicates that technology readiness may influence this relationship (Hung et al., 2010; Ringkamp, 2022). Three research questions and hypotheses guide this study. Additionally, several practitioner control variables were discovered that need to be considered, such as age, race and ethnicity, educational attainment, income, and urban or rural status.

For early childhood practitioners in an asynchronous online professional development course:

RQ1: Is mobile phone usage positively associated with self-directed learning, after controlling for relevant participant variables?

H1: Early childhood practitioners who use mobile phones will exhibit a greater propensity for self-directed learning than those who do not use a mobile phone.

Statistical hypotheses:

$H_{0:}\ b_1 = 0$

$H_{1:}\ b_1 > 0$

Where b_1 represents the relationship between mobile phone usage and self-directed learning.

RQ2: Is technology readiness positively associated with self-directed learning, after controlling for relevant participant variables?

H2: Early childhood practitioners who exhibit greater levels of technology readiness will exhibit a greater propensity for self-directed learning.

Statistical hypotheses:

$H_{0:}\ b_2 = 0$

$H_{1:}\ b_2 > 0$

Where b_2 represents the relationship between technology readiness and self-directed learning.

RQ3: Does technology readiness influence the relationship between mobile phone usage and self-directed learning, after controlling for relevant participant variables?

H3: When technology readiness is low, mobile phone usage decreases practitioners' propensity for self-directed learning, but when technology readiness is high, mobile phone usage increases their propensity for self-directed learning.

Statistical hypotheses:

$H_{0:}\ b_3 = 0$

$H_{1:}\ b_3 > 0$

Where b_3 represents the interaction between mobile phone use and technology readiness on early childhood practitioners self-directed learning.

Methods

Study Design

This study incorporates a cross-sectional multiple linear regression analysis using survey data. Field (2018) characterizes cross-sectional research as observing natural occurrences without direct intervention or interference. Multiple linear regression is a statistical method used to examine the relationship between a dependent variable and two or more independent variables by fitting a linear equation to the data (Field, 2018). Cross-sectional regression analysis employs models to examine the relationship between the outcome variable and multiple predictor variables derived from the proposed research questions and hypotheses (Roberts & Roberts, 2021). This study will accomplish this through a nonexperimental research design. Nonexperimental research is a systematic empirical inquiry of a situation that cannot be manipulated since the researcher does not control the change in the independent variable because it has already occurred (Kerlinger, 1986). In a nonexperimental design, the researcher starts with a group of people who have already experienced the variables under study and then determines if there is a relationship between the variables (Hoy & Adams, 2016).

An interaction analysis examines the extent to which the relationship between these two variables changes depending on the level of a third variable, called a moderating variable. A moderating variable influences the effect of the independent variable on the dependent variable and affects the strength or direction of the relationship between two other variables (Hoy & Adams, 2016). The current study aims to go beyond simply looking at the effect of mobile phone use on practitioners' propensity for self-directed learning. It also examines the potential for technology readiness to moderate (strengthen or weaken) the relationship between these factors

as early childhood practitioners participate in online asynchronous professional learning experiences.

Data will be collected through two Likert-type surveys conducted concurrently. This approach, common in survey data analysis, is used to explore how different predictor variables relate to an outcome variable (Roberts & Roberts, 2021). As Levin (2006) suggests, "cross-sectional studies estimate the prevalence of a particular outcome for a given population" (p. 24). The nature of cross-sectional design assumes there will be variation among the variables' measurements taken simultaneously for all the participants in the study's sample (Roberts & Roberts, 2021).

The survey data will be gathered for all early childhood practitioners participating in the specified online asynchronous professional development course. A cross-sectional multiple linear regression analysis is best suited to analyze the survey data since it contains multiple variables and an interaction effect. This method allows me to determine how early childhood practitioners' mobile phone usage influences their propensity for self-directed learning when participating in a self-paced professional development course. It also allows me to understand whether this relationship is stronger, weaker, or non-existent based on their varying technology readiness levels.

Study Setting

The study's setting includes a one-hour online asynchronous professional development course titled *Preventing Expulsion 1- The Teaching Pyramid* provided by the research and evaluation division within a school of medicine in Arkansas. The research division aims to explore the impact of family and environmental factors on areas of health and development through collaborative efforts with community partners. They also offer research-based early

childhood professional development through a range of programs. Naptime Academy is one of the training programs developed to eliminate training barriers for rural and busy childcare providers. Naptime Academy consists of e-learning modules that allow early childhood professionals to access training on demand via desktop computers, laptops, or mobile devices. In addition, the courses can be accessed through the Go.Learn.App on any mobile device. The free mobile application is available in Apple and Android stores, allowing learners to access learning content anytime and anywhere. This application allows learners to view courses, learning plans, and shared content while tracking their progress (Naptime Academy, 2023).

Currently, over 50 Naptime Academy courses are offered at no cost for licensed Arkansas early childhood practitioners in all 75 counties in Arkansas (Naptime Academy, 2023). These courses are shorter-duration training modules that can be completed in one setting, increasing the probability of participants in the course using a mobile phone. In addition, all courses are registered in the Arkansas Professional Development Registry (PDR), which tracks all professional development hours to satisfy licensing and quality rating improvement systems' ratings.

Participants

A non-probability convenience sampling will be used to identify a sample of early childhood practitioners ages 18-65 who work in a licensed childcare facility in Arkansas and have completed the specified course. Participant data will be collected from early childhood practitioners who enrolled in or completed the specified course. This population is appropriate for the current study for several reasons. First, this one-hour course has one of the highest completion rates, with 1,582 participants completing in 2022 and an additional 1,129 participants completing as of November 2023 for a total of 2,711 eligible participants for this study. Since the

courses are free for early childhood practitioners in every state region, they will likely draw participants from rural and urban areas statewide, accounting for the rural demographic variable in the study's population. It should be noted that a significant majority of early childhood practitioners who work in public and private-sector homes, centers, and schools in Arkansas are female. As such, gender has not been controlled for as a variable in the analysis, as it does not represent a diverse distribution within the sample.

Consistent and reliable race/ethnicity data of early childhood practitioners is lacking. The Early Childhood Workforce Index Report of 2020 explains this absence of national comprehensive data in the following statement: "Demographic characteristics such as race/ethnicity and gender are not reported due to a lack of comparable data across states. State-based surveys or registries may provide more comprehensive estimates of the ECE workforce" (Gould et al., 2020, p. 12). Without current study-specific data, a sample of early childhood practitioners from one of Arkansas' most extensive 2022 statewide surveys represent the participants who will likely respond to the current study survey.

The 2022 Arkansas Early Childhood Care and Education (ECCE) Staff Workforce Study gathered data from early childhood practitioners who participated in training that was registered in the state's Professional Development Registry to understand critical issues facing the early childhood workforce (McKelvey et al., 2022). A total sample of 1,300 early childhood professionals responded. The participants comprised 1,151 current and 141 former practitioners from center-based and family childcare programs (McKelvey et al., 2022). This sample reflects a similar demographic composition and relevant characteristics within the population under investigation. Of the 1,151 current practitioners that responded, the average age of respondents was 38 years, with a racial/ethnic breakdown of 72% White/Caucasian, 21% Black/African

American, 6% Hispanic/Latino(a), 3% Multi-Racial, 2% Asian/Pacific Islander, 2% Native American, and 2% Other. Because of the small sample sizes, categories were combined for analyses (McKelvey et al., 2022). The job roles across these categories comprised 55% lead teachers and 45% assistant teachers in childcare centers and family childcare homes (McKelvey et al., 2022). Within these roles, 51% reported having obtained an associate degree or less with a Child Development Associate (CDA) credential, 18% had a bachelor's degree or higher in an early childhood-related field, and 11% had a bachelor's degree or higher in an unrelated field (McKelvey et al., 2022).

The early childhood workforce sector has been significantly impacted by changes in economic trends since 2017 (McKelvey et al., 2022). Of the practitioners surveyed in the 2022 workforce survey, only 40% of current teachers had a higher education degree related to early childhood education when CDAs were factored into their educational attainment (McKelvey et al., 2022). Even though 77% of these early childhood practitioners are employed full-time, a significant portion did not earn sufficient income to cover essential living expenses (McKelvey et al., 2022). Therefore, participant household income will be included in the demographic data based on the Asset Limited, Income Constrained, Employed (ALICE) measure, which represents household income for workers earning more than the Federal Poverty Level (FPL) but who cannot afford necessities in their communities (United for ALICE, 2023).

According to the 2022 Arkansas ECCE Staff Workforce Study, Arkansas early childhood practitioners' hourly pay ranged from $16.53 to $12.48 depending on multiple factors, with practitioners' education and race/ethnicity being the most significant predictors related to compensation (McKelvey et al., 2022). The educational attainment of a CDA increased practitioners' annual wages by $5,297 or more per year, yet inequities exist for communities of

color (McKelvey, 2022). Therefore, practitioners' race, ethnicity, and educational attainment will be included in the current study's participant demographics as control variables.

To determine a sufficient number of participants for the data collection, an a priori G*Power analysis was conducted for an F test for linear multiple regression (Fixed model, R^2 deviation from zero). Using an effect size of $r^2 = 0.15$, err prob = 0.05, power (1-β err prob) = 0.80, and number of predictors =11, the minimum sample size needed for this study is 123.

Materials

A survey will be collected and managed using Research Electronic Data Capture (REDCap), an electronic data capture tool hosted by the School of Medicine's research and evaluation division. The secure, web-based software platform is designed to support data capture for research studies (Harris et al., 2009). Advanced instrument design features allow flexibility to create a unique student identifier and align the identifier to the participant data to keep respondents anonymous.

The REDCap survey will also serve as the tool to administer the demographic questions (Appendix A) and two scales that participants will complete online. A separate section will be created for each scale within the same survey. Each section will include the items pertaining to each scale. Once the different sections are created, specialized features within REDCap will be used to customize the survey design by adding branching questions and skip logic to improve data quality and efficiency by tailoring questions to the respondent's context, leading to more accurate and meaningful survey results. I will also include any additional instructions or information that pertains to each scale in the appropriate survey sections. Instructions for each scale can be found in each of the designated Appendices. The survey will be designed to ask one question at a time, allowing respondents to answer parts of the survey and save their work to

resume at a more convenient time to complete the survey. The survey consists of the following scales.

Technology Readiness Index Scale (TRI) 2.0.

The first scale included in the survey is TRI 2.0, which measures and classifies respondents into four domains by their tendency to adopt and embrace technology in their daily lives, at home, and at work (Parasuraman & Colby, 2015). Researchers have used TRI 2.0 to measure participants' technology readiness across various contexts. Appendix B contains the questions for the TRI 2.0 scale. Appendix C contains the license and permission to use the TRI 2.0 instrument in this study. The survey instrument will contain 16 items addressing contemporary themes affecting the adoption of new technologies, such as distraction and becoming socially disconnected. The TRI 2.0 can be administered via several modalities (by phone, in person, or distributed online through a survey application) and only takes 10 minutes to complete.

The original instrument, the Technology Readiness Index (TRI) 1.0, developed by Parasuraman (2000), was a valid and reliable tool. However, it became outdated with the advancement of newer technologies, including mobile devices, social media, and cloud-based computing (Parasuraman & Colby, 2014). The TRI 1.0 "measures people's propensity to embrace and use cutting-edge technologies" (Parasuraman & Colby, 2015, p. 59).

More recently, researchers have used the TRI 2.0 scale to assess the technological readiness of various individuals across many different contexts within four dimensions: Optimism, Innovativeness, Discomfort, and Insecurity. The TRI 2.0 was developed through a two-phase research project to update and streamline the TRI 1.0 to deem it a reliable, valid, and valuable tool (Parasuraman & Colby, 2015). The first research phase consisted of an exploratory

qualitative study that contained an interactive discussion with consumers through a virtual data collection forum called OpinionPond (Woodall & Colby, 2011). The weeklong online forum generated responses and questions on technology-related motivation and inhibitors involved in adopting and using novel technologies that led to the modification of TRI 1.0 and validation of TRI 2.0 (Parasuraman & Colby, 2015).

After the completion of the exploratory research phase, the authors identified potential improvements in the form of "(a) wording changes to current scale items and (b) additional items to capture contemporary themes" (Parasuraman & Colby, 2015, p.63). The qualitative research phase led to 25 of the 36 original items being left unchanged and 11 updated. The second phase consisted of a quantitative research phase that included a mail and online survey, resulting in the empirical assessment of a 16-item TRI 2.0 construct validity.

Three simple linear regression analyses were conducted for both TRI 1.0 and TRI 2.0, using the total technology readiness (TR) score as the independent variable and three categories of technology behavior (number of gadgets owned, number of online behaviors in the past year, and number of technology-oriented behaviors) as the dependent variables to assess the variance explained in each scale's regression analysis. All models were significant at the .001 level, suggesting that the total TR score is an essential predictor of technology-related behaviors. A statistical analysis confirmed TRI 2.0's predictive validity, which showed significant differences in TRI 2.0 scores on a 1-5 scale based on respondents' engagement in 23 online behaviors. This validation study highlights TRI 2.0's capability to distinguish between various technology readiness levels, supporting its validity as an assessment tool (Parasuraman & Colby, 2015). Cronbach's alpha was used to establish the reliability of each of the four dimensions of TRI 2.0. All dimensions surpassed the threshold of .7, with the discomfort domain having the lowest score

at .70, followed by the insecurity domain at .71, the optimism domain at .80, and the innovativeness domain at .83 (Parasuraman & Colby, 2015).

The TRI 2.0 instrument contains 16 questions across the four dimensions and is categorized into positive and negative themes. The optimism and innovativeness dimension questions are classified as positive themes. Meanwhile, the questions about insecurity and discomfort are classified into negative themes. A 5-point Likert scale also contains values ranging from 1 (s*trongly agree*) to 5 (s*trongly disagree*). Indexes from the 16-item scale are analyzed by determining the missing values across all items, computing new variables for each item, and coding any missing data as refused. Respondents who do not respond to three or more items will be excluded (Parasuraman & Colby, 2015). Next, the averages for each of the four dimensions are computed. Finally, a total technology readiness score is calculated by reversing the dimensions of insecurity and discomfort, subtracting from six, then computing the averages of each dimension and dividing them by four. The lowest possible score is a combined score of 1.0, suggesting lower technology readiness levels. The highest possible score is a combined score of 5.0, suggesting higher technology readiness levels (Parasuraman & Colby, 2015).

This scale is best suited for this study because the intent behind the scale regards technology readiness as a mindset, not a measure of competence or knowledge, that has proven to be a stable characteristic that does not change easily for an individual (Parasuraman & Colby, 2015). Research has shown that early childhood practitioners' mindsets centered around technology not only involve personal characteristics but are also deeply rooted around the concern of developmentally appropriate practice when integrating technology into the early learning curriculum for children under the age of five (Blake et al., 2011; Pila et al., 2019).

Therefore, TRI 2.0 is the most appropriate instrument to capture early childhood practitioners' propensity for using technology at home and in their work.

Resource Associates Transition to College Self-Directed Learning Scale (RATTC SDLS).

The second scale included in the survey instrument is the RATTC SDLS (Lounsbury & Gibson, 2010). This instrument is a 10-item scale with responses on a Likert scale ranging from 1 (s*trongly disagree*) to 5 (s*trongly agree*). The self-directed learning score is determined by summing the assigned values for responses to each of the 10 items for scores ranging from 10 (lowest score) to 50 (highest score). The scale was developed as part of a larger scale for measuring the personality traits of late adolescents and adults (Lounsbury & Gibson, 2010). Brockett's (1983) conceptualization of self-directed learning provided the theoretical framework for the self-directed learning construct in the RATTC SDLS in which "self-directed learning refers to activities where primary responsibility for planning, carrying out, and evaluating a learning endeavor is assumed by the individual learner" (p. 16).

Lounsbury et al. (2009) conducted a study using the RATTC SDLS to investigate self-directed learning as a personality construct. In this study, they first aimed to examine the factor structure of the self-directed learning measure. Next, they aimed to support the conceptualization of self-directed learning as a personality construct by assessing the ability of the measure to predict GPA across middle school, high school, and college grade levels. The last aim of the study was to establish the construct validity of self-directed learning by investigating it with related self-directed learning constructs and another more established self-report measure of self-directed learning known as the Self-Directed Learning Readiness Scale (SDLRS) developed by Guglielmino (1977). Three distinct samples of students were included in the study, consisting of

966 middle and high school students, 1,218 college students, and 4,125 first-year university students. Students completed the RATTC SDLS and several other personality measures. The first additional measure students completed was the Myers-Briggs Type Indicator, which was developed from the Myers-Briggs Framework and consists of eight preferences structured into four pairs of opposites that represent a person's natural preferences in four aspects of personality. The opposite preference pairs include extraversion or introversion, sensing or intuition, thinking or feeling, judging or perceiving. Students also completed the NEO Personality Inventory (NEO-PI-R), which measures the Five Factor Model consisting of 30-eight-item facet scales containing six for each of the five basic personality factors: neuroticism, extraversion, openness, agreeableness, and consciousness. The following measure they completed was the Resource Associates Adolescent Personal Style Inventory (APSI). The Resource Associates APSI differs from other personality measures in that most items were contextualized for work settings consistent with other work-related personality validity measures (Schmit et al., 1995). It assesses the Big Five personality traits, which include neuroticism, extraversion, agreeableness, openness, and conscientiousness.

The Big Five personality traits have been extensively studied and supported by empirical research, including three meta-analyses that found that conscientiousness consistently predicts job performance across various job types and industries (Barrick & Mount, 1991; Salgado, 1997; Tett et al., 1991). In addition, the APSI also includes the narrow personality traits (optimism, conscientiousness, emotional stability, and extraversion) because they have been found to be a more predictable measure than even the Big Five traits for many jobs and performance criteria (Lounsbury et al., 2009; Gibson & Lounsbury, 2023). The last related personality measure

students took was the Sixteen Personality Factor Questionnaire (16PF), which assessed the sixteen normal-range personality traits, including the Big Five traits as second-order dimensions.

A confirmatory factor analysis supported a single-factor model for the self-directed learning measure, suggesting the model to be a good fit and that it reflects a single underlying factor. However, the finding does not confirm that measure to be self-directed learning. However, a criterion-related validity of self-directed learning demonstrated a positive correlation with GPA across the various grade levels, supporting the idea that self-directed learning is a stable personality trait over time.

The construct validity of self-directed learning compared with other personality measures showed significant correlations with openness, conscientiousness, and emotional stability as measured by the other instruments and an inverse relationship with neuroticism and anxiety. Self-directed learning also correlated with other traits such as career-decidedness, optimism, sense of identity, and work drive. Additionally, a significant positive correlation was found between the RATTC SDLS inventory and the more established SDLRS instrument developed by Guglielmino (1977), suggesting both instruments measure the same underlying construct. This finding further supports the construct validity of the RATTC SDLS.

Another study conducted by Kirwan et al. (2010) examined the relationship between personality and learner self-direction based on Brockett's (1983) conceptualization of self-directed learning. The term learner self-direction refers to a learner's inclination to take responsibility for the learning process. The study addressed three aims and subsequent hypotheses. The first examined the degree to which the Big Five personality traits explained the variance in learner self-direction. The second was to determine if learner self-direction correlates

with narrow personality traits, and the third was to examine the extent to which these traits accounted for the additional variance beyond the Big Five traits.

The study consisted of 2,102 first-year students who were administered the RATTC SDLS. The results showed significant associations with learner self-direction and the Big Five traits, except for extraversion. A stepwise regression used to control for student variables of sex, age, and academic year indicated that the Big Five traits explained 37% of the variance in learner self-direction. Optimism explained 14% more variance than the previously entered variables, and work drive contributed to an additional 1.5%. Sense of identity and tough-mindedness did not contribute to additional explanations of variance in learner self-direction (Kirwan et al., 2010). Another stepwise regression that included demographic variables in the first step and both Big Five and narrow personality traits in the second step revealed that optimism contributed to 44% of the variance, with work drive contributing another 3% and conscientiousness explaining 1.4%. Emotional stability and tough-mindedness explained less than 1% of the variance.

The latest study conducted by Kirwan et al. (2014) examined the relationship between the Big Five, narrow personality traits, and learner self-direction using correlation and multiple regression analyses. Semi-partial correlations were used to determine the specific contributions of each variable in the regression models. The squared part correlations represented the proportion of variance of the dependent variable (learner self-direction) that was accounted for by the independent and control variables. Work drive accounted for 9.6% of the variance, openness accounted for 4.3% of the variance and optimism accounted for nearly 1% of the variance, with extroversion and agreeableness accounting for less than 1% of the variance in learner self-direction. These findings suggest that people with higher levels of work drive are more likely to set challenging goals and exhibit persistence in their learning. Likewise, these

findings suggest that people who are open to new experiences, ideas, and perspectives are more likely to engage in self-directed learning experiences (Kirwan et al., 2014).

Additionally, the researchers suggest several considerations that lead to a conceptual model that illustrates the significance of a relationship between personality traits and learner self-direction. According to Kirwan et al. (2014), although personality traits are consistently shown to be constant over time and across situations, another explanation to consider is that environmental factors could potentially influence that learner's self-direction. They also propose that since these traits are commonly noted in children as young as three years of age, it is likely that some traits could precede learner self-direction.

The RATTC SDLS is the instrument chosen to determine early childhood practitioners' self-directed learning in the current study. This scale is best suited for the present study for several reasons. The validity and reliability of the study's findings suggest that the instrument has demonstrated effectiveness in predicting learner self-direction, even considering a broad range of personality traits likely to influence self-directed learning. Due to the significant differences among early childhood practitioners' educational attainment, age, and experience, this scale provides distinct contributions to predicting self-direction even after controlling for personality traits, making it suitable for a diverse group of learners. Additionally, the shorter duration, 10-item scale, will likely generate more completion rates than longer, more comprehensive instruments that could result in detrimental non-completion rates.

Measures

Dependent Variable: Self-Directed Learning

The dependent variable, self-directed learning, refers to learner self-direction as a personality trait characterized by the ability to take responsibility for planning, implementing,

and evaluating their learning experience (Lounsbury et al., 2009; Brockett, 1983). Self-directed learning is operationalized by the 10- item Likert scale in the *Resource Associates Transition to College (RATTC) Self-Directed Learning Scale* (2009). The variable is a continuous scale variable measured by single score that will be obtained by adding up responses ranging from 1 reflecting a person strongly disagrees with the statement, to a 5 reflecting a person strongly agrees with the statement to obtain a total score ranging from 5-50 as the measure of each participants self-directed learning.

Independent Variable: Mobile Phone Usage

The independent variable, mobile phone usage, is defined as the use of a smartphone with the goal of accessing the Internet (Graben et al., 2020). For this study, mobile phone usage is a binary variable operationalized at two levels: yes, a mobile phone was used, and no, a mobile phone was not used. This variable is measured by a required multiple choice survey question, "Did you use a mobile phone when taking the Naptime Academy course titled *Preventing Expulsion- The Teaching Pyramid?"* (Select Yes/No).

Independent Variable: Technology Readiness

The moderating variable, technology readiness (TR), refers to "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (Parasuraman, 2000, p. 308). Technology readiness is regarded as a mindset, not a measure of competence or knowledge, and has proven to be a stable characteristic that does not change easily for an individual. Technology readiness is a continuous scale variable operationalized by the 16 items in the Technology Readiness Index Scale (TRI) 2.0 (Parasuraman & Colby, 2015). I will mean center the response values by subtracting the mean score across all responses, aligning each response with its deviation from the overall average within the scale. This variable is

measured by reversing the averages for two domains (insecurity and discomfort), then adding the averages of the four domains together and dividing by four (the total number of domains).

Control Variable: Age

Age is defined as the number of years a person has lived (Dictionary.com, 2021, para. 2). Age is a continuous variable operationalized by the participant's chronological age, which is measured in years. I will mean center the age variable by subtracting the average age from each participant's age to standardize the values around the average so that the slope between the predictor and age variable stays constant. Age will be measured using participants' responses to the required form field survey question asking, "What is your age?"

Control Variable: Educational Attainment

Educational attainment is defined as "the level of education a person has successfully completed or the qualifications they have obtained (U.S. Census Bureau, 2021). For this study, educational attainment is a binary variable, operationalized by completing a Child Development Associate (CDA) Credential or 60 hours of formal early childhood education training in the form of an associate degree or higher in early childhood education. Educational attainment will be measured by the required multiple choice survey question, "Have you completed a Child Development Associate (CDA) Credential or associate degree with 60 hours of formal early childhood education training?" (Select Yes or No).

Control Variable: Race/Ethnicity

Race refers to "the physical characteristics of a person, such as skin color, eye color, hair texture, and facial features" (The U.S. Equal Employment Opportunity Commission [EEOC], 2021, para. 2). Ethnicity is defined as shared cultural characteristics, such as "language, ancestry, practices, and beliefs." (EEOC, 2021, para. 2). For this study, participants' race/ethnicity is a

binary categorical variable operationalized by White or non-White following culturally appropriate practices demonstrated by Goldenberg (2014) when categorizing diverse groups within learning environments. This variable will be measured by the required multiple choice survey questions, "Are you Hispanic, Latino/a, or Spanish origin?" (Select *one* that applies: Hispanic or Latino/a; Not Hispanic or Latino/a) and a subsequent question, "What is your race? (Select *all* that apply: American Indian or Alaska Native, Asian, Black, African American, Native Hawaiian or Pacific Islander, White).

Control Variable: Household Income

Household income is defined as the total gross income received by all household members within 12 months (Scott, 2023). Income is a continuous variable, operationalized by the total amount of money earned by an individual or household in a year, including all sources of income such as wages, salaries, bonuses, tips, investments, and government benefits (Stiglitz et al., 2010). I will mean center the variable income, which is categorized into five ranges, by subtracting the average income within each range from each individual income values to standardize the values across income ranges within each category. For this study, participants' income is measured by the optional multiple-choice question, "What is your total household income?" (Select *one* that applies). The following options will be provided: ($0-$19,999; $20,000-$49,999; $50,000-$79,999; $80,000-$109,999; $110,000+).

Control Variable: Urban/Rural Status

The United States Census Bureau (2021) defines urban areas as "densely developed residential, commercial, and other nonresidential areas. Rural areas are defined as the population in any areas outside of those classified as urban" (para. 1). For this study, urban or rural status is a binary categorical variable operationalized by population density (distance from nearest city,

and size of nearest city) to determine participants urban or rural status as specified by the United States Census Bureau (2021). Urban/rural status will be measured by the required form field question, "What is your residence zip code?"

Data Collection

Before the data collection process begins, I will request Institutional Review Board (IRB) approval from the School of Medicine to ensure commitment to ethical research practices and to protect participants' rights, confidentiality, and well-being. Once IRB approval is granted, an email containing the IRB approval, the purpose of the study and the consent form will be distributed via the institution's e-learning management system to all users' registered emails who completed the specified course. The email will ask participants to sign and return the consent form to determine their interest in participating in the study and will contain a link to the REDCap survey that will be used to gather data. The email will also explain that participants who choose to complete the survey can be entered into a drawing to win one of three $100 Amazon gift cards (See Appendix E for the solicitation email and consent form). At the end of the survey, a separate link will direct participants who wish to be entered into the drawing to a Microsoft Form. A separate form for the drawing will ensure that participant data is not linked to their survey responses.

Participants will have two weeks to complete the surveys. A reminder email will be sent one week after the initial email is sent to increase participation. After two weeks, the surveys will close. I will extend data collection if the required sample size is not reached. Once all surveys are submitted, participant demographic data, self-directed learning scores, and technology readiness scores will be matched with participant ID numbers associated with participant responses to

ensure anonymity. All data will be secured through a password-protected Excel file and summarized before analysis.

Data Analysis

The study's hypotheses will be tested using hierarchical multiple regression. Multiple regression is a statistical method that assumes linear relationships between a dependent variable and two or more independent variables (Roberts & Roberts, 2021). According to Field (2018), multiple regression aims to identify the strength and direction of the relationships between the variables and to predict the dependent variable's value based on the independent variables' values. This technique enables researchers to evaluate how each independent variable influences the dependent variable while considering and adjusting for the influence of other variables in the model (Field, 2018). Roberts and Roberts (2021) state, "It is almost always more realistic for there to be multiple influences on a dependent variable than to suppose that truly only a single factor influences Y" (p. 23). For this reason, hierarchical multiple regression is used to answer the research questions to determine the predictive effects of mobile phone usage and technology readiness on early childhood practitioners' self-directed learning in an asynchronous online course.

The premise of activity theory suggests that multiple cultural and contextual predictor variables influence the outcome variable. A review of the literature indicated multiple variables that must be controlled for when determining the effect of the predictors on the outcome. Hierarchical multiple regression allows the researcher to add multiple variables to the model in separate steps called "blocks." Blocking the variables allows the researcher to statistically control individual variables to determine if they significantly improve a model's ability to predict the outcome variable (Fein, 2022). Additionally, this modeling approach will reveal if a moderating

effect of the variable, technology readiness, influences the relationship between the independent and dependent variables (Roberts & Roberts, 2021).

The general linear model in multiple regression makes several assumptions about the data and the relationship between the variables. The key assumptions are linearity and additivity, normality, independence, homoscedasticity/homogeneity of variance, and multicollinearity. Violations of these assumptions can lead to biased and inaccurate results (Field, 2018). For this reason, each of these assumptions will be checked before conducting multiple regression analysis to ensure the validity and reliability of the findings.

I will test for the assumption of independence by examining the residuals or differences between observed and predicted values in a residual plot to look for any discernable patterns or trends. If a pattern exists, it suggests that the assumption is violated and that the residuals may be correlated among observations. Scatterplots will be used to visually examine the relationship between the variables to test for the assumption of linearity and additivity and determine if the data is linear (straight-line) or nonlinear (curved or clustered). The assumption of additivity in multiple regression suggests that the relationship between the dependent variable and the independent variables is linear and additive, meaning that the effect of each independent variable on the dependent variable is constant across all levels of the other independent variables. Additionally, a visual inspection of the data will identify potential outliers that may have an unwarranted influence on the results. This measure helps identify non-independence patterns where data is clustered or suggests a pattern indicating that the observations are not independent (Field, 2018). If the scatterplot suggests a nonlinear relationship between the dependent and independent variables, I will consider using nonlinear regression or transforming the variables to

attain linearity. In this case, a logarithmic or exponential transformation of the independent variable may help to achieve linearity (Field, 2018).

Two well-known tests can be used to check the assumption of normality (Field, 2018). Beyond a Q-Q plot to visually inspect the data for a normal distribution, the Kolmogorov–Smirnov (KS) test will be used to test the assumption of normality. If the p-value of the KS Test is larger than 0.05, I will assume a normal distribution. However, if the p-value of the KS test is smaller than 0.05, I will assume the assumption has been violated and there is no normal distribution. To mitigate this risk, I will perform bootstrapping to create multiple resampled datasets that allow for the calculation of robust estimates for the study's variables (Field, 2018)

Homoscedasticity is the assumption that the variance of the residuals (the differences between the observed values and the predicted values) is constant across all levels of the independent variables. A residual plot will be used to check for homoscedasticity by plotting the residuals against the predicted values (Field, 2018). If the plot shows no discernible pattern, it suggests that the assumption of homoscedasticity is met. If there is evidence of heteroscedasticity, the assumption has been violated. I will transform the data using a robust regression, or removing any outliers that may be causing an undue influence on the results (Field, 2018).

Lastly, multicollinearity occurs when two or more predictor variables in a regression analysis are highly correlated and can cause problems in statistical analyses, making it difficult to determine the independent effect of each predictor on the outcome variable. To test for multicollinearity, I will use a correlation matrix to identify any correlations between all predictor variables greater than the 0.80 threshold, meaning that they may be too strongly correlated to provide a reliable explanation of the variation in the outcome variable. Additionally, I will check

for collinearity using the Variance Inflation Factor (VIF) for each independent variable. The higher the VIF value, the higher the correlation between the independent variable and the remaining variables. Should collinearity exist, it may be necessary to remove one of the correlated variables from the analysis (Field, 2018). The statistical software IBM Statistical Package for the Social Sciences (SPSS) Version 28 will be used to run the statistical tests and perform the appropriate data analyses.

Model 1

This model addresses the first two research questions. The main effect model is $\hat{Y} = b_0 + b_1X_1 + b_2X_2 + \sum b' X'$ where b_1 is the regression coefficient for mobile phone usage, with no phone used as the reference category, and b_2 is the regression coefficient for technology readiness, a continuous variable, and the sum of b' represents the participant control variables. For early childhood practitioners in an asynchronous online professional development course:

RQ1. Is mobile phone usage positively associated with self-directed learning, after controlling for relevant participant variables?

RQ2. Is technology readiness positively associated with self-directed learning, after controlling for relevant participant variables?

Model 2

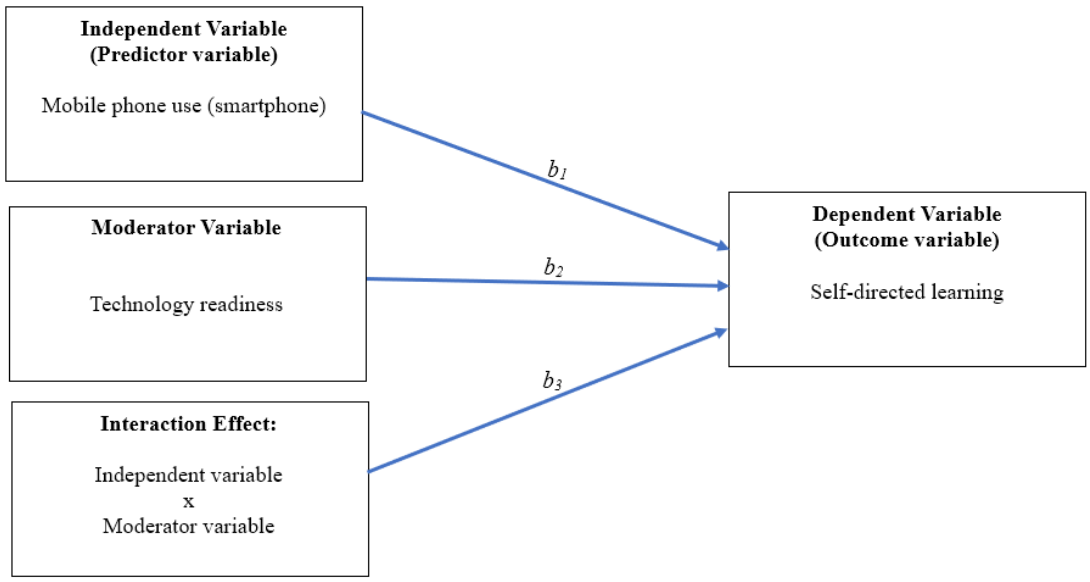
This model addresses the third research question. The interaction model is $\hat{Y} = b_0 + b_1X_1 + b_2X_2 + b_3X_1X_2 + \sum b' X'$ where b_1 is the regression coefficient for mobile phone usage, with no phone used as the reference category, b_2 is the regression coefficient for technology readiness, b_3 is the regression coefficient for the interaction between mobile phone use and technology readiness, and the sum of b' represents the participant control variables. To visually illustrate the

observed relationships in the analysis, I will include a graphical representation of the interaction model when presenting the study's findings.

RQ3. Does technology readiness influence the relationship between mobile phone usage and self-directed learning, after controlling for relevant participant variables?

Figure 3 depicts a statistical model representing relationships among the study's variables.

Figure 3.
Statistical Model Illustrating the Interaction Analysis



Note: This interaction analysis examines the extent to which the relationship between the independent variable (mobile phone use) and dependent variable (self-directed learning) changes depending on the moderating variable (technology readiness). Technology readiness is hypothesized to influence the strength or direction of the relationship between mobile phone use and self-directed learning, revealing conditions under which this relationship may be stronger or weaker.

Internal and External Validity

Threats to internal validity consist of broad factors that can often cloud our ability to make clear causal inferences (Mark &Reichardt, 2001). In this non-experimental, multiple regression study, the first and most notable threat to internal validity is the presence of a history effect since the study data occurs after the COVID-19 pandemic. A history effect is related to an

outside event or experience that will likely influence the dependent variable. This type of threat can result in changes that may be attributed to factors other than the independent variable being studied (Mark & Reichardt, 2001). The pandemic may be an unrelated event that could influence the relationship between early childhood practitioners' mobile phone usage and self-directed learning when engaging in an asynchronous online course. The pandemic could also impact the interaction effect of technology readiness on this relationship, making this a limitation of the study's findings.

Another internal threat to validity is a type of response bias known as extreme responding. Since the survey contains Likert-type scales, there is a possibility that respondents will only choose the extreme choices rather than how they truly feel. To mitigate this threat, I intentionally chose shorter instruments totaling only 26 combined items plus the demographic questions so participants could complete the survey in under 15 minutes. I have also provided a generous incentive to achieve high participation rates. The closer participation is to 100%, the less likely this bias will influence the results. Typically, the participation of 80% or more of those invited will diminish this threat (Boston University, n.d.). Additionally, attention check questions are inserted within the survey to identify respondents who are not engaged or answering questions thoughtlessly (Kung et al., 2018).

An external threat to validity relevant to the study is a type of sampling bias known as convenience sampling. This study employs a convenience sample of all those who completed the chosen course. Since the survey will be administered online, people with greater technology readiness may be more likely to agree or self-select to participate than those with less technology-ready behaviors. Since participants willingly participate in the survey, the sample may not represent the larger population and may skew the data results (Bhandari, 2023).

Summary

This chapter described the cross-sectional study used to determine if a relationship exists between early childhood practitioners' mobile phone usage and self-directed learning when participating in an asynchronous professional development course. The potential interaction effect of the technology readiness was examined to determine the strength or direction of this effect on the relationship between mobile phone usage and self-directed learning. I restated the research questions and hypotheses and provided each question's regression models, explaining each of the variables within the models. I described the study's setting, participants, and the materials and measures used to collect the data. I also explained the data analyses performed and the study's threats to internal and external validity. Finally, I discussed how I would mitigate these threats to improve the accuracy and reliability of the study's results and increase confidence in the study's findings.

References

Abe, J. A. A. (2020). Big five, linguistic styles, and successful online learning. *The Internet and Higher Education*, *45*, 1–9. https://doi.org/10.1016/j.iheduc.2019.100724

Abidin, N. Z., & Tho, S. (2018). The development of an innovative resonance experiment using smartphones with free mobile software applications for tertiary education. *International Journal of Educational Development. 14*(1), 164–176. https://files.eric.ed.gov/fulltext/EJ1178364.pdf

Ackerman, D. J. (2017). Online child care training in the United States: a preliminary investigation of who participates, what is offered, and on which topics the workforce is focusing. *International Journal of Child Care and Education Policy (Seoul)*, *11*(1), 1–22. https://doi.org/10.1186/s40723-017-0037-7

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior Human Decision Process. 50*, 179–211. https://doi.org/10.1016/0749-5978(91)90020-

Ally, M. (2004). Foundations of educational theory for online learning. In T. Anderson & F. Elloumi (Eds.), *Theory and practice of online learning* (pp. 3–31). Athabasca University Press.

Alsaadat, K. (2017). Mobile learning—An alternative approach in higher education. *European Journal of Alternative Education Studies*. https://doi.org/10.5281/zenodo.815474

American Library Association. (n.d.). *Digital literacy. Welcome to ALAs literacy clearinghouse.* https://literacy.ala.org/digital-literacy/.

Anshari, M., & Alas, Y. (2015). Smartphones habits, necessities, and big data challenges. *The Journal of High Technology Management Research*, *26*(2), 177–185. https://doi.org/10.1016/j.hitech.2015.09.005

Arkansas Early Childhood Association. (n.d.). *T.E.A.C.H. Early Childhood Arkansas: A program of the Arkansas Early Childhood Association*. https://arkansasearlychildhood.org/teach/.

Arkansas State Broadband Office. (2023, November 21). *Latest updates*. Arkansas Department of Commerce – Broadband Office. https://broadband.arkansas.gov/

Asghar, M. Z., Barberà, E., & Younas, I. (2021). Mobile learning technology readiness and acceptance among pre-service teachers in Pakistan during the COVID-19 pandemic. *Knowledge Management & E-Learning*, *13*(1), 83–101. https://doi.org/10.34105/j.kmel.2021.13.005

Attewell, J., & Savill-Smith. (2005). *Mobile learning anytime everywhere: A book of papers from mLearn 2004*, 15–19. https://www.voced.edu.au/content/ngv%3A36586

Audet, É. C., Levine, S. L., Metin, E., Koestner, S., & Barcan, S. (2021). Zooming their way through university: Which big 5 traits facilitated students' adjustment to online courses

during the COVID-19 pandemic. *Personality and Individual Differences, 180,* 1–5. http://hdl.voced.edu.au/10707/29470

Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, *44*(1) 1-26. https://doi.org/10.1111/j.1744-6570.1991.tb00688.x

Bass, M. (2020). Power to the profession and the unifying framework for the early childhood education profession. *YC Young Children, 75*(1), 62–63. https://www.jstor.org/stable/26906576

Beach, P., Minuk, A., & Favret, E. (2022). Teachers' self-directed online strategies and experiences: A longitudinal study. *Online Learning, 26*(4), 5–30. https://doi.org/10.24059/olj.v26i4.3441

Bagawan, A., Douglas, S. N., & Gerde, H. K. (2023). Components of effective supervision and training for paraeducators. *Intervention in School and Clinic*, *58*(4), 264–272. https://doi.org/10.1177/10534512221093778

Bhandari, P. (2023, March 17). *Sampling bias and how to avoid it: Types & examples.* Scribbr. https://www.scribbr.com/research-bias/sampling-bias/

Bird, J., & Charteris, J. (2021). Teacher performance assessments in the early childhood sector: Wicked problems of regulation. *Asia-Pacific Journal of Teacher Education, 49*(5), 503–516. https://doi.org/10.1080/1359866X.2020.1843596

Bitsko, R. H., Holbrook J. R., Robinson L. R. (2016). Health care, family, and community factors associated with mental, behavioral, and developmental disorders in early childhood: United States, 2011–2012. *Morbidity and Mortality Weekly Report, 65,* 221–226. http://dx.doi.org/10.15585/mmwr.mm6509a1external icon

Blackwell, C. K., Wartella, E., Lauricella, A. R., & Robb, M. B. (2015). *Technology in the Lives of Educators and Early Childhood Programs: Trends in Access, Use, and Professional Development from 2012 to 2014* (1-25). Northwestern University. https://cmhd.northwestern.edu/wp-content/uploads/2015/12/1927_1_SOC_ConferenceReport_EarlyChildhood_Final.pdf

Blake, S., Winsor, D., Burkett, C., & Lee, A. (2011). Developmentally appropriate technology practice: Exploring myths and perceptions of early childhood and instructional technology professionals. *I-Manager's Journal on School Educational Technology, 6*(3), 35-48. https://www.proquest.com/scholarly-journals/developmentally-appropriate-technology-practice/docview/1473908775/se-2

Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *International Review of Research in Open and Distance Learning*, *13*(1), 56–71. https://doi.org/10.19173/irrodl.v13i1.1076

Boston University. (n.d.). *Identifying and Preventing Bias*. PH717 Module 10 - Bias. https://sphweb.bumc.bu.edu/otlt/MPH-Modules/PH717-QuantCore/PH717-Module10-Bias/PH717-Module10-Bias_print.html

Bozkurt, A., Karakaya, K., Turk, M., Karakaya, Ö., & Castellanos-Reyes, D. (2022). The impact of COVID-19 on education: A meta-narrative review. *TechTrends*, *66*(5), 883–896. https://doi.org/10.1007/s11528-022-00759-0

Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G., Lambert, S. R., Al-Freih, M., Pete, J., Olcott, D., Rodes, V., Aranciaga, I., Bali, M., Alvarez, A. V., Roberts, J., Pazurek, A., Raffaghelli, J. E., Panagiotou, N., de Coëtlogon, P., Paskevicius, M. (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education*, *15*(1), 1–126. http://doi.org/ 10.5281/zenodo.3878572

Bozkurt, A., & Sharma, R. C. (2020). Emergency remote teaching in a time of global crisis due to Coronavirus pandemic. *Asian Journal of Distance Education, 15*(1), i-vi. https://zenodo.org/records/3778083

Brandisauskiene, A., Cesnaviciene, J., Miciuliene, R., & Kaminskiene, L. (2020). What factors matter for the sustainable professional development of teachers? Analysis from four countries. *Journal of Teacher Education for Sustainability, 22*(2), 153–170. https://doi.org/10.2478/jtes-2020-0022

Bragg, L. A., Walsh, C., & Heyeres, M. (2021). Successful design and delivery of online professional development for teachers: A systematic review of the literature. *Computers & Education, 166*, 104–158. https://doi.org/10.1016/j.compedu.2021.104158

Broadband Development Group. (2022, April 18). *Arkansas broadband master plan: Assessment and recommendations*. Altman Solon. https://broadband.arkansas.gov/wp-content/uploads/2022/04/Arkansas-Broadband-Master-Plan.pdf

BroadbandNow. (2023, August 8). *Internet access in Arkansas: Stats & figures*. BroadbandNow. https://broadbandnow.com/Arkansas

Brockett, R. (1983). Self-directed learning and the hard-to-reach adult. *Lifelong Learning: The Adult Years*, *6(*8), 16–18.

Brockett, R. G., & Hiemstra, R. (1991). *Self-direction in adult learning: Perspectives on theory, research, and practice*. Routledge. https://doi.org/10.4324/9780429457319

Brown, S. (2018). *An investigation of faculty perceptions about mobile learning in higher education* (Publication No. 10817578) [Doctoral dissertation, Nova Southeastern University]. ProQuest Dissertations and Theses Global.

Brunsek, A., Perlman, M., McMullen, E., Falenchuk, O., Fletcher, B., Nocita, G., Kamkar, N. & Shah, P. S. (2020). A meta-analysis and systematic review of the associations between professional development of early childhood educators and children's outcomes. *Early*

Childhood Research Quarterly, *53*, 217–248. https://doi.org/10.1016/j.ecresq.2020.03.003

Burchinal, M. R., Cryer, D., Clifford, R. M., & Howes, C. (2002). Caregiver training and classroom quality in child care centers. *Applied Developmental Science*, *6*(1), 2–11. https://doi.org/10.1207/S1532480XADS0601_01

Burden, K., Kearney, M., Schuck, S., & Burke, P. (2019). Principles underpinning innovative mobile learning: Stakeholder's priorities. *Association for Educational Communications & Technology, 63,* 659–668. https://doi.org/10.1007/s11528-019-00415-0

Buysse, V., Winton, P. J., & Rous, B. (2009). Reaching consensus on a definition of professional development for the early childhood field. *Topics in Early Childhood Special Education, 28*(4), 235–243. https://doi.org/10.1177/0271121408328173

Candy, P. C. (1987). *Reframing research into 'self-direction' in adult education: A constructivist perspective* (Doctoral dissertation, University of British Columbia).

Candy, P. C. (1991). *Self-direction for lifelong learning. A comprehensive guide to theory and practice*. Jossey-Bass.

Callaway-Cole, L., & Kimble, A. (2021). Maintaining professional standards in early childhood teacher preparation: Evaluating adaptations to fieldwork-based experiences during COVID-19. *Early Childhood Education Journal*, *49*(5), 841–853. https://doi.org/10.1007/s10643-021-01227-9

Chau, K. Y., Law, K. M., & Tang, Y. M. (2021). Impact of self-directed learning and educational technology readiness on synchronous e-learning. *Journal of Organizational and End User Computing, 33,* 1–20. https://doi.org/10.4018/JOEUC.20211101.oa26

Cheon, J., Lee, S., Crooks, S. M., & Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computers & Education*, *59*(3), 1054–1064. https://doi.org/10.1016/j.compedu.2012.04.015

Child Care Aware of America (2022). *Demanding change: Repairing our child care system.* https://www.childcareaware.org/demanding-change-repairing-our-child-care-system/

Consumer and Governmental Affairs. (2022, July 18). *Getting broadband Q&A.* Federal Communications Commission. https://www.fcc.gov/consumers/guides/getting-broadband-qa

Cooper, J. (2018). Examining factors that influence a woman's search for information about menopause using the socio-ecological model of health promotion. *Maturitas, 116,* 73–78. https://doi.org/10.1016/j.maturitas.2018.07.013

Coşkun Çelik, H., & Karayaman, S. (2018). Investigating attitudes of prospective mathematics teachers towards the use of mobile learning at a higher learning institution. *Universal*

Journal of Educational Research, *6*(8), 1784–1794. https://doi.org/10.13189/ujer.2018.060823

Council for Professional Recognition. (n.d.). *CDA® state fact sheet Arkansas*. https://www.cdacouncil.org/wp-content/uploads/2023/09/AR_CDA-State-Fact-Sheet.pdf.

Crompton, H., & Burke, D. (2018). The use of mobile learning in higher education: A systematic review. *Computers & Education*, *123*, 53–64. https://doi.org/10.1016/j.compedu.2018.04.007

Cronin-Golomb, L. M., & Bauer, P. J. (2023). Self-motivated and directed learning across the lifespan. *Acta Psychologica*, *232*, 103816. https://doi.org/10.1016/j.actpsy.2022.103816

Curran, V., Fleet, L., Simmons, K., Lannon, H., Gustafson, D., Wang, C., Garmsiri, M., & Wetsch, L. (2019). Adoption and use of mobile learning in continuing professional development by health and human services professionals. *The Journal of Continuing Education in the Health Professions,39*(2), 76–85. https://doi.org/10.1097/ceh.0000000000000243

Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J. (2006). Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and aging*, *21*(2), 333–352. https://doi.org/10.1037/0882-7974.21.2.333.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development* (ED606743). Learning Policy Institute. https://files.eric.ed.gov/fulltext/ED606743.pdf

Davis, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* (Doctoral dissertation, Massachusetts Institute of Technology).

Dede, C., Jass Ketelhut, D., Whitehouse, P., Breit, L., & McCloskey, E. M. (2009). A research agenda for online teacher professional development. *Journal of teacher education*, *60*(1), 8–19. https://doi.org/10.1177/0022487108327554

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, *38*(3), 181–199, doi:10.3102/0013189x08331140.

DiMaggio, P., Hargittai, E., Celeste, C., & Shafer, S. (2004). Digital inequality: From unequal access to differentiated use. *Social inequality*, 355-400. Russell Sage Foundation.

Dingle, M. P., Brownell, M. T., Leko, M. M., Boardman, A. G., & Haager, D. (2011). Developing effective special education reading teachers: The influence of professional development, context, and individual qualities. *Learning Disability Quarterly*, *34*(1), 87–103. https://doi.org/10.1177/073194871103400106

Division of Child Care and Early Childhood Education, Child Care Licensing Unit. (2020). *Minimum licensing requirements for child care centers* (Pub002, Rev. 12/01/2020). https://dese.ade.arkansas.gov/Offices/office-of-early-childhood/child-care-licensing

Division of Child Care and Early Childhood Education. (n.d.). *What is the Arkansas professional development registry?*. https://pdregistry.arkansas.gov/Home/About

Domingo, M. G., & Garganté, A. B. (2016). Exploring the use of educational technology in primary education: Teachers' perception of mobile technology learning impacts and applications' use in the classroom. *Computers in Human Behavior*, *56*, 21–28. https://doi.org/10.1016/j.chb.2015.11.023

Dolgunsöz, E., & Yıldırım, G. (2021). The role of mobile devices on online EFL skill courses during COVID-19 emergency remote education. *Acuity: Journal of English Language Pedagogy, Literature and Culture*, *6*(2), 118–131. https://doi.org/10.35974/acuity.v6i2.2486

Duran, F., Hepburn, K., Irvine, M., Kaufmann, R., Anthony, B., Horenn, N., & Perry, D. (2009). What works? A study of effective early childhood mental health consultation programs. Washington, DC: Georgetown University. *Center for Child and Human Development*. https://doi.org/10.35974/acuity.v6i2.2486

Dwyer, A., Jones, C., & Rosas, L. (2019). What digital technology do early childhood educators use and what digital resources do they seek?. *Australasian Journal of Early Childhood*, *44*(1), 91–105. https://doi.org/10.1177/1836939119841459

Early Educator Investment Collaborative (2020). *Early educator preparation landscape. 2020 report.* Center for the Study of Child Care Employment. https://files.eric.ed.gov/fulltext/ED614020.pdf

EdSurge. (2021). *Online Professional Development: What You Need to Know*. https://www.edsurge.com/research/guides/online-professional-development-what-you-need-to-know.

Education Super Highway. (n.d.). *Bridging the broadband affordability gap.* https://www.educationsuperhighway.org/wp-content/uploads/No-Home-Left-Offline-Report_EducationSuperHighway2021.pdf

Engeström, Y. (2014). *Learning by expanding: An activity-theoretical approach to developmental research* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/CBO9781139814744

Engeström, Y., Miettinen, R., & Punamäki, R. L. (1999). *Perspectives on activity theory*. Cambridge University Press.

Fabiano, G. A., Reddy, L. A., & Dudek, C. M. (2018). Teacher coaching supported by formative assessment for improving classroom practices. *School Psychology Quarterly*, *33*(2), 293–304. https://doi.org/10.1037/spq0000223

Federal Communications Commission. (2021). (rep.). *Fourteenth broadband deployment report* (p. 1–290). Washington DC. https://docs.fcc.gov/public/attachments/FCC-21-18A1.pdf

Fein, E. C., Gilmour, J., Machin, T., & Hendry, L. (2022, June 16). *Section 5.4: Hierarchical regression explanation, assumptions, interpretation, and write up.* Statistics for Research Students. https://usq.pressbooks.pub/statisticsforresearchstudents/chapter/hierarchical-regression-assumptions/#:~:text=Hierarchical%20regression%20is%20a%20type,always%20be%20based%20on%20theory

Field, A. (2018). *Discovering statistics using IBM SPSS statistics: North American edition*. SAGE.

Findley, M. G., Kikuta, K., & Denly, M. (2021). External validity. *Annual Review of Political Science, 24*, 365-393. https://doi.org/10.1146/annurev-polisci-041719102556.

First Five Years Fund (2023). *The first five things to know about: Preschool development grants birth through five (PDG B-5).* https://www.ffyf.org/resources/2023/07/first-five-things-to-know-pdg/.

Fischer, G. (2001). Lifelong learning and its support with new media. In N.J. Smelser & P.B. Baltes (Eds.), *International Encyclopedia of Social and Behavioral Sciences, 13*. 8836–8840. Elsevier Ltd. https://doi.org/10.1016/B0-08-043076-7/04675-1

Fitzgerald, R.M. (2023). *A storied picture of international students' Hope in online learning*. [Doctoral dissertation, Athabasca University]. https://dt.athabascau.ca/jspui/handle/10791/414.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *The American Psychologist*, *34*(10), 906–911. https://doi.org/10.1037/0003-066X.34.10.906

Fonsén, E., Marchant, S., & Ruohola, V. (2023). Leadership in early childhood education: Cross-cultural case studies before and during the COVID-19 pandemic. *Educational Management Administration & Leadership*, https://doi.org/10.1177/17411432231194849

Ford, T. G., Kwon, K. A., & Tsotsoros, J. D. (2021). Early childhood distance learning in the US during the COVID pandemic: Challenges and opportunities. *Children and Youth Services Review*, *131*, 106297. https://doi.org/10.1016/j.childyouth.2021.106297

Fortner, A. (2023). FY2023 *Omnibus spending package includes important investments for child care and early education.* CLASP The Center for Law and Social Policy. https://www.clasp.org/blog/fy2023-omnibus-spending-package-includes-important-investments-for-child-care-and-early-education/

Fritschi, J., & Wolf, M. A. (2012). *Mobile learning for teachers in North America exploring the potential of mobile technologies to support teachers and improve practice.* UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000216084

Fuglini, A. S., Howes, C., Lara-Cinisomo, S., & Karoly, L. (2009). Diverse pathways in early childhood professional development: An exploration of early educators in public preschools, private preschools, and family child care homes. *Early Education and Development, 20,* 507–526. https://doi.org/10.1080/10409280902783483

Fukkink, R. G., & Lont, A. (2007). Does training matter? A meta-analysis and review of caregiver training studies. *Early Childhood Research Quarterly, 22*(3), 294–311. https://doi.org/10.1016/j.ecresq.2007.04.005

Gallardo, R. (2022). *The state of the digital divide in the United States.* Purdue University. https://pcrd.purdue.edu/the-state-of-the-digital-divide-in-the-united-states/.

Gallucci, C., DeVoogt Van Lare, M., Yoon, I. H., & Boatright, B. (2010). Instructional Coaching: Building Theory About the Role and Organizational Support for Professional Learning. *American Educational Research Journal, 47*(4), 919–963. https://doi.org/10.3102/0002831210371497

García Botero, G., Questier, F., & Zhu, C. (2019). Self-directed language learning in a mobile-assisted, out-of-class context: Do students walk the talk?. *Computer Assisted Language Learning*, *32*(1-2), 71–97. https://doi.org/10.1080/09588221.2018.1485707

Gardner-Neblett, N., Henk, J. K., Vallotton, C. D., Rucker, L., & Chazan-Cohen, R. (2021). The what, how, and who, of early childhood professional development (PD): Differential associations of PD and self-reported beliefs and practices. *Journal of Early Childhood Teacher Education*, *42*(1), 53–75. https://doi.org/10.1080/10901027.2020.1735584

Garrison, D.R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly, 48*(1), 18–33. https://doi.org/10.1177/074171369704800103

Geng, S., Law, K. M., & Niu, B. (2019). Investigating self-directed learning and technology readiness in blending learning environment. *International Journal of Educational Technology in Higher Education*, *16*(1), 1–22. https://doi.org/10.1186/s41239-019-0147-0

Gibbons, M. (2002). *The self-directed learning handbook: Challenging adolescent students to excel*. Jossey-Bass.

Gibson, L. W., & Lounsbury, J. W. (2023). *Resource Associates Personal Style Inventory: A Personality Assessment System for the Work Place*. Knoxville; Resource Associates. /https://www.resourceassociates.com/wp-content/uploads/pre-employment-personality-testing-official-manual.pdf.

Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education, 19,* 18–26. https://doi.org/10.1016/j.iheduc.2013.06.002

Global System for Mobile Communications Association (GSMA). (2023). *The mobile economy 2023.* https://www.gsma.com/mobileeconomy/wp-content/uploads/2023/03/270223-The-Mobile-Economy-2023.pdf.

Goldenberg, B. M. (2014). White teachers in urban classrooms: Embracing non-white students' cultural capital for better teaching and learning. *Urban Education (Beverly Hills, Calif.), 49*(1), 111–144. https://doi.org/10.1177/0042085912472510

Gomez, R. E., Kagan, S. L., & Fox, E. A. (2015). Professional development of the early childhood education teaching workforce in the United States: An overview. *Professional Development in Education*, *41*(2), 169–186. https://doi.org/10.1080/19415257.2014.986820

Gould, E., Whitebook, M., Mokhiber, Z., & Austin, L. (2020). *Financing Early Educator Quality: A Values-Based Budget for Every State.* Economic Policy Institute and University of California Berkeley's Center for the Study of Child Care Employment. https://cscce.berkeley.edu/financing-early-educator-quality-a-values-based-budget-for-every-state/.

Gradillas, M., & W. Thomas, L. D. (2023). Distinguishing digitization and digitalization: A systematic review and conceptual framework. *Journal of Product Innovation Management*. https://doi.org/10.1111/jpim.12690

Graben, K., Doering, B. K., Jeromin, F., & Barke, A. (2020). Problematic mobile phone use: Validity and reliability of the Problematic Use of Mobile Phone (PUMP) Scale in a German sample. *Addictive Behaviors Reports*, *12*, 1–7. https://doi.org/10.1016/j.abrep.2020.100297

Graves, J. M., Abshire, D. A., Amiri, S., & Mackelprang, J. L. (2021). Disparities in technology and broadband internet access across rurality: Implications for health and education. *Family & Community Health*, *44*(4), 257–265. https://doi.org/10.1097/FCH.0000000000000306

Grow, G. O. (1991). Teaching learners to be self-directed. *Adult education quarterly*, *41*(3), 125–149. https://doi.org/10.1177/0001848191041003001

Grimmett, H. (2014). *The practice of teachers' professional development: A cultural-historical approach* (1st ed.). Sense Publishers. https://doi.org/10.1007/978-94-6209-610-3

Guglielmino, L. M. (1978). *Development of the self-directed learning readiness scale.* (Publication No. 7806004) [Doctoral dissertation, University of Georgia]. ProQuest Dissertations & Theses Global.

Guglielmino, L. M. (2008). Why self-directed learning? *International Journal of Self-Directed Learning, 5*(1), 1–14.

Gunter, G. A., & Reeves, J. L. (2016). Online professional development embedded with mobile learning: An examination of teachers' attitudes, engagement and dispositions. *British*

Journal of Educational Technology, *48*(6), 1305–1317. https://doi.org/10.1111/bjet.12490

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, *3*, 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hamre, B. K., Partee, A., & Mulcahy, C. (2017). Enhancing the impact of professional development in the context of preschool expansion. *Aera Open*, *3*(4) https://doi.org/10.1177/2332858417733686 .

Hamre, B. K., Pianta, R. C., Mashburn, A. J., & Downer, J. T. (2012). Promoting young children's social competence through the preschool paths curriculum and MyTeachingPartner professional development resources. *Early Education and Development*, *23*(6), 809–832. https://doi.org/10.1080/10409289.2011.607360

Hao, S., Dennen, V. P., & Mei, L. (2017). Influential factors for mobile learning acceptance among Chinese users. *Educational Technology Research and Development*, *65*, 101–123. https://www.jstor.org/stable/45018532

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap): A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of biomedical informatics*, *42*(2), 377–381. https://doi.org/10.1016/j.jbi.2008.08.010

Hashim, A. S., Ahmad, W. F. W., & Ahmad, R. (2011). Mobile learning course content application as a revision tool: The effectiveness and usability. *2011 International Conference on Pattern Analysis and Intelligence Robotics*, *2*, 184–187. https://doi.org/10.1109/ICPAIR.2011.5976941

Hiemstra, R., & Brockett, R. G. (2012). Reframing the meaning of self-directed learning: An updated modeltt. *Adult Education Research Conference*. https://newprairiepress.org/aerc

Herzenberg, S., Price, M., & Bradley, D. (2005). *Losing ground in early childhood education.* Economic Policy Institute. https://www.researchgate.net/publication/237470430

Hong, C., Hwang, M., Liu, H., & Chen (2014). Using a "prediction- observation explanation" inquiry model to enhance student interest and intention to continue science learning predicted by their internet cognitive failure. *Computers & Education, 72*, 110–120. https://doi.org/10.1016/j.compedu.2013.10.004

Horn, E. A., Anderson, R., & Pierick, K. (2018). Open educational resources (OERs) in self-directed competency-based education. *Information Discovery and Delivery*, *46*(4), 197–203. https://doi.org/10.1108/IDD-02-2018-0005

Houle, C. O. (1981). Continuing learning in the professions. *Journal of Continuing Education in the Health Professions, 1*(1), 76–80. https://doi.org/10.1002/chp.4760010112

Howes, A. (2003). Twelve tips for developing professional attitudes in training. *Medical Teacher*, *25*(5), 485–487. https://doi.org/10.1080/01421590310001605624

Hoy, W. K., & Adams, C. M. (2016). *Quantitative research in education: A primer*. Sage Publications.

Hung, M., Chou, C., Chen, C., & Own, Z. (2010). Learner readiness for online learning: Scale development and student perceptions. *Computers and Education, 55,* 1080–1090. https://doi.org/10.1016/j.compedu.2010.05.004

Huss-Keeler R. L. (2020) Going back to school: The perceived value of the bachelor's degree for early childhood practitioners. *Journal of Early Childhood Teacher Education, 41*(4), 359–383, http://doi.org/10.1080/10901027.2019.1704949

Ibieta, A., Hinostroza, J. E., Labbé, C. & Claro, M. (2017). The role of the Internet in teachers' professional practice: activities and factors associated with teacher use of ICT inside and outside the classroom. *Technology, Pedagogy and Education*, *26*(4), 425–438. https://doi.org/10.1080/1475939X.2017.1296489

Jacott, L. (2010). Mobile learning. A handbook for educators and trainers- Edited by Agnes Kukulska-Hulme and John Traxler. *British Journal of Educational Studies, 57*(3), 337–339. https://doi.org/10.1111/j.1467-8527.2009.437_6.x

Jaquith, A., Mindich, D., Chung Wei, R., & Darling-Hammond, L. (2011). Teacher professional learning in the U.S. *The Education Digest, 77*(2), 33–39. https://www.proquest.com/magazines/teacher-professional-learning-u-s-case-studies/docview/896478460/se-2

Jalongo, M. R. (2021). The effects of COVID-19 on early childhood education and care: Research and resources for children, families, teachers, and teacher educators. *Early Childhood Education Journal 49*, 763–774 https://doi.org/10.1007/s10643-021-01208-y

Justice, L. M., Kaderavek, J. N., Fan, X., Sofka, A., & Hunt, A. (2009). Accelerating preschoolers' early literacy development through classroom-based teacher–child storybook reading and explicit print referencing. *Language Speech And Hearing Services In Schools*, *40*(1), 67–85. https://doi.org/10.1044/0161-1461(2008/07-0098

Kaliisa, R., & Picard, M. (2017). A systematic review on mobile learning in higher education: The African perspective. *The Turkish Online Journal of Educational Technology*, *16*, 1–18.

Kao, C.-P., Tsai, C.-C., & Shih, M. (2014). Development of a Survey to Measure Self-efficacy and Attitudes toward Web-based Professional Development among Elementary School Teachers. *Educational Technology & Society*, *17*(4), 302–315. https://www.jstor.org/stable/10.2307/jeductechsoci.17.4.302

Karatas, K., & Arpaci, I. (2021). The role of self-directed learning, metacognition, and 21st century skills predicting the readiness for online learning. *Contemporary Educational Technology*, *13*(3). https://doi.org/10.30935/cedtech/10786

Karimi, S. (2016). Do learners' characteristics matter? An exploration of mobile-learning adoption in self-directed learning. *Computers in Human Behavior*, *63*, 769–776. https://doi.org/10.1016/j.chb.2016.06.014

Kenny, R. F., Van Neste-Kenny, J. M., Park, C. L., Burton, P. A., & Meiers, J. (2009). Mobile learning in nursing practice education: Applying Koole's FRAME model. *Journal of Distance Learning*, *23*(3), 75–96.

Kerlinger, F. N. (1986), *Foundations of Behavioral Research*, 3rd ed., Holt, Rinehart & Winston.

Kim, D., Lee, I. H., & Park, J. H. (2019). Latent class analysis of non-formal learners' self-directed learning patterns in open educational resource repositories. *British Journal of Educational Technology*, *50*(6), 3420-3436. https://doi.org/10.1111/bjet.12746

Kim, D., Jung, E., Yoon, M., Chang, Y., Park, S., Kim, D., & Demir, F. (2021). Exploring the structural relationships between course design factors, learner commitment, self-directed learning, and intentions for further learning in a self-paced MOOC. *Computers & Education*, *166*, 1-12. https://doi.org/10.1016/j.compedu.2021.104171

Kim, O. S. (2020). Effect of flipped learning using media convergence in practice education on academic self-efficacy and self-directed learning of nursing students. *Journal of Convergence for information Technology*, *10*(6), 49–58. www.emeraldinsight.com/2414–6994.htm

Kirwan, J. R., Lounsbury, J. W., & Gibson, L. W. (2010). Self-direction in learning and personality: The big five and narrow personality traits in relation to learner self-direction. *International Journal of Self-Directed Learning*, *7*(2), 21-34.

Kirwan, J. R., Lounsbury, J. W., & Gibson, L. W. (2014). An examination of learner self-direction in relation to the big five and narrow personality traits. *SAGE Open*, *4*(2), 215824401453485. https://doi.org/10.1177/2158244014534857

Koole, M. (2009) A model for framing mobile learning. In M. Ally (Ed.), *Mobile learning: transforming the delivery of education & training* (p. 25–47). AU Press.

Knowles, M. S. (1968). Andragogy, not pedagogy. *Adult Leadership*, *16(*10), 350–352.

Knowles, M. S. (1975). *Self-directed learning: A guide for learners and teachers.* Cambridge.

Kukulska-Hulme, A. (2007). Mobile usability in educational contexts: what have we learnt? *International Review of Research in Open Distance Learning 8*(2),1–16. https://doi.org/10.19173/irrodl.v8i2.356

Kukulska-Hulme, A., & Pettit, J. (2008). Semi-formal learning communities for professional development in mobile learning. *Journal of Computing in Higher Education, 20*(2), 35–47. https://doi.org/10.1007/s12528-008-9006-z

Kung, F. Y., Kwok, N., & Brown, D. J. (2018). Are attention check questions a threat to scale validity?. *Applied Psychology*, *67*(2), 264–283. https://doi.org/10.1111/apps.12108

Lam, P., & Tong, A. (2012). Digital devices in classroom: Hesitations of teachers-to-be. *Electronic Journal of e-Learning*, *10*(4), 387–395. https://eric.ed.gov/?id=EJ986647

Lan, Y.-F., & Sie, Y.-S. (2010). Using RSS to support mobile learning based on media richness theory. *Computers and Education*, *55*(2), 723–732. https://doi.org/10.1016/j.compedu.2010.03.005

Leacock, C. J., & Warrican, S. J. (2020). Helping teachers to respond to COVID-19 in the Eastern Caribbean: Issues of readiness, equity and care. *Journal of Education for Teaching*, *46*(4), 576–585. https://doi.org/10.1080/02607476.2020.1803733

Levenberg, A., & Caspi, A. (2010). Comparing perceived formal and informal learning in face-to-face versus online environments. *Interdisciplinary Journal of E-Learning and Learning Objects*, *6*, 323–333. https://doi.org/10.28945/1318

Leont'ev, A. N. (1978). *Activity, consciousness, and personality.* Prentice-Hall.

Levin, K. A. (2006). Study design III: Cross-sectional studies. Evidence-Based Dentistry, *7*(1), 24–25. https://doi.org/10.1038/sj.ebd.6400375

Lindblom S. & Pounds M. (2016). *Arkansas early childhood individualized professional development plan.* Arkansas State University. https://img1.wsimg.com/blobby/go/cca6f767-bf3f-45b1-b8e9-502223014ef3/downloads/IPDP-%20Prof%20Dev%20Plan.pdf?ver=1688756315558.

Long, H. B. (1989). *Self-directed learning: Emerging theory & practice*. Oklahoma Research Center for Continuing Professional and Higher Education, McCarter Hall, University of Oklahoma, Norman, OK 73037.

Lounsbury, J., & Gibson, L. (2010). *Technical manual for the Resource Associates Personal Style Inventory and Adolescent Personal Style Inventory*. Resource Associates.

Lounsbury, J. W., Levy, J. J., Park, S. H., Gibson, L. W., & Smith, R. (2009). An investigation of the construct validity of the personality trait of self-directed learning. *Learning and Individual Differences, 19,* 411–418. doi:10.1016/j.lindif.2009.03.001

Makovec, D. (2018). The teacher's role and professional development. *International Journal of Cognitive Research in Science, Engineering and Education*, *6*(2), 33–45. https://doi.org/10.5937/ijcrsee1802033M

Mark, M.M., Reichardt, C.S. (2001). *Internal validity* (pp. 7749-7752). In N. J. Smelser & P. B. Baltes (Eds.) *International Encyclopedia of the Social & Behavioral Sciences*. Pergamon. https://doi.org/10.1016/B0-08-043076-7/00729-4

McDonald, K., & Smith, Charlene M. (2013). The flipped classroom for professional development: Part I. Benefits and strategies. *The Journal of Continuing Education in Nursing*, *44*(10), 437–438. https://doi.org/10.3928/00220124-20130925-19

McKelvey, L., Fox, L., & Chapin-Critz, M. (2022). *2022 Arkansas workforce study: instructional staff in early childhood care & education*. University of Arkansas Medical Sciences. https://medicine.uams.edu/familymedicine/research/red/research-evaluation/arkansas-workforce-study/

McLean, C., Austin, L. J. E., Whitebook, M., & Olson, K. L. (2021). *Early childhood workforce index – 2020.* University of California, Berkeley. https://cscce.berkeley.edu/workforce-index-2020/report-pdf/

McQuiggan, S., McQuiggan, J., Sabourin, J., & Kosturko, L. (2015). *Mobile learning: A handbook for developers, educators, and learners*. John Wiley & Sons.

McMeans, A. (2015). Incorporating social media in the classroom. *Education, 135*(3), 289–290.

Minor, E. C., Desimone, L., Lee, J. C., & Hochberg, E. D. (2016). Insights on how to shape teacher learning policy: The role of teacher content knowledge in explaining differential effects of professional development. *Education Policy Analysis Archives, 24*(61). http://epaa.asu.edu/ojs/article/view/2365/1783.

Mohammadi, M., Sarvestani, M. S., & Nouroozi, S. (2020). Mobile phone use in education and learning by faculty members of technical-engineering groups: Concurrent mixed methods design. *Frontiers in Education (Lausanne), 5*. https://doi.org/10.3389/feduc.2020.00016

Morris, T. H., & Rohs, M. (2021). Digitization bolstering self-directed learning for information literate adults–A systematic review. *Computers and Education Open, 2*, 1–11. https://doi.org/10.1016/j.caeo.2021.100048

Moya, S., & Camacho, M. (2023). Developing a framework for mobile learning adoption and sustainable development. *Technology, Knowledge and Learning*, *28*(2), 727–744. https://doi.org/10.1007/s10758-021-09537-y

National Association for the Education of Young Children. (2023). *Appendix B: Glossary*. https://www.naeyc.org/resources/position-statements/dap/glossary

National Institute for Early Education Research. (2022). *The state of preschool 2022: State preschool yearbook-Arkansas*. https://nieer.org/

National Professional Development Center on Inclusion. (2008). *What do we mean by professional development in the early childhood field?* Chapel Hill: University of North Carolina, FPG Child Development Institute.

National Workforce Registry Alliance. (2023, September 19*). Registry participation requirements: A policy brief.* https://www.registryalliance.org/wp-content/uploads/2023/08/Mandatory-Registry-Participation_-An-Info-Brief-2023_FINAL-NWRA-19-1.pdf

Nedungadi, P., & Raman, R. (2012). A new approach to personalization: integrating e-learning and m-learning. *Educational Technology Research and Development*, *60*, 659–678. https://doi.org/10.1007/s11423-012-9250-9

Ng, W., & Nicholas, H. (2013). A framework for sustainable mobile learning in schools. *British Journal of Educational Technology*, *44*(5), 695–715. https://doi.org/10.1111/j.1467-8535.2012.01359

Nolan, D. (2019). *Social media and technology use by early childhood educators*. Barnardos Christchurch Square.

Northwest Arkansas Community College. (n.d.). *Child development associate- Center based*. Northwest Arkansas Community College. https://careertraining.ed2go.com/nwacc/training-programs/child-development-associate-center-based/

Oddi, L. F. (1984). *Development of an instrument to measure self-directed continuing learning* [Unpublished doctoral dissertation]. Northern Illinois University.

Oxford University Press. (2023). *Readiness noun - definition, pictures, pronunciation and usage notes* . https://www.oxfordlearnersdictionaries.com/us/definition/english/readiness

Park, Y. (2011). A Pedagogical Framework for Mobile Learning: Categorizing Educational Applications of Mobile Technologies into Four Types. *International Review of Research in Open and Distance Learning*, *12*(2), 78–102. https://doi.org/10.19173/irrodl.v12i2.791

Parasuraman, A. (2000). Technology Readiness Index (TRI) is a multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research, 2*(4), 307–320. doi:10.1177/109467050024001

Parasuraman, A., & Colby, C. L. (2015). An updated and streamlined technology readiness index. *Journal of Service Research*. https://doi.org/10.1177/1094670514539730

Passey, D., Shonfeld, M., Appleby, L., Judge, M., Saito, T., & Smits, A. (2018). Digital agency: Empowering equity in and through education. *Technology, Knowledge and Learning*, *23*, 425–439. https://link.springer.com/article/10.1007/s10758-018-9384-x

Pedro, L.F.M.G., Barbosa, C.M.M.d. & Santos, C.M.d. (2018). A critical review of mobile learning integration in formal educational contexts. *International Journal of Educational Technology in Higher Education*, *15*(10), 1–15. https://doi.org/10.1186/s41239-018-0091-4.

Peng, H., Su, Y., Chou, C., & Tsai, C. C. (2009). Ubiquitous knowledge construction: Mobile learning re-defined and a conceptual framework. *Innovations in Education and Teaching International*, *46*(2), 171–183. https://doi.org/10.1080/14703290902843828

Perrin, A. (2021, June 3). *Mobile technology and home broadband 2021*. Pew Research Center. https://www.pewresearch.org/internet/2021/06/03/mobile-technology-and-home-broadband-2021/

Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008). *Classroom Assessment Scoring System (CLASS).* Brookes Publishing.

Pila, S., Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2019). *Technology in the Lives of Educators and Early Childhood Programs: 2018 Survey.* Center on Media and Human Development, Northwestern University. https://cmhd.northwestern.edu/wp-content/uploads/2019/08/NAEYC-Report-2019.pdf

Pole, T. (1814). *History of the origin and progress of adult schools.* Woburn.

Pölzl-Stefanec, E. (2021). Challenges and barriers to Austrian early childhood educators' participation in online professional development programmes. *British Journal of Educational Technology*, *52(*6), 2192–2208. https://doi.org/10.1111/bjet.13124

Poole, T., Fitzgerald, A., & Dann, C. (2020). Effective online professional development: Teacher perceptions, practices, and preferences. *Research Square*, 1–19. https://doi.org/10.21203/rs.3.rs-79141/v1

Pozas, M., Letzel-Alt, V., & Schneider, C. (2022)."The whole is greater than the sum of its parts": Exploring teachers' technology readiness profiles and its relation to their emotional state during COVID-19 emergency remote teaching. *Frontiers in Education, 7*, 1–11. https://doi.org/10.3389/feduc.2022.1045067

Prestridge, S. (2017). Conceptualising self-generating online teacher professional development. *Technology, Pedagogy and Education, 26*(1), 85–104. https://doi.org/10.1080/1475939X.2016.1167113

Qualcomm. (2014). *The evolution of mobile technologies: 1G, 2G, 3G, 4G LTE*. https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/the_evolution_of_mobile_technologies-wireless-networks.pdf

Reeves, T.D., and Pedulla. J.J. (2011). Predictors of teacher satisfaction with online professional development: Evidence from the USA's e-Learning for Educators initiative. *Professional Development in Education, 37*, (4), 591–611. https://doi.org/10.1080/19415257.2011.553824

Reeves, T. D., & Li, Z. (2012). Teachers' technological readiness for online professional development: Evidence from the US e-learning for Educators initiative. *Journal of Education for Teaching, 38*(4), 389–406. https://doi.org/10.1080/02607476.2012.707921

Ringkamp, S. (2022). *The relationship between technology readiness and online professional development*. (Publication No. 29393188) [Doctoral Dissertation, Walden University]. ProQuest Dissertations Publishing.

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy sciences*, *4*(2), 155–169. https://doi.org/10.1007/BF01405730

Roberts, A., & Roberts Jr, J. M. (2021). *Multiple regression: A practical introduction*. SAGE Publications, Incorporated.

Rohs, M., & Ganz, M. (2015). MOOCs and the claim of education for all: A disillusion by empirical data. *International Review of Research in Open and Distributed Learning*, *16*(6), 1–19. https://doi.org/10.19173/irrodl.v16i6.2033

Roessger, K. M., Weese, J., Parker, D. A., & Hevel, M. S. (2022). Bridging the distance? How proximity and online learning shape communities' adult participation in public universities. *The Journal of Continuing Higher Education*, *71*(2), 199–214. https://doi.org/10.1080/07377363.2021.2024001

Rucker, L., Zajicek, A., & Kerr, B. (2023). Variation in state early childhood lead educator qualifications: Pre-service versus in-service qualification, professional organization, and geographical proximity. *Early Childhood Education Journal*, *51*(1), 67–77. https://doi.org/10.1007/s10643-021-01277-z

Salgado, J. F. (1997). The five factor model of personality and job performance in the European Community. *Journal of Applied Psychology*, *82*, 607–620. https://doi.org/10.1037/0021-9010.82.1.30

Sannino, A. E., Daniels, H. E., & Gutiérrez, K. D. (2009). *Learning and expanding with activity theory*. Cambridge University Press.

Scales, P. (2011). *Continuing professional development in the lifelong learning sector: 1. publ*. Open Univ. Press.

Schachter, R. (2015). An analytic study of the professional development research in early childhood education. *Early Education and Development*, *26*(8), 1057–1085 https://doi.org/10.1080/10409 289.2015.1009335

Scherer, R., Howard, S. K., Tondeur, J., & Siddiq, F. (2021). Profiling teachers' readiness for online teaching and learning in higher education: Who's ready? *Computers in Human Behavior*, *118*, 106675. https://doi.org/10.1016/j.chb.2020.106675

Schmit, M.J., Ryan, A.M., Stierwalt, S.L. & Powell, A.B. (1995). Frame-of-reference and criterion-related validity. *Journal of Applied Psychology*, *80*, 607–620. https://doi.org/10.1037/0021-9010.80.5.607

Scott, K. W. (2002). *High self-efficacy and perseverance in adults committed to new challenging life pursuits after age 50: A grounded theory study*. Dissertations Abstract International, 63(04), 2101B. (UMI No. 3050223).

Scott, K. W. (2006). Self-directed learners' concept of self as learner: Congruous autonomy. *International Journal of Self-Directed Learning*, *3*(2), 1–13.

Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers & Education*, *34*, 177–193. https://doi.org/10.1016/S0360-1315(99)00044-5

Sheridan, S. M., Edwards, C. P., Marvin, C. A., & Knoche, L. L. (2009). Professional development in early childhood programs: Process issues and research needs. *Early Education and Development*, *20*(3), 377–401. https://doi.org/10.1080/19415257.2020.1725594

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2019). *Teaching and learning at a distance: Foundations of distance education* (7th ed.). Information Age Publishing.

Skinner, R. B. (2022). *The Elementary and Secondary Education Act (ESEA), as amended by the Every Student Succeeds Act (ESSA): A Primer* (5th ed.). Congressional Research Service. https://crsreports.congress.gov.

Snedden, D. (1930). Self-education: A needed emphasis in current proposals for adult education. *Journal of Adult Education*, *2*(1), 32–37.

Snell, M. E., Forston, L. D., Stanton-Chapman, T. L., & Walker, V. L. (2013). A review of 20 years of research on professional development interventions for preschool teachers and staff. *Early Child Development and Care*, *183*(7), 857–873. https://doi.org/10.1080/03004430.2012.702112

Song, L., & Hill, J. R. (2007). A conceptual model for understanding self-directed learning in online environments. *Journal of Interactive Online Learning*, *6*(1), 27–42. https://eric.ed.gov/?id=EJ1092260

Sophonhiranrak, S. (2021). Features, barriers, and influencing factors of mobile learning in higher education: A systematic review. *Heliyon*, *7*(4). https://www.sciencedirect.com/science/article/pii/S2405844021007994

Stone-MacDonald, A., & Douglass, A. (2015). Introducing online training in an early childhood professional development system: Lessons learned in one state. *Early Childhood Education Journal*, *43*(3), 241–248. https://doi.org/10.1007/s10643-014-0649-2

Mardapi, D., & Herawan, T. (2019). Community-Based Teacher Training: Transformation of Sustainable Teacher Empowerment Strategy in Indonesia. *Journal of Teacher Education for Sustainability*, *21*, 48–66. https://doi.org/10.2478/jtes-2019-0004

Sumuer, E. (2018). Factors related to college students' self-directed learning with technology. *Australasian Journal of Educational Technology, 34(*4), 29–43. https://ajet.org.au/index.php/AJET

Taskin, B. (2019). *Analysis of computer literacy in terms of self-directed learning: A cognitive ethnographic study* [Doctoral dissertation]. Hacettepe University.

Tett, R.P., Jackson, D.N. & Rothstein, M. (1991). Personality measures as predictors of job performance: A meta-analytic review. *Personnel Psychology*, *44*, 703–742. https://doi.org/10.1111/j.1744-6570.1991.tb00696.x

The CPD Standards Office. Part Of The Professional Development Consortium. (2023, November 17). *What is CPD?*. The CPD Standards Office. https://www.cpdstandards.com/resources/what-is-cpd/.

Thomas, K. M., O'Bannon, B. W., and Britt, V. G. (2014). Standing in the schoolhouse door: teacher perceptions of mobile phones in the classroom. *The Journal of Research on Technology in Education, 46*, 373–395. https://doi.org/10.1080/15391523.2014.925686

Tough, A. M. (1966). The assistance obtained by adult self-teachers. *Adult Education*, *17*(1), 30–37. https://doi.org/10.1177/074171366601700105

Tough, A. M. (1978). Major learning efforts: Recent research and future directions. *Adult Education*, *28*(4), 250–263. https://doi.org/10.1177/074171367802800403

Traxler, J. (2007). Defining, discussing, and evaluating mobile learning: The moving finger writes and having writ. *International Review of Research in Open and Distance Learning*, *8*(2), 1–12. https://doi.org/10.19173/irrodl.v8i2.346

Trentin, G. (2001). From Formal Training to Communities of Practice via Network-Based Learning. *Educational Technology, 41*(2), 5–14. https://www.jstor.org/stable/44428654

United States Census Bureau. (n.d.). Income definitions. *In Guidance on measuring income*. Retrieved April 27, 2023, https://www.census.gov/topics/income-poverty/income/guidance-on-measuring.html

United States Census Bureau (2022, December 29*). Nation's urban and rural populations shift following 2020 census*. Retrieved April 27, 2023, https://www.census.gov/newsroom/press-releases/2022/urban-rural-populations.html

United States Department of Education. (2019). *Starting strong: Increasing preschool quality and access: The preschool development grants program summary report.* https://www2.ed.gov/programs/preschooldevelopmentgrants/index.html

United States Equal Employment Opportunity Commission. (n.d.). *Race/color discrimination*. Retrieved April 27, 2023, https://www.eeoc.gov/racecolor-discrimination

United States Department of Health and Human Services Office of Minority Health. (n.d.). *Explanation of data standards for race, ethnicity, sex, primary language, and disability*. Office of Minority Health. https://minorityhealth.hhs.gov/explanation-data-standards-race-ethnicity-sex-primary-language-and-disability

Vavoula, G., & Sharples, M. (2009). Meeting the challenges in evaluating mobile learning: A 3 level evaluation framework. *International Journal of Mobile and Blended Learning, 1*(2), 54–75. https://doi.org/10.4018/jmbl.2009040104

Venkatesh, V., Morris, M.G., Davis, G.B. & Davis, F.D. (2003). User acceptance of information technology: Toward a unified view, *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly, 36*(1), 157–178. https://doi.org/10.2307/41410412

Vu, J., Jeon, H. J., & Howes, C. (2008). Formal education, credential, or both: Early childhood program classroom practices. *Early Education and Development*, *19*, 479–504. https://doi.org/10.1080/10409280802065379

Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*. Harvard university press.

Warschauer, M. (2003). *Technology and social inclusion: Rethinking the digital divide*. MIT Press.

Washington, V. (2017). *Professionalizing early childhood education requires national standards and strong career pathways.* Council for Professional Recognition. https://www.cdacouncil.org/white-papers/white-papers-archive

Weichbroth, P. (2020). Usability of mobile applications: A systematic literature study. *IEEE Access*, *8*, 55563–55577. https://doi.org/10.1109/ACCESS.2020.2981892

Weisenfeld, G. G., & Connors-Tadros, L. (2020 February). Creating and supporting a highly qualified workforce during pre-K expansion. Guide to support pre-K expansion: workforce. *National Institute for Early Education Research*. https://nieer.org/wp-content/uploads/2020/02/Pre-K-Expansion-Support-Guide-Series-Workforce.pdf.

Welch-Ross M, Wolf A, Moorehouse M, & Rathgeb C. (2006). Improving connections between professional development research and early childhood policies (pp. 369-394). In: M Zaslow & I Martinez-Beck (eds.). *Critical issues in early childhood professional development.* Paul H. Brookes.

Whitebook, M., McLean, C., Austin, L. J. E., & Edwards, B. (2018). *Early childhood workforce index – 2018*. University of California, Berkeley. https://cscce.berkeley.edu/topic/early-childhood-workforce-index/2018/.

Winton, P. J.,Snyder, P.A.,& Goffin, S.G. (2016). Beyond the status quo:Rethinking professional development for early childhood teachers. *Handbook of Early Childhood Teacher Education*. (54–68). Routledge.

Worth, J., & Van den Brande, J. (2020). *Teacher autonomy: How does it relate to job satisfaction and retention?* National Foundation for Educational Research. https://files.eric.ed.gov/fulltext/ED604418.pdf.

Yoshikawa, H., Leyva, D., Snow, C. E., Treviño, E., Barata, M., Weiland, C., & Arbour, M. C. (2015). Experimental impacts of a teacher professional development program in Chile on preschool classroom quality and child outcomes. *Developmental psychology*, *51*(3), 309. http://dx.doi.org/10.1037/a0038785

Yen, Y. (2020). Horace Mann on popularizing common school education: Thoughts and practices. *Taiwan Educational Sociology*, *20*(2). 91-138. https://doi.org/10.3966/168020042020122002003

Zaslow, M., Tout, K., Whittaker, T., Vick, J., & Bridget, L. (2010). *Toward the identification of features of effective professional development for early childhood educators* (ED527140). https://eric.ed.gov/?id=ED527140

Appendices

Appendix A: Survey

1. Would you be willing to participate in a brief survey about your experience for the chance to win a $100 Amazon gift card? (Select Yes/No)

(a) Yes

(b) No

If yes, enter your email address so we may contact you to redeem your prize should you win.

*Enter Email Address _____

Important: Email addresses will not be connected to the data collected in the survey.

2. (Required) What is your age?

_____

3. (Required) Do you live in Arkansas? (Select Yes/No)

(a)Yes

(b)No

If yes, enter your Residence Zip Code?

_____

4. (Required) Are you Hispanic, Latino/a, or Spanish origin? (Select one that applies).

(a) Hispanic or Latino/a

(b) Not Hispanic or Latino/a

5. (Required) What is your race? (Select all that apply)

(a) American Indian or Alaska Native

(b) Asian

(c) Black or African American

(d) Native Hawaiian or Pacific Islander

(e) White

6. (Required) Have you completed a Child Development Associate (CDA) Credential or an associate degree with 60 + hours of formal early childhood education training? (Select Yes/No)

(a)Yes

(b) No

7. (Required) Did you use a mobile phone when taking the Naptime Academy™ course *Preventing Expulsion- The Teaching Pyramid*? (Select Yes/No)

(a) Yes

(b) No

8. (Optional) What is your annual household income in dollars? (Select one that applies).

(a) $0-$19,999

(b) $20,000-$49,999

(c) $50,000-$79,999

(d) $80,000-$109,999

(e) $110,000+

Appendix B: Technology Readiness Index 2.0: Instructions

July 24, 2014

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). To use the TRI 2.0, you merely insert the appropriate questions in a survey. You can compute your own scores for analysis and/or return the data to Rockbridge for scoring.

Instructions for the scale were removed to comply with copyright.

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

Appendix C: Technology Readiness Index 2.0 License and permission for use

February 6, 2023

Appendix D: Research Associates Transition to College Self Directed Learning Scale

Read each of the following statements and place an 'X' in the column which best describes how strongly you disagree or agree with the statement to the left.

Number	Question
1.	I regularly learn things on my own outside of class.
2.	I am very good at finding out answers on my own for things that the teacher does not explain in class.
3.	If there is something I don't understand in a class, I always find a way to learn it on my own.
4.	I am good at finding the right resources to help me do well in school.
5.	I view self-directed learning based on my own initiative as very important for success in school and in my future career.
6.	I set my own goals for what I will learn.
7.	I like to be in charge of what I learn and when I learn it.
8.	If there is something I need to learn, I find a way to do so right away.
9.	I am better at learning things on my own than most students.
10.	I am very motivated to learn on my own without having to rely on other people.

Note. Adapted from Resource Associates Transition to College Inventory, by J. Lounsbury, J. Levy, S. Park, L. Gibson, R. Smith, 2009, p. 413.

Appendix E: Solicitation Email and Consent Form

INVITATION TO PARTICIPATE
You are invited to participate in a research study about mobile phone use and self-directed learning during online professional development. You are being asked to participate in this study because you completed the course titled *Preventing Expulsion- The Teaching Pyramid* from Naptime Academy™.

WHAT YOU SHOULD KNOW ABOUT THE RESEARCH STUDY

Who is the Principal Researcher?

Jennifer Bowman, jbowman@uark.edu

What is the purpose of this research study?

The purpose of this study is to examine the relationship between Arkansas early childhood practitioners' mobile phone usage and their self-directed learning, while considering the moderating influence of technology readiness when participating in asynchronous online professional development.

Who will participate in this study?

Early childhood practitioners aged 18-65.

What am I being asked to do? Your participation in this study will require the following:

Provide honest and thoughtful responses to the best of your ability.

What are the possible risks or discomforts?

There are no anticipated risks to participating in this study.

What are the possible benefits of this study?

There are no anticipated benefits to participating in this study.

How long will the study last?

The survey is expected to take approximately 15 minutes to complete.

Will I receive compensation for my time and inconvenience if I choose to participate in this study?
No, but all participants are eligible to participate in a drawing for one of three $100 Amazon gift cards.

Will I have to pay for anything?

No, there will be no cost associated with your participation.

What are the options if I do not want to be in the study?

If you do not want to be in this study, you may refuse to participate. Also, you may refuse to participate at any time during the study.

How will my confidentiality be protected?

All information will be kept confidential to the extent allowed by applicable State and Federal law. All responses provided in this survey will be kept strictly confidential. Your answers will not be linked to any personal identifiers, ensuring that your participation remains anonymous. The data collected will be securely stored in a locked file, accessible only to the research team.

Will I know the results of the study?

At the conclusion of the study, you will have the right to request feedback about the results. You will receive a copy of this form for your files.

What do I do if I have questions about the research study?

You have the right to contact the Principal Researcher as listed below for any concerns that you may have.

Principal Researcher, Jennifer Bowman at jbowman@uark.edu

I have read the above statement and have been able to ask questions and express concerns, which have been satisfactorily responded to by the investigator. I understand the purpose of the study as well as the potential benefits and risks that are involved. I understand that participation is voluntary. I understand that significant new findings developed during this research will be shared with the participant. I understand that no rights have been waived by signing the consent form. I have been given a copy of the consent form.