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**THE ROLE OF TECHNOLOGY IN THE DEVELOPMENT OF
PK-12 TEACHER LEADERSHIP DURING COVID-19**

By

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A DISSERTATION

Submitted in Partial Fulfillment of
the Requirements for the Degree of

Doctor of Education

(in Educational Leadership)

The Graduate School

The University of Maine

May 2021

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THE ROLE OF TECHNOLOGY IN THE DEVELOPMENT OF PK-12 TEACHER

LEADERSHIP DURING COVID-19

By Mia L. Morrison

Dissertation Advisor: Dr. Ian Mette

An Abstract of Dissertation Presented
in Partial Fulfillment of the Requirements for the
Degree of Education
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May 2021

In March of 2020, school buildings were closed in response to the global health crisis. Administrators and teachers alike were forced to reimagine education in order to meet the needs of students and the community, effectively over a single weekend across an ever changing landscape. Servant and distributive styles of leadership were needed to face these unprecedented, adaptive challenges and a “new normal” model of leadership rose to prominence. Because connecting in a virtual environment requires technological acuity in skill, pedagogy, and practice, effective teachers who had developed cultures of choice, creativity, and autonomy in their student-centered classrooms weathered this rapid shift more easily than others. These effective teachers modeled successful, productive communication and collaboration norms and many were called upon to share their expertise to support communication and collaboration norms and many were called upon to share their expertise to support dynamic, ever shifting pandemic conditions to identify how elements of technology interacted with teacher leadership identity and development by way of effective instruction, teacher voice, influence and reach, collegial interactions, recognition, and opportunity.

DEDICATION

I am dedicating my efforts and time throughout this process as well as the final completion of this work to my mother, who passed without being able to call me “Dr. Mia” as she had always hoped and for which she tried valiantly to wait. May you rest in peace and smile with the knowledge that I made it, Mom.

ACKNOWLEDGEMENTS

I am forever indebted and grateful for the support of my life's partner in crime, Don without whom I might have thrown in the towel any number of times along this journey. You always remind me that life is an adventure. I also want to acknowledge the incredible support of Dr. Simone Elias; an amazing mentor, expert in the field, innovative colleague, and most importantly, great friend. I would not have made it without all of these wonderful facets of you and your broad shoulders - upon which this work and I depended. Thank you.

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CHAPTER 1

THE ROLE OF TECHNOLOGY IN THE DEVELOPMENT OF PK-12

TEACHER LEADERSHIP DURING COVID-19

On March 11, 2020, the World Health Organization (2020) declared COVID-19 a pandemic and by March 25th--just two weeks later--all schools across the US had been shuttered (Education Week, 2020). During the rapid shift to remote learning, technology played a critical role in connecting learners to their peers, teachers, and learning resources (Alvarez, 2020; Ferdig et al., 2020; Fisher, 2020; Kim, 2020; McCarty, 2020). McKenney and Visscher (2019) emphasized that technology is inexplicably tied to teacher growth and performance whereby their core tasks of classroom design, enactment and reflection can be elevated. Historically, teacher leaders have been called upon to facilitate professional learning with colleagues (Nicholson et al., 2016) and during these unprecedented challenges, diversely positioned teachers volunteered and were asked to lead and support (Ferdig et al., 2020; Fernandez & Shaw, 2020). Not only was their expertise in effective instruction needed to support their colleagues, teacher leaders were sharing and modeling communication and collaboration norms as well as expert navigation and utilization of technology in a dynamic, virtual environment for administrators in addition to their colleagues (Fernandez & Shaw, 2020; Gandolfi & Kratcoski, 2020).

Introduction

During the upheaval that began in March, 2020, technology was an integral component of action and success at every level of education for all stakeholders throughout the immediate crisis and beyond (Mineo, 2020; US DOE, 2020). In facing the adaptive challenges of COVID-19, effective teachers rose to the occasion to support colleagues (Carey et al., 2020; Gandolfi & Kratcoski, 2020; Shin & Bolrup, 2020) and model successful and efficient communication and collaboration norms for administrators through the adroit utilization of technological tools,

practice, theory and drive (Cowen, 2020; Fernandez & Shaw, 2020). In concert with formal leadership that understood, recognized and provided opportunity (Leithwood et al., 2020), effective teachers developed as teacher leaders who impacted decision making, outcomes, and work during COVID-19 (Fernandez & Shaw, 2020; Harris, 2020). Leithwood et al. (2020) posited that this style of context responsive leadership, which integrates the functional and the personal (understanding and developing people) was critical in identifying the ever evolving needs of the community and realizing the equally dynamic scope of organizational goals.

Technology and the Role of the Teacher

In the rapid shift to remote learning, technology played a critical role in connecting learners to their peers, teachers, and learning resources (Ferdig et al. 2020; Fisher, 2020; Kim, 2020; McCarty, 2020; Onyema et al., 2020). Alvarez (2020) termed the conditions of rapid school closure Emergency Remote Teaching (ERT), a response to continued education despite the global health threat. Under this new context of virtual connectivity, teachers were compelled to reflect upon the goals and design of their instruction (Ferdig et al., 2020; Onyema et al., 2020; Swallow & Morrison, 2020). Not only were digital tools and skills in demand, pedagogical frames and practice were brought to the forefront (Ferdig et al., 2020; Fisher et al., 2020; Hodges et al., 2020; Lee, 2020; Onyema et al., 2020; Swallow & Morrison, 2020). The new virtual context for learning required a modification in teacher and student roles, content manifestation and assessment, as well as collaboration and ownership of experience (Swallow & Morrison, 2020).

Hofstein et al. (2004) proposed that teachers are best positioned to lead and influence others when they possess strong content and pedagogical knowledge for effective instruction, which can then afford the ability for teachers to develop and expand upon strong leadership skills. For effective instruction, Mishra and Koehler (2006) added technological knowledge to the content and pedagogical knowledge domains through their TPACK framework (Technological, Pedagogical, And Content Knowledge). During the pandemic, a plethora of

effective teachers stepped up to support, coach, and mentor other teachers based on need (Ferdig et al., 2020; Watson-Brown et al., 2020), thus embracing an expanded role stance and leadership identity. Effective teachers were also modeling productive, successful collaboration and communication norms, instruction and guidance for administrators (Fernandez & Shaw, 2020). Without historical event or precedence to guide decision making, some administrators invited teachers to gather data and anecdotal evidence from students, share expertise, and participate in ideation (Fernandez & Shaw, 2020). These teachers and administrators worked together to understand needs, reset goals, and provide the supports necessary for stakeholder success and forward motion (Alvarez, 2020; Fernandez & Shaw, 2020; Reimers & Scheicher, 2020). Multiple technological elements played into the role of the teacher during COVID-19, from skill and perspective through confidence and adoption to device, resources, and access (Ferdig et al., 2020; Hodges et al., 2020; Lee, 2020; Onyema et al., 2020; Swallow & Morrison, 2020).

Teacher Influence and Leadership

Over the last decade, there has been a shift in the view of teacher leadership from stepping stones toward administration to an avenue for transforming practice across a larger landscape than the single classroom (Buchanan et al., 2020; Fairman & Mackenzie, 2016; Katzenmeyer & Moller, 2009; Sinha & Hanuscin, 2017). As such, teacher leadership can play a vital role in helping address instructional and pedagogical practices that can lead to improved student outcomes, collaborations, environment, vision, and school wide policy. Teacher leadership has been traditionally viewed through the lens of two global spheres in which factors can be categorized: individual and contextual (Cochran-Smith & Lytle 2009, Wenner & Campbell, 2017; York-Barr & Duke, 2004). Individual factors include those that stem from teacher choice and perspective (Buchanan et al., 2020; Sinha & Hanuscin, 2017). On the other side, contextual factors embrace environmental or external forces outside the control of the

individual teacher (Smylie & Eckert, 2018). The confluence of these factors impact the trajectory of a teacher's career (Cheung et al, 2018; Wenner & Campbell, 2017; York-Barr & Duke, 2004).

Teacher leader influence extends beyond the confines of a single classroom to empower colleagues through interactive spaces for collaboration, sharing and support (Ferdig et al., 2020; Fairman & Mackenzie, 2016; Nicholson et al., 2016; Sinha & Hanuscin, 2017; Wenner & Campbell, 2017). As the Digital Age continues to permeate our daily landscape, educators are able to connect and collaborate with colleagues near and far in spaces such as communities of practice, social and networking media, professional development, and discussion forums (Cheung et al., 2018; Margolis, 2011). This affords broader exchange of ideas and impact. Alongside collaboration outside the classroom, teacher leader development is advanced through recognition and opportunity afforded by formal leadership empowerment (Wenner & Campbell, 2017; York-Barr & Duke, 2004). The timeline and confluence of these individual and contextual factors will govern the trajectory and development of teacher leaders. At apotheosis, teacher leaders can be transformational in driving school or district wide policy and affecting systemic change (Buchanan et al., 2020; Fairman & Mackenzie, 2012; Reimers & Schleicher, 2020; Sleeter 2013).

Problem of Practice Statement (2-3)

Education has been changing for the last decade as online instruction has become increasingly popular throughout the US (Allen & Seaman, 2013; US DOE, 2013). This shift was expedited by school closures in forcing education stakeholders into virtual spaces. Pandemic conditions changed the perspective and core focus of education, from the definition and design of effective teaching and learning to the very foundational goals of school (Alvarez, 2020; Ferdig et al., 2020; Onyema et al., 2020; Swallow & Morrison, 2020). Technological skills and adoption became critical for communication, collaboration, instruction, and development with stakeholders at all levels (Fernandez and Shaw, 2020; Ferdig et al., 2020; Fisher, 2020; Hartshorne et al., 2020; Onyema et al., 2020). As such, the role of technology was magnified in

its contribution and effect in the growth and success of educators (Lee, 2020; Reimers & Schleicher, 2020).

Technology continues to permeate all facets of life in concert with the proliferation of teachers' role and purview outside the confines of the classroom (Buchanan et al., 2020; Fairman & Mackenzie, 2016; Wenner & Campbell, 2017). The International Society for Technology in Education (ISTE) refreshed their standards in 2014 to align with such adjustments in the educational environment across all sectors. The new educator lens placed emphasis on teacher voice and action beyond the classroom (ISTE, 2020). The new ISTE roles embrace standards for educators such as Learner, Designer, Collaborator, and Leader to accentuate the importance of teacher voice, reach, and participation in a connected community. As the role of the teacher expands, so too does their influence. Given the expansive reach of networking platforms, professional level tools for collaboration and creation, as well as the powerful, cooperative promise of a global community, teachers now have the ability to influence an exponentially larger audience in the digital realm (Bakia et al., 2017; Desimone, 2020; Fairman & Mackenzie, 2012; ISTE, 2020; Pew Research Center, 2020). The potential impact of the teacher has expanded outside the confines of the classroom and as such, teacher leadership embraces interactivity among and contributions to the education community.

However, despite the increase in 1:1 technology environments across the country (Santos et al., 2018; Selwyn et al., 2017), there have been problems and resistance in the integration of technology into classrooms, schools, and districts based on financial and philosophical obstacles as well as issues with time demands, professional development, and opportunities (Bryans-Bongey, 2020; Garthwait & Weller, 2005; Goldfine, 2018; McCrea, 2016). The shift of focus from acquisition of device to integration, professional development, and constructivist ideologies have lagged (Goldfine, 2018; McCrea, 2016). The literature provides strong evidence that teachers are essential to the implementation and success of technology-infused classrooms (Bebell & O'Dwyer, 2010). As such, effective teachers with technologically advanced,

constructivist practices were especially well situated during the shift to remote teaching to lead and advance their leadership identities. It is critical to explore their experience during the rapid move to ERT as well as the following preparations for a return to diverse environments for Fall, 2020.

The foundational layer of teacher leadership begins with the individual and manifests through the development of skills needed for effective instruction, strong practice and pedagogy that empower learners (Katzenmeyer & Moller, 2009; Smylie & Eckert, 2018). Equally important is a personal inquiry stance that models lifelong learning (Buchanan et al., 2020). Learning and leading are inextricably woven together, whereby teachers who find joy in continuous learning are more likely to collaborate with colleagues, contribute to the community, and adopt an expanded role stance to exercise creativity in collegial and organizational work (Barth, 2001; Darling-Hammond et al., 1995; Steffy et al., 2000). In this way, teachers are motivated and inspired to affect change and contribute to improving conditions at the school level and beyond. Whether novice or veteran, teachers that are curious and motivated are able to develop as leaders (Buchanan et al., 2020; Fairman & Mackenzie, 2015). Teacher leaders have become increasingly recognized as a catalyst for educational change as well as a key factor in guiding and sustaining curricular reform efforts (Sinha & Hanuscin, 2017; York-Barr & Duke, 2004). Understanding the experience of teachers during ERT will provide insight and inform next steps in supporting educators, redefining student outcomes, improving educational environments, policy and scope as well as advancing effective measures of communication, collaboration, growth and instruction across all environments, with all stakeholders.

Purpose Statement (1-2)

The purpose of this study is to explore the experiences of teachers in the PK-12 environment during the pandemic crisis, with particular focus on how technology impacted teacher leadership. Teacher leadership is broadly defined as the skills and behaviors that educators utilize to empower those around them, thus facilitating learning as well as improving

the environment (Desimone, 2020; Katzenmeyer & Moller, 2009; Nicholson et al, 2016,). For the purpose of this study, teacher leadership refers to effective teacher influence that extends outside the classroom from collegial interactions in collaborative spaces through school, district, and state level projects to national campaigns that affect educational change to empower community near and far. Traditionally, teacher leadership has been viewed through the scope of individual and contextual factors (York-Barr & Duke, 2004). During the unplanned, rapid shift to remote learning, technology was thrust onto the main stage in teacher communication, collaboration, and effective instruction (Ferdig et al., 2020). Technologically adroit teachers that had cultivated 21st century classrooms of creativity and student autonomy were well positioned for ERT (Alvarez, 2020; Ferdig et al., 2020; Onyema et al., 2020) and modeled successful communication and collaboration norms as well as expert navigation in virtual spaces and utilization of digital tools (Fernandez & Shaw, 2020; Gandolfi & Kratcoski, 2020). Administrator technology stance and attitude acts to influence school wide culture, teacher growth and leadership development (Francisco et al., 2020; Leithwood et al., 2020; Sinha and Hanuscin, 2017). Investigating the experiences of teachers during the pandemic through the lens of technology stance, adoption and use, interactivity, recognition and opportunity will begin to unpack the interplay of technological factors with the individual and contextual elements that led to the emergence and development of teacher leaders.

Research Questions (1)

This study will look to answer the following questions around leadership development by classroom teachers during the global health crisis that began in March, 2020. The researcher seeks to explore the experience of teachers as they shifted pedagogy, practice, and classroom norms to embrace virtual environments. As school buildings closed, communication and collaboration norms were affected, with the very core purpose of school building and education coming under scrutiny (Reimers & Schleicher, 2020). Throughout this emergency, unplanned change, teachers were positioned at the heart of the crisis (Ferdig et al., 2020). Effective

instruction and student connections were among the primary drivers in cultural, social, and school level decision making (Carey et al., 2020; Gandolfi & Kratcoski, 2020; Harris, 2020; Leithwood et al., 2020). The researcher will work to unpack data that describes and analyzes the experience of classroom teachers during the forced school closures in March, 2020. From this foundation, the researcher will examine teacher action and behaviors in developing voice and leader identity as well as the factors that impacted growth and advanced leadership development. Secondary questions include the specific interplay between technology and the spheres of influence identified through teacher leadership theory as well as the conditional supports that should now be considered to sustain leadership development and longevity as well as future study.

- RQ1 : What role, if any, did technology play in the development of PK-12 teacher leadership during the forced shifts to remote learning caused by the COVID-19 public health crisis?
- RQ2: How did technology factors during emergency remote teaching (ERT) interact with the individual and contextual factors that are traditionally touted as developmentally critical?
- RQ3: What organizational conditions support the development and continued growth of teacher leaders?

Overview of Methodology

This research employed a concurrent triangulation mixed methods design to explore the wide variety of teacher experiences throughout the unprecedented challenges of school closures and virtual environments. Through concurrent data collection and cyclical analysis, the researcher probed into the experiences, perceptions and development of these teachers during initial unplanned school closures and the preparations for the 2020-2021 academic year with quantitative measure and interactive discussions with participants. The researcher explored teacher stance and attitude, voice, drive, innovation and influence to determine development of

leadership skills at the individual level. Recognition, opportunity, and sense of value were constructs used to assess contextual factors. Data were collected both in a 19 question survey and through semi-structured interviews around effective instruction, relationships and interactions with administrators and colleagues. Both qualitative and quantitative data analysis examined the opportunities and conditions that supported the emergence and growth of leadership. Participants were teachers engaged as students in or graduates from one or more Instructional Technology programs at the University of.

As the data was analyzed, initial survey results began to yield areas of interest that added direction and new focus for interview discussion to probe more deeply into the developing categories and themes. Emerging themes from preliminary coding also provided direction for inferential analyses. Descriptive quantitative analysis, inferential analysis and both deductive and inductive qualitative investigation informed and directed the work to identify the interplay of technology related themes around leadership during the unplanned shift away from traditional in person education. Survey data and analysis were used primarily to address the research question around the role of technology on the development of teacher leadership during COVID-19. Interview data and analysis provided great detail for the research questions around the interaction of technology with the traditionally touted individual and contextual components in teacher leadership development as well as the organizational level factors necessary for continued growth and development of leadership.

Positionality

This study examined the emergence and development of teacher leaders during the shift to remote learning last March, 2020 through a constructivist lens of educational technology. As a researcher, my experiences, gender, and diverse identities color my worldview and assumptions from which I view, develop methodologies, make meaning and analyze data around learning, technology, and leadership. To this end, I have endeavored to explore and call out my past, current, and potentially biased perspectives to provide a foundation of transparency in my

exploration. Although I grew up in the heart of Connecticut's suburbs, I left home at 14 years old. Boarding school, college, graduate school, and post educational travels allowed me to experience numerous other environments from urban to rural, affluent to socio-economically depressed, technology rich to deprived, and overcrowded metropoli to isolated communities. This has given me a wide lens through which to view learning, opportunity, and technological advancement. In addition, I have worked within diverse environments from big company to educational to family run settings. I have performed field work, written technical reports, mentored young adults, trained faculty and education personnel, served on local and international boards, created learning experiences, led start up organizations, and acted as chief editor for a national newsletter with hundreds of subscribers. I lived many years disdaining technology and living off grid, as well as teaching in a 1:1 school environment touting international fame for its cutting edge innovation in teaching and learning, for which I can proudly take some credit. Through such diverse experiences, it has become natural to push envelopes and envision alternative, non-traditional methods for access, interaction, and pursuit of solutions.

Most recently, I have lived in this wonderfully rural setting, where there is limited to no access and where generations don't leave the local area. Having lived in urban and suburban environments, the combination of strengths and limitations are clearly visible. While rural environments can provide community, stability, tradition and strong neighborly relationships, there can also be a lack of diversity, tolerance, and resistance to change. It is in these environments that I see the most poignant impact that technology can bring when leveraged correctly. Technology can offer a connection to worlds and perspectives proximally inaccessible, participation in a global community and economy, glimpses of potential unrealized, and opportunity for advancement that is affordable and accessible. Equally impactful is the resistance to change and luddite mentality.

Considerations for Scholarly Practitioners

Teacher leadership has long been viewed through numerous lenses: individual traits and skills, practice, and stance (Buchanan et al., 2020; Center for Strengthening the Teacher Profession, 2018; Weiner & Lamb, 2020) and contextual factors such as opportunity, feedback, and sustained support (Fairman & Mackenzie, 2015; Nicholson et al., 2016; Smylie & Eckert, 2018; York-Barr & Duke, 2004). Despite the encroachment of the Digital Age in education and proliferation of 1:1 environments across the US (Selwyn et al., 2017), there is limited to no consideration or inclusion of technology in the development of teacher leadership in the literature. The utilization of technology and constructivist ideology have been studied in their effects on instruction (Bakia et al., 2007; Bebell et al., 2004; ; Fu, 2013; Garthwait and Weller, 2004) but not in connection to the growth and development of teachers as leaders.

The pandemic forced education stakeholders into virtual environments and shone a bright light on the utilization of and access to technology device, platforms and spaces (Alvarez, 2020; Ferdig et al. 2020; Fisher, 2020; Lee, 2020; McCarty, 2020; Onyema et al., 2020) as well as stance and attitude of both teacher and administration (Alvarez, 2020; Fernandez & Shaw, 2020; Reimers & Scheicher, 2020; Watson-Brown et al., 2020). Multiple technological elements played into the role of the teacher during COVID-19, from skill and perspective through confidence and adoption to device, resources, and access (Ferdig et al., 2020; Hodges et al., 2020; Lee, 2020; Onyema et al., 2020). It is critical to explore the interplay and role of technology with these factors in developing leadership. While individual factors affect the inception and foundation of leadership identity (Sinha & Hanuscin, 2017; York-Barr & Duke, 2004), contextual factors will greatly affect longevity and application of skills and innovation (Cochran-Smith & Lytle 2009; Smylie & Eckert, 2018). As there has been a shift in the view of teacher leadership from stepping stones toward administration to an avenue for transforming practice across a larger landscape than the single classroom (Buchanan et al., 2020; Fairman & Mackenzie, 2016; Katzenmeyer & Moller, 2009; Sinha & Hanuscin, 2017), pandemic conditions have illuminated the influence and potential that effective, technologically

adroit teacher leaders can bring to the table in preparation for future years and reaction to the continual effects of COVID-19 on education. Fairman and Mackenzie (2014) reported that while the role of the teacher is rooted in the classroom, their sphere of influence exceeds the confines of these walls. It is important for building leaders and administration to recognize and nurture effective teachers in establishing their leader identity, contributing to ideation, and piloting initiatives.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this study was to explore the experiences of teachers in the PK-12 environment during the pandemic crisis, with particular focus on how technology impacted teacher leadership. This literature review begins by laying a foundation for understanding teacher leadership through seminal writings that provided definitions, methods for conceptualization and evaluation, and how the lens has shifted over the last several decades. The next section investigates technology through the lenses of stance, adoption and utilization in education as well as alignments with constructivist theory in terms of pedagogy and shifts in classroom environments which impact teacher roles and leadership. Throughout the research process, both the quantitative and qualitative data pointed to the importance of established frameworks for ongoing teacher growth and leadership. To this end, the last section of this literature review will dive into the seminal writings and research around teacher support, drive, and satisfaction as it relates to growth, professional path, and contributions to community.

Teacher Leadership

Teacher leadership refers to the skills and behaviors that educators utilize to empower those around them, thus facilitating learning as well as improving the environment (Desimone, 2020; Katzenmeyer & Moller, 2009; Nicholson et al., 2016). Teacher leaders build trust, inspire autonomy, and bring out the best in their students (Center for Comprehensive School Reform and Improvement, 2005; Center for Strengthening the Teacher Profession, 2018) while providing a positive influence that extends beyond their own classroom (Jackson et al., 2015; Nicholson et al., 2016). Across the millennial divide, York-Barr and Duke (2004) reported that numerous qualitative studies explored the conditions, behaviors, traits, and skills related to and defining teacher leadership.

Role of the Teacher

As the role of the teacher began to expand from classroom leadership and student achievement to embrace teachers as drivers of educational reform, studies around the development of teacher leaders began to grow (Silva et al, 2000; York-Barr and Duke, 2004). The definition of teacher leadership has since evolved to embrace actions and behaviors that influence the community outside the classroom (Katzenmeyer & Moller, 2014) from participation in learning communities (Childs-Bowen et al., 2000), contributions to curricular improvements and school wide policy (Wenner & Campbell, 2017) to improvements in school culture and education policy (ME DOE, 2020). Fairman and Mackenzie (2014) reported that while the role of the teacher is rooted in the classroom, their sphere of influence exceeds these walls to embrace collegial inquiry, support, and collaboration as they learn about and improve their practice. Harris and Muijs (2006) termed a component of these actions as “participative leadership”, where teachers develop and share new strategies. Galvanized by the desire to improve learning conditions, inspired by collaborative activities, and supported through communities of practice, the teacher’s role and opportunities to affect change have expanded (Katzenmeyer & Moller; Spillane, 2006; Wenger, 1998).

Leadership Development

York-Barr and Duke (2004) posit that the development of teacher leaders can be seen through the lens of three domains: individual development, collaboration (or team) development, and organizational development. On a more granular level, Sinha and Hanuscin (2017) identify the domains as identity, practice and views, proposing that the interactivity of leadership views, practices, and identity coupled with school context, priorities and experience influence the development and consequent emergence of teacher leaders. Others report that teacher inquiry stance and engagement in expanded roles are critical factors (Buchanan et al., 2020; Cochran-Smith & Lytle 2009; Smylie & Eckert, 2018). All these domains, factors, and views can be teased out and identified as falling into the individual category, which is based on

teacher characteristics and beliefs or into the contextual category, which embrace the components outside of teacher control. Individual components include how a teacher views oneself and leadership, interest in taking risks and exploring new concepts or strategies outside their comfort zone, style and action in their practice, and an expanded role stance, which is the drive to go above and beyond the expectations of their defined position (Buchanan et al., 2020; Center for Strengthening the Teacher Profession, 2018; Weiner & Lamb, 2020). Contextual factors can include opportunity, feedback and recognition, reflection, and sustained support (Fairman & Mackenzie, 2015; Nicholson et al., 2016; Smylie & Eckert, 2018; York-Barr & Duke, 2004). Throughout the literature, teacher leadership frameworks show that both individual and contextual factors influence the development and path an educator follows throughout their career (Buchanan et al., 2020; Sandbakken, 2004; Sinha & Hanuscin, 2017). When and how these elements interact on the timeline of a teacher's tenure will influence and impact the development of leadership skills and implementation. As well, the shape and extent of a teacher leader's sphere of influence is regulated by the interplay of these individual and contextual elements (Fairman & Mackenzie, 2014; Wenner & Campbell, 2017).

Distributive and New Normal Leadership

Spillane et al. (2001) introduced the concept of distributive leadership, whereby leadership is extended across all stakeholders in an organization to improve conditions. To support the development of teacher leaders, it is critical that they are recognized and afforded opportunity by formal leadership to share their expertise, gather data and anecdotal evidence, and participate in ideation (Fernandez & Shaw, 2020; Margolis & Huggins, 2012). The broad conditions that influence the development of teacher leaders include school culture and context, roles and relationships, and structures (York-Barr & Duke, 2004). Katzenmeyer and Moller (2001) reported that encouragement for taking initiative promoted development, with Darling-Hammond et al. (1995) adding that it was critical for the structures to support leading and learning were embedded into teacher roles. Wenner and Campbell (2017) found that principals

played a significant role in the development of leadership skills through the creation of a supportive environment. Teachers were found to grow and develop leadership skills when given time, autonomy and explicit articulation of leadership roles and opportunities (Chew & Andrews, 2010; Gigante & Firestone, 2008). They required opportunities to act as agents of change (Sleeter, 2013) and system level infrastructure that cultivated collegial learning and leading (Cheung et al., 2020).

In recent literature, concepts and initial studies around leadership during crises and unprecedented challenges have emerged (Chitpin & Karoui, 2021; Kamaruzaman et al., 2020; Peters et al., 2021; Sahin & Shelley, 2021). COVID-19 exerted great pressure on the current educational paradigm starting March, 2020, and the on-going pandemic crisis is most likely to continue to do so for the foreseeable future. Francisco et al. (2020) report that this new normal is a “reality and certainty by which everyone seeking to improve education must accept” and term the leadership required during the pandemic “new normal leadership.” They contend that leaders must have the ability to be adaptive while staying strong to original intent and commitment, whereby leadership is about being an effective instructional decision maker and that a new normal leader is a good planner, vigilant and acts as an *initiator*.

Technology

In 2016, Reeves & Oh reported that there had been a trend in educational technology research over the last three decades that moved from theory development to exploratory studies. The authors hypothesized that early researchers hoped to promote easily quantifiable and identifiable increases in learning outcomes or educational transformations directly attributable to the use of diverse technologies. Few studies found statistically significant, clear correlations (Reeves & Oh, 2016), which led to an increase in descriptive/interpretivist studies. Bebell et al. (2004) contended the research around technology integration to be extremely complex, further muddled by varying definitions of technology, the multitude of tools and applications, as well as the rate of change in device and tools themselves. In addition to the myriad variations of

technological stance, tool, support and device, practice and pedagogy hold front seat influence. The lens of research has turned to pre-service preparations (Admiraal et al., 2017; Lambert & Gong, 2010), perceptions of technology (Scherer et al., 2018; Schmidt et al., 2009; Sherry & Gibson, 2004), and the use of specific practices such as Problem Based Learning (Bate et al., 2014; Torp & Sage, 2002). Narrative or descriptive studies bring in anecdotal evidence and begin the dialogue around factors and interactions under specific circumstances (Moen, 2006).

Infiltration and Evolution in Education

The number of post-secondary students enrolled in at least one online course in the United States increased from 21.4% in 2005 to 32.5% in 2012 of total students in higher education, with numbers continuing to grow (Allen and Seaman, 2013; US DOE, 2013). Higher education institutions across the country are exploring and offering an increased number of online and blended options for students as well as including online learning as a key component to their long term strategies (Kentnor, 2015). Researchers have worked at developing frameworks to explore and quantify the efficacy of critical components necessary for successful online learning (Aparicio et al., 2016; Bollinger & Halupa, 2018). Much of the focus has been around student engagement (Chen et al. 2010; Coates, 2006; Redmond et al., 2018) and the impact of community building (Sadera et al., 2009), focused primarily on post-secondary learners. With the shift to remote learning in March, 2020, new factors in this research must be considered and studies expanded to embrace the PK-12 environment.

From Device to Practice and Pedagogy

In 2002, Maine became the first state to provide a computing device to each 7th and 8th grade public school student and teacher, with approximately 88% of School Administrative Units (SAU) choosing to participate in the Maine Learning Technology Initiative (ME DOE, 2020). Governor King believed that the economic future belonged to the technologically adept (Waters, 2009) and that the 1:1 initiative would promote digital literacy throughout Maine's diverse student population, defined by the use of technology for innovation, creation, and

problem solving (Waters, 2009). While the expectation across Maine was that learning outcomes would rise, the focus on device rather than pedagogy (Silverman & Lane, 2004), further hampered by teacher perceptions and stance (Garthwait & Weller, 2005), limited advancement of student learning. However, 1:1 programs began to blossom across the United States and technology has become an integral component in education across the globe since this time (Bakia et al., 2007; Fu, 2013). Some studies have shown improvements in student learning outcomes through the use of technology and online resources (Lopez-Perez et al., 2013) while other researchers claim that the integration of information and communication technologies (ICT) has not had statistically significant impact on either teaching or learning despite major advances in technology infrastructures (Ward & Barr, 2010). It is unclear whether this can be attributed to ICT itself or the practice and pedagogy of technology integration.

Lowther et al. (2008) posit that the three most important characteristics to develop quality learning experiences with technology are autonomy, capability, and creativity. Others promote the incorporation of technology to foster student social independence amidst the real world which calls for teaching students how to search and evaluate information, connect with a global community, and inspire active participation in their own growth and development (Jonassen et al., 2003; Papert, 2000; Sanders & George, 2017). Broad themes seen in the research around integration of technology center on student voice, inquiry and collaborative learning (Bond et al., 2018). Overall, there has been a shift in perspective for educational technologists toward strong constructivist classroom leanings. They suggest that the role of the teacher is in guiding students how to think, question, and find solutions as opposed to content and fact dissemination (Jonassen, 1991; Jonassen, 2000; Spector, 2020). From the constructivist perspective, learning should be student centered and promote lifelong learning and curiosity.

Constructivist Theory

Constructivist theory as applied to education is founded in the perspective that learning and knowing are personal activities (Papert, 1980; Jonassen et al., 1995; Newby et al., 1996), whereby learners construct knowledge based on their own reality and that learning is an active process (Jonassen, 1991). This is in direct opposition to the traditionally accepted objectivist view of education where knowledge and truth exist outside the learner and the role of the teacher is to introduce the learner to the “real world” (Jonassen, 1991). The educational technology paradigm aligns perfectly to constructivist views, with the student at the active center of the learning process (Piaget, 1968; Papert, 1980; Jonassen, 1991). Instructional technology pedagogy and practice align with the constructivist foundational belief that learning and knowledge construction take place through doing, with an emphasis on student autonomy (Duffy & Jonassen, 1991; Jonassen et al., 2003; Papert, 1980; Tam, 2000; Zivkovic, 2016). Constructivist instructional models advocate student driven instruction and active learning, where learners develop knowledge through interacting with a dynamic learning environment (Jonassen, 1999; Papert, 1980; Piaget, 1968; Soenens & Vansteenkiste, 2011). Ouyang and Stanley (2014) took this one step further to emphasize that the construction of knowledge incorporates the learner’s initiative, social and situational experience.

The learning process is a complex interplay between the student’s existing knowledge, the social and ecological context, and the problem to be solved (Dewey, 1966; Papert, 1980; Tam, 2000). Collaboration and interactivity, autonomy, critical thinking and creativity are main stage factors in the constructivist learning environment (Dewey, 1966; Tam, 2000; Papert, 1980). The role of the teacher is as a participant and guide rather than expert and disseminator of information (Jonassen, 2000). Constructivist principles are highly congruent with educational technology paradigms of teaching and learning (Tam, 2000). Learning is a personal and social activity, whereby activities for all age learners should be authentic, relevant, and meaningful (Papert, 1980). During COVID-19 specifically, the alignment of constructivist tenets

and technology may have been invaluable in teachers' shift from in person, controlled environments to virtual spaces. Educators that had developed constructivist classrooms, with focus on student autonomy, creativity, and strong interactive, collaboration norms were potentially better positioned to embrace a virtual environment.

Effective Instruction

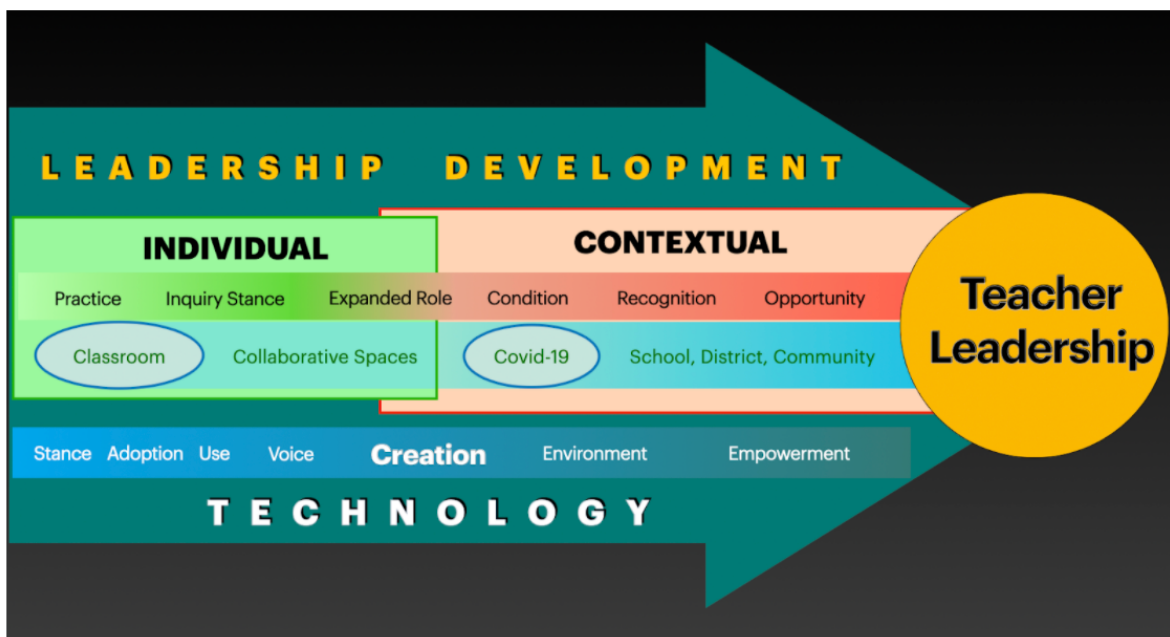
Over the last decades, the educational landscape has changed dramatically. The classroom has moved away from a teacher centric environment, where the teacher is considered an expert who disseminates information to students (Loyens & Rikers, 2011). Pushed by the increase in technologic innovations and infiltration into the classroom (Bakia et al., 2007; Fu, 2013), the very paradigm of learning has embraced a constructivist view (Jonassen et al., 2003). Students are now active participants in their learning, in fact driving their experience, evaluating resources, and constructing knowledge based on their personal, social and contextual surroundings (Jonassen, 2000). Student autonomy, voice, and choice have become buzz words in the 21st century classroom (Evans & Boucher, 2015; Hastie et al. 2013). Baeten et al. (2010) provided five categories in which this paradigm shift can be organized: (1) stimulating knowledge construction, (2) considering the teacher as a facilitator and coach of the learning process, (3) implementing cooperative work, (4) using authentic assignments and (5) embedding opportunities for self-regulated learning. Of particular focus in this study, the role of the teacher has changed from the provider of information to a facilitator of learning (Beijaard et al., 2000), stimulating inquiry, sparking curiosity and both guiding evaluation skills and challenging students to form their own conclusions (Pratt, 2008). Beyond content knowledge, the examination, evaluation, and reflection upon instruction now includes pedagogical and technological knowledge (Mishra & Koehler, 2006; Shulman, 1986).

Conceptual Framework

Teacher leaders facilitate learning and improve the environment by empowering those around them (York-Barr & Duke, 2004). Development begins in the classroom with effective instruction and an active learning environment (Mishra & Koehler, 2006. Sinha & Hanuscin, 2017). Teacher skills and behavior can move the influence of effective instruction outside the classroom through interactions in collaborative spaces (Cheung et al. 2018; Wenner & Campbell, 2017). Teacher leaders have an inquiry stance that models lifelong learning as well as a willingness to embrace an expanded role outside the traditional confines of the classroom with a wide purview of opportunity (Buchanan et al., 2020; Sinha & Hanuscin, 2017; Smylie & Eckert, 2018). Other mitigating factors that advance teacher leadership include recognition, condition, opportunity and support (Wenner & Campbell, 2017). The timeline, order, and mix of these individual and contextual elements work cooperatively and in unique combinations to drive the development of teacher leaders.

Based on my experience and interactivity with teachers during the pandemic, and bolstered by readings from the literature, technology played a significant role most immediately in the design and implementation of effective remote instruction. Figure 1 depicts the development of teachers progressing along a continuum of growth that integrates individual, contextual, and technological elements, all of which were further mobilized by school closures during the pandemic. Teachers were required to rethink classroom norms and expectations, resources and assessment, activities and interactivity. Teachers that had cultivated a constructivist learning environment were well positioned to embrace this shift and, if recognized, were called upon to lead and support their colleagues. They modeled effective collaboration and communication norms in virtual spaces as well as gathering data and anecdotal evidence for decision making and ideation. Organizational protocols, functions, and

Figure 2.1 Conceptual Frame. This conceptual model shows the development of a teacher leader experienced during the emergency shift to virtual environments. Leadership begins in the classroom with effective instruction and empowering learners. As a teacher moves into collaborative spaces and is offered opportunity, she moves into empowering first her colleagues and then the community.



workflows shifted in concert with parallel new norms and a distributive leadership framework. Conditions continued to evolve. New and diverse opportunities arose with digital resources and farther reaching, virtual communities and consortiums beginning to surface. COVID-19 shone a bright light on the importance of technology in every layer of education for all stakeholders.

Technological factors catalyzed the development of teacher leaders during COVID-19 beginning in the classroom with tools, pedagogy and practice for effective instruction (Mineo, 2020; National Center for Education Statistics, 2020) through collaborative spaces and virtual communities (Carey et al., 2020; Gandolfi & Kratcoski, 2020) to the organizational conditions and environments for growth, collaboration, communication, and decision making (Harris, 2020; Leithwood et al., 2020). Although the pandemic shone a forced light on technology due to the physical closure of schools, there are deeper and long lasting implications for educational

technology tools, utilization and practice at all levels of 21st century education moving into the future. As students engaged from remote and diverse home conditions during ERT, it was critical for teachers to leverage technology skills, tools, and practice in concert with constructivist foundations of instruction, which include student autonomy and empowerment, leveraging dynamic learning environments, choice, and inquiry (Alvarez, 2020; Ferdig et al., 2020; Fisher, 2020). Throughout ERT, effective teacher leaders were able to sustain student engagement and continue instruction (Ferdig et al., 2020). These students were often engaged in creative expression of understanding and pedagogies such as project or inquiry based learning, where there is an emphasis on student ownership and choice (Fisher, 2020; Jonassen, 2000; Lee, 2020). When students are allowed to direct their learning in modalities and pathways that best suit their interests and situation, they are engaged in knowledge construction and higher order thinking (Jonassen et al., 2003; Papert, 1980; Piaget, 1968; Reimers & Schleicher, 2020; Tam, 2000). This will be the future of applying instructional technology to authentic, relevant, and meaningful educational experiences.

This study will analyze the experience of teachers during ERT to explore the role of technology in providing the underpinnings of effective instruction and leading to development of teacher leadership. The investigation looks to initiate identification of critical technology elements and start the dialogue around how these factors (a) promote the necessary conditions to empower learners and (b) amplify effective teacher voice, influence, impact and leadership. COVID-19 focused the educational lens on the significance of technology across all sectors of education from effective instruction to stakeholder communication, collaboration, and systemic operations. Exploring and analyzing the teacher experience will be the first steps in unpacking the role of technology in the development of teacher leadership during crisis as well as its importance in education at large.

Theoretical Framework

It is important to delineate the stance, adoption and use of technology by teachers during non-crisis times to unpack their influence during COVID-19 on the development of teacher leadership. As technology has infiltrated education, technology adoption and utilization in the classroom have been widely regarded as a pedagogical and professional choice, influenced and somewhat mandated by environment and administration (Bull et al., 2007; Fitzer et al., 2007). Without policy in place in terms of utilization, equity, or educational technology pedagogy, at the moment of ERT, teachers were in various stages of technology stance, adoption and use, which impacted their interactions and work with learners, colleagues, and administrators (Alvarez, 2020; Ferdig et al., 2020; Fernandez & Shaw, 2020).

Effective Instruction and Beyond

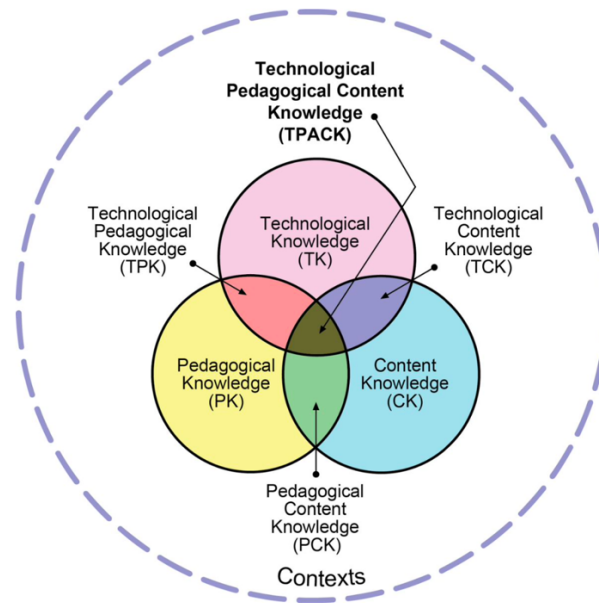
Effective instruction is fundamental to teacher leadership. The first place a teacher leads is in the classroom, where they inspire and empower their learners (Katzenmeyer & Moller, 2009; Smylie & Eckert, 2018). Once effective instruction and practice is in place, a teacher can begin to extend their work and development to influence outside the classroom (Fairman & Mackenzie, 2016). The next layer of teacher leadership expansion will be a teacher's inquiry stance and willingness to embrace an expanded role (Buchanan et al., 2020). Both of these factors can be teased out through collaborative space interactivity, whether this be near, far, face to face or virtual. Teachers who are lifelong learners and willing to take on a role outside the classroom will work with colleagues to share, learn, and collaborate on projects and the creation of new knowledge (Barth, 2001; Buchanan et al., 2020; Cheung et al., 2018; Darling-Hammond et al., 1995; Steffy et al., 2000). In addition, to explore the development of teacher leaders during COVID-19, contextual factors that include opportunity, recognition, support and conditions must be added. This study will explore the reaction, service, and development of teacher leaders during the pandemic crisis and their subsequent influence of transformational

teacher leadership on school strategy, student success, and professional development in the face of a global pandemic.

TPACK and LAM

The Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) is central in educational technology research as a way to characterize the essential knowledge for effective instruction (Chai, Koh, & Tsai, 2013). As shown in Figure 2.2, this framework, founded on Shulman's (1996) work and rooted in constructivist theory, highlights the interplay of a teacher's content, pedagogical, and technological knowledge to identify teacher strengths. Analysis of a "teacher's TPACK" will be used to understand where teachers were positioned during the emergency shift to remote learning. The influence of TPACK on scholarship and practice is well documented; there have been over 1900 publications focused on or supported by the TPACK framework (Harris & Wildman, 2019). Teacher growth and development continues to be informed by the framework when engaging in learning, instruction, and knowledge sharing. Sherry and Gibson (2002) presented the Learning/Adoption Trajectory professional growth model by which teachers progress through a series of four stages at which they learn to use instructional technology to enhance teaching and learning. The four stages of the Learning Adoption model (LAM) are: 1) teacher as learner, 2) teacher as adopter, 3) teacher as co-learner, and 4) teacher as reaffirmer or rejecter. This model offers a very broad lens for teacher perception of technology. Position on this growth timeline helps elucidate a teacher's inquiry stance, relationship with technology, and ability. In this study, TPACK (Mishra and Koehler, 2006) will be used to identify and analyze instruction and practice in combination with LAM (Sherry and Gibson, 2002) to establish teacher stance on technology in both the survey and interview components. In using the TPACK framework (Mishra, 2012), the teacher's technologic, pedagogic, and content knowledges can be integrated

Figure 2.2 TPACK Framework. Mishra & Koehler's (2006) TPACK model is a framework that is commonly used to examine effective instruction through the interplay of technological knowledge, pedagogical knowledge, and content knowledge.



with LAM (Sherry and Gibson, 2012) to identify barometers of where teachers were positioned during the shift to remote learning. Additionally, there will be questions to cover contextual factors such as opportunity, perspective on building leadership, interactivity with learners, colleagues, and administration, recognition, and opportunity.

CHAPTER 3

METHODS

COVID-19 forced deep reflection and redirection of resources, views, decision making hierarchy and goals as well as precipitating a new landscape that required technological considerations (Fisher, 2020; Kim, 2020; McCarty, 2020). This concurrent triangulation mixed methods study explored the role of technology in the development of teacher leadership that began with emergency school closures and continues to affect education. The researcher investigated the experiences, reactions, interactions, recognition, and opportunities of teachers during the unplanned move to virtual environments through a constructivist lens of educational technology beginning in March, 2020, extending into the spring of 2021. Effective instruction lies at the heart of the teacher role, with collaboration and impact extending outward to embrace leadership and the empowerment of learners, colleagues, administrators, and the community at large.

Setting and Context

The unplanned, emergency closure of schools in March, 2020 forced districts and educational institutions to reflect upon their objectives, test communication, safety and support systems, and take a reactive stance to the unique needs, dangers, and problems of their community within the scope of an ever changing environment (Hartshorne et al., 2020; Onyema et al., 2020; Pew Research Center, 2020). More importantly, it became necessary to embrace new technological tools, philosophy, and pedagogy (Ferdig et al., 2020; Fisher, 2020; Kim, 2020; McCarty, 2020). Servant and distributive styles of leadership were employed amidst the adaptive challenges of this shifting landscape, as administrators jumped into the trenches alongside faculty and staff to troubleshoot (Fernandez & Shaw, 2020; Lee, 2020; Onyema et al., 2020), listen, and strategize based on daily, sometimes hourly fluctuations in need and scope (Ferdig et al., 2020; Long, 2020).

During the rapid shift to remote learning, technology played a critical role in connecting learners to their peers, teachers, and learning resources (Alvarez, 2020; Ferdig et al. 2020; Fisher, 2020; Kim, 2020; McCarty, 2020; Onyema et al., 2020). In response, schools were forced into ERT with no preparation and lacking unified strategy. The very goal of each school unit was put into question as administrators scrambled to meet the individual needs of their community with their unique blend of available resources (Fernandez & Shaw, 2020). Under this new context of virtual connectivity, teachers were compelled to modify instructional design as well as rethink their learning objectives (Ferdig et al., 2020; Onyema et al., 2020). Digital tools, skills and pedagogical frames and practice were in high demand as well as constructivist ideologies and communication and collaboration norms (Ferdig et al., 2020; Fisher et al., 2020; Hodges et al., 2020; Lee, 2020; Onyema et al., 2020).

While Hofstein et al. (2004) proposed that teachers are best positioned to lead and influence others when they possess strong content and pedagogical knowledge for effective instruction, Mishra and Koehler (2006) added technological knowledge to the content and pedagogical knowledge domains; thus altogether termed TPACK – Technological, Pedagogical And Content Knowledge. During the pandemic, TPACK strong teachers, defined as those who held strong footholds in all domains and were able to move seamlessly through all domain combinations, transitioned easily to ERT. Without historical precedence, these effective teachers were modeling productive, successful collaboration and communication norms for colleagues and administrators (Fernandez & Shaw, 2020). Many teachers were willing to support others as well as contribute to ideation (Alvarez, 2020; Reimers & Scheicher, 2020). Multiple technological elements played into the role of the teacher during COVID-19, from skill and perspective through confidence and adoption to device, resources, and access (Ferdig et al., 2020; Hodges et al., 2020; Lee, 2020; Onyema et al., 2020).

In the recent decade, teacher leadership has shifted from a route to administration to a pathway for transforming classroom practice, curricular reform, and school culture (Buchanan

et al., 2020; Fairman & Mackenzie, 2016; Katzenmeyer & Moller, 2009; Sinha & Hanuscin, 2017). Thus, teacher leaders play a vital role in addressing instructional and pedagogical practices for improved student outcomes, collaborations, environment, vision, and school wide policy. Teacher leader influence extends beyond the confines of a single classroom to empower colleagues through interactive spaces for collaboration, sharing and support (Ferdig et al., 2020; Fairman & Mackenzie, 2016; Nicholson et al., 2016; Sinha & Hanuscin, 2017; Wenner & Campbell, 2017). As the Digital Age continues to permeate our daily landscape, educators are able to connect and collaborate with colleagues near and far in spaces such as communities of practice, social media, professional development, and discussion forums (Cheung et al., 2018; Margolis, 2011). This allows for greater exchange of ideas and larger impact.

Teacher leadership has been traditionally viewed through the lens of two global spheres in which factors can be categorized: individual and contextual (Cochran-Smith & Lytle 2009, Wenner & Campbell, 2017; York-Barr & Duke, 2004). Individual factors include those that stem from teacher choice and perspective (Buchanan et al., 2020; Sinha & Hanuscin, 2017). On the other side, contextual factors embrace environmental or external forces outside the control of the individual teacher (Smylie & Eckert, 2018). The confluence of these factors impact the trajectory of a teacher's career (Cheung et al, 2018; Wenner & Campbell, 2017; York-Barr & Duke, 2004). The timeline and confluence of these individual and contextual factors will govern the trajectory and development of teacher leaders. At its peak, teacher leaders can contribute to transformational shifts in school culture and student success, as well as drive district wide policy and affect systemic change (Buchanan et al., 2020; Fairman & Mackenzie, 2012; Reimers & Schleicher, 2020; Sleeter 2013).

Research Design

Andrews and Holcomb (2009) suggest considering a mixed methods design when studying phenomena that are new or where there is limited information in the literature, whereby testing a hypothesis and exploring the experience work together to fully answer the

research questions. Based on the unplanned, unpredictable and ongoing nature of the COVID-19 condition and its unknown long term effects on education in both the immediate and large scope, this exploratory study followed a concurrent triangulation mixed method research design. A mixed methods approach acts to provide multiple perspectives as well as different but complementary data for a more complete understanding of an experience (Creswell & Plano Clark, 2007), specifically in this case as it relates to technology and teacher leadership during COVID-19. The researcher used a combination of qualitative and quantitative data collection and analysis methods simultaneously to explore the experience of teachers during COVID-19, starting in March of 2020 and continuing through the spring of 2021. Integration of the data transpired predominantly during interpretation, where the two, separate data sets were merged to unpack the teacher experience, find relationships, and identify themes. At times, survey data analysis worked to refine interview questioning as well as areas of exploration.

According to Saldaña and Omasta (2018), researchers can employ qualitative research to understand social progressions of human activities, responses, and communication. However, Saldaña (2016) also warns that the analysis and interpretation of data will reflect the constructs, concepts, models, lexicon and theories upon which the study is founded. Therefore, technology frames must be selected carefully. Qualitative research is also rooted in an interpretive and constructivist paradigm, whereby emphasis is placed on how people construct and make meaning from their experiences and interactions (Patton, 2015). Through interviews, participants shared how they felt and the knowledge constructed based on their experiences during COVID-19. With little prior knowledge of a phenomenon or lack of clarity around the details, Krathwohl (2009) noted that researchers should begin by exploring and describing everything in their purview. As such, having no precedent or historical data for virtual education, the exploration of the teacher experience during the first stages of COVID-19 beginning in March, 2020 is both timely and important. In addition, a survey was administered to collect quantitative data around the teacher experience for initial descriptive and inferential

analysis. It was merged with the qualitative, interview data for interpretation. The quantitative data offers a wider perspective around the teacher experience as well as direction for further investigation. The methods ran concurrently and data from both areas afforded more insight and clarity around the other in both directions.

This research employed a concurrent triangulation mixed methods design to explore, describe and unpack the effects of technology first in analyzing effective instruction then merging this data with teacher reaction, action, and behaviors as well as conditions and contextual factors that influenced the development of teacher leaders during the shift to ERT. This study analyzed classroom level technology integration using the TPACK framework to explore the interplay of content, pedagogical and technological knowledge on instruction amongst teachers that are currently enrolled in one or more of the Instructional Technology programs at the University of Maine. As well, Sherry and Gibson's (2002) Learning Adoption Model (LAM) highlighted where teachers were positioned as schools were closed. Combining information from the LAM and Mishra and Koehler's TPACK model, (2006), teacher TPACK strength and stance around technology were established. Once TPACK strength was determined, this study examined the behaviors and actions of teachers, thus moving the investigation outside the immediate (virtual) classroom to explore interactions, behaviors, and influence.

The interviews and survey probed into their interactions with colleagues and administrators, as well as the influence of these interactions on the trajectory of their development of leadership. As most communication was virtual during early pandemic months, the use of digital networking and collaboration was also taken into consideration, allowing the inclusion of colleagues near and far. Survey results identified perceptions of recognition, opportunity and sense of value based on the interactions with colleagues and administrators. While survey data could be correlated with demographics such as point in career, age, technological environment and tenure in the Instructional Technology programs, interviews clarified and provided deeper insight into the impact of these interactions on individuals.

Research Questions

This concurrent triangulation mixed methods study sought to examine the following questions around leadership development by classroom teachers during the global health crisis that began in March, 2020. The researcher explored the diverse experiences of teachers as they shifted their practice to virtual environments. Moving onto digital platforms affected communication and collaboration norms, with the very goals of education coming under scrutiny (Reimers & Schleicher, 2020). Throughout ERT, teachers were positioned at the heart of the crisis (Ferdig et al., 2020). The researcher worked to unpack data that describes and analyzes the experience of classroom teachers as they ranged out to provide educational opportunity and connections with students, innovate, support their colleagues and administrators, and grow as professionals, expanded roles, and leaders. Secondary questions include the specific interplay between technology and the spheres of influence identified through teacher leadership theory as well as the conditional supports that should now be considered for continued growth and future study.

- RQ1 : What role, if any, did technology play in the development of PK-12 teacher leadership during the forced shifts to remote learning caused by the COVID-19 public health crisis?
- RQ2: How did technology factors during emergency remote teaching (ERT) interact with the individual and contextual factors that are traditionally touted as developmentally critical?
- RQ3: What organizational conditions support the development and continued growth of teacher leaders?

Methods

This research explored teacher stance and attitude, voice, innovation, action and behaviors as well as influence to determine development of leadership skills at the individual level. Interactivity, recognition, opportunity, and sense of value were constructs used to assess

contextual factors. As well, administrator stance and attitude were explored for its influence on teacher growth, motivation, and sense of value. Through concurrent data collection and cyclical analysis, the researcher probed into the experiences, perceptions and development of teacher leadership during initial unplanned school closures and preparations for the 2020-2021 academic year. The pandemic continues to affect education, with teacher leadership expanding and contracting based on stance and attitude, perception, recognition and opportunity for all levels of stakeholders.

Participant Selection

For purposive sampling, participant selection is based on a commonality of experience, phenomenon, conditions, position or context under investigation (Creswell, 1988). Participants for this study were current and past students in the Instructional Technology programs (EDT) at the University of Maine. All participants experienced the transition to remote teaching with learners in a classroom that began in March, 2020. The researcher selected this population as a representative sample of teachers with a strong inquiry stance for learning and personal advancement. As well, they embraced at least a modicum of an expanded role stance, whereby enrollment in an Instructional Technology course at the University of Maine in the College of Education and Human Development necessitates work and collaboration outside their PK-12 classroom. The majority of these students were current and future in service teachers predominantly across the state of Maine but extending beyond state lines, New England and even national boundaries. They cover a wide swath of diversity in demographics at all levels, both contextually and individually.

Data Collection

This research employed a concurrent triangulation mixed methods design. Data collection began with a survey for descriptive analysis as well as basic inferential analysis around teachers in the EDT program and their experience during the COVID-19 transition to a virtual environment. Concurrently, interviews were conducted using a semi-structured protocol.

Interactive discussion with teachers in the EDT program afforded a deeper and more customized investigation of the teacher experience. There were questions in the survey and interview protocol that explored the interplay of content, pedagogical and technological knowledge (TPACK) on instruction. However, while effective instruction lies at the foundation of teacher leadership, other individual and contextual factors were critical in this investigation. These other factors include teacher action and behaviors, content and technical exploration, and interactivity with colleagues and administration upon facing unplanned school closures both at the classroom and school or district wide level.

Data was collected both in a survey and through interviews around effective instruction, relationships and interactions with administrators and colleagues, as well as the opportunities and conditions that supported emergence and growth of leadership. Descriptive quantitative analysis, preliminary inferential analysis and both deductive and inductive qualitative investigation informed and directed the work to identify the interplay of technology related themes and leadership during the unplanned shift away from traditional in person education. Survey data and analysis were used primarily to address the research question around the role of technology on the development of teacher leadership during COVID-19. Interview data and analysis provided great detail for the research questions around the interaction of technology with the traditionally touted individual and contextual components in teacher leadership development as well as the organizational level factors necessary for continued growth and development of leadership.

Recruitment

Participants were recruited via email and through course LMS. The audience and recruitment embraced participants that are currently in the EDT program or students that have graduated in the last two years from an EDT program. Some students that are currently active in the EDT programs were NOT enrolled last spring (during COVID-19). They brought an

interesting view to the data as current participation still shows an inquiry stance of lifelong learning as well as willingness to embrace an expanded role.

Instruments and Protocols: Interviews (qualitative component)

The researcher began discussions and requests for interview participants in mid-January, with the call put out to current and former EDT students. The main stipulations for eligibility were: 1) the participant is a teacher in a classroom that works with students on a consistent schedule (not a coach, integrationist or technology teacher, even if in a classroom) and 2) participation in a leadership activity either prior to or during the shift to ERT. Said activities were listed and/or discussed beforehand so potential participants were aware of this requirement for eligibility.

Sampling. Patton (2015) suggested studies with information-rich cases use purposeful sampling for extensive exploration of the study question. Creswell (2014) adds that such selection enhances the researcher's comprehension and acuity of both the research question and context. In this study, a purposive selection of 20 interview candidates was completed by the researcher based on known leadership activities, behaviors, or skills in which the participant engaged during the shift to remote learning or previously and their school role. Candidates with diverse backgrounds, environments, technology stance, position, experience, and interactions were selected. Diversity included three teachers in their first to third year in the profession, eight veteran teachers in their 15th year or beyond, at least one teacher from each of the following technology environments: one to one, shared device, and no device provided. Teacher participants covered a broad range of ages, content area, learner age, and tenure in the EDT program. Prior to each interview, participants completed a short pre-interview survey to record demographics. There were still 2-3 candidates that could have been interviewed should further investigation been required for data or diversity.

Structure. Krathwohl (2009) reported that while unstructured interviews are useful for exploring issues, they are best conducted by skilled personnel. Additionally, the author added

that highly structured interviews are easier to analyze and useful for measuring the response of a carefully selected sampling population. For this study, the researcher used a focused, semi structured approach with a clearly delineated population, starting broadly and then narrowing in order to follow the flow of the interaction and topics that arise. The semi-structured design offered time and flexibility for the participant to express their diverse views and experiences while allowing the interviewer to react and ask more follow up questions as ideas and events emerge (Creswell, 2009). Harris et al. (2012) used a structured interview protocol to assess experienced teachers' TPACK (Appendix A), which acted as a foundation for the interview protocol of this study. While this research uses TPACK as a frame to explore effective instruction, there will be other components in the investigation such that the dialogue will depart from a strictly structured protocol.

Questions. Patton (1987) noted that there are six basic types of questions that can be asked: experience/behavior, opinion/belief, feelings, knowledge, senses, background or demographics. This study embraced all of those listed to unpack the experience of classroom teachers during COVID-19 through the lens of constructivist educational technology and interactions with their community. The interview protocol (Appendix B) began with TPACK focused questions and followed with larger scoped questions around teacher experience, interactivity, and reactions to the pandemic. Questions directed at effective instruction were modeled after or taken directly from the TPACK protocol (Appendix A). The researcher asked the participant to pick a learning activity to which the TPACK questions apply. While the interview protocol in Appendix A acted as the foundation for the TPACK portion of the interviews, the questions were not structured and incorporated the lens of the newly forced virtual environment. In addition, there were additional questions to induce discussion around professional identity and stance, experience with administration, learners and community during ERT, perceptions of school decisions, reactions to virtual living, and comfort/confidence around technology. The interview protocol

can be seen in Appendix B, with the pre-interview survey that collected demographic data in Appendix C.

Instruments and Protocols: Survey (quantitative component)

The initial survey was created, shared with participants, and data collected through Qualtrics to ensure fidelity. Neither IP addresses nor identifying information were collected; the survey was anonymous. A number of instruments have been developed to assess a teacher's level of TPACK. Schmidt et al. (2009) developed a survey that was tested with 124 pre-service teachers resulting with an internal consistency reliability (coefficient alpha) ranging from .75 to .92 for the seven TPACK subscales (Appendix D). Many scholars have used this survey (Harris & Wildman, 2019) with modifications to fit their needs, including content matter and context (TPACK, 2020). Dr. Schmidt welcomes the use of this instrument provided researchers contact her with details, as she is creating a database of instrument use (TPACK, 2020). The survey was modified by Schmidt and colleagues following the pilot to include 54 Likert-scale items that focus on the four sub context domains of math, science, social studies, and literature.

Another well used survey instrument was created by Archambault and Crippen (2009) to assess the seven components of TPACK (Appendix E). This survey was created specifically for and piloted with 596 K-12 online educators and measured the content knowledge domain more generally rather than through the four subdomains as with Schmidt et al. (2009). The authors reported Cronbach alpha ranges from .699 for the technology content domain to .888 for the domain of technology. This researcher predominantly used the Archambault and Crippen (2009) survey but with potential modifications taking the Schmidt et al. (2009) questions into consideration, in language and scope. In addition to the two TPACK subscale assessment that incorporate technology and pedagogy focused on in-service teachers, questions around leadership activities and opportunity, interaction with colleagues and administration, sense of value following initial school closures, and demographics were added. Both surveys from the literature are included as Appendices D and E. Appendix F shows the research survey.

Questions. TPACK related survey questions were taken from the two instruments described above (Appendices A and B). The survey by Schmidt et al. (2009) was created and tested on pre-service teachers. It contains questions specific to four content subdomains. Two subdomains (technological knowledge and technological and pedagogical knowledge) were used as well as overall TPACK evaluation for the purposes of this study. Because Archambault and Crippen's (2009) survey embraced online teaching and in-service teachers, much of the language and formatting from there survey were utilized. However, since the teachers in this study will not have had training, preparation nor the resources readily available for remote teaching, the questions were modified.

In addition to TPACK assessment, there were questions that collected data around relationships, interactions, and activities with colleagues and administrators during ERT. These questions gathered data around contextual elements, specifically targeting recognition, opportunity, expanded role, and technology. Activity questions included availability to support colleagues, creation, digital interactivity and collaboration, and time spent researching and exploring methods and strategies for technology integration and tools. In addition, there were questions that explored teacher reaction based on their interactions for a first round determination of teachers' sense of value following this early pandemic experience. Demographics included age, gender, school environment, years of teaching experience, learner age, role (ex. classroom, integrator, librarian), content area, technology environment, and tenure in the EDT program.

Data Analysis

The researcher examined survey results for descriptive and inferential themes and initial connections. Survey data provided insight around the significance of school and technology environment, self-assessed technological ability, tenure in the IT programs, and utilization of networking media on effective instruction, teacher action and behavior, perception of recognition, opportunity, and sense of value. From these insights further investigation and

mergence with the qualitative data illuminated overarching trends and themes of technology utilization, stance and attitude, interactivity with colleagues and administrators as well as open ideation and teacher leaders as levers of change.

Inferential and Descriptive Survey Analysis

Descriptive analysis was used to characterize the experience of teachers during COVID-19. The researcher analyzed the data to examine the attitudes, behaviors and tendencies of the sample population - namely, stance and use of technology, participation in leadership activities, relational factors with colleagues and administrators, outreach and influence as well as environmental factors such as technology environment, recognition, and opportunity. Inferential statistics were employed to identify relationships and significance between demographic predictors such as gender, years in profession, tenure in EDT program, content area, age of learner, technology or school environment with effective instruction, leadership identity and behaviors, as well as opportunity and post early pandemic sense of value. The researcher also explored the influences of experience, tenure in program, and technological environment to technological acuity, stance, recognition, action, and sense of value through ANOVA analysis. All analyses were completed using SPSS.

Interview Modality

Interviews were conducted via Zoom in a password protected room. This platform offers videoconferencing, recording, and transcribing and has security measures embedded, all of which help to ensure ethical and professional standards. When recorded, the files include a transcript with time stamp and speaker name. The quality of the zoom transcript was moderate to high moderate and required checking for accuracy, which was done by the researcher. Upon inspection, the researcher decided to send the Zoom audio files through REVV.com for automated transcription to text. These transcripts were inspected and accuracy was confirmed to be improved. They have been stored on the researchers computer with no identifying markers

beyond Participant 1, 2, etc. The researcher let participants know that they could withdraw for any reason at any time during data collection. None chose to withdraw.

Coding

Coding allows the researcher to analyze and assign meaning and interpretation to data (Saldaña, 2016). Ryan and Bernard's study (2003) reported four categories of ways to identify themes in qualitative studies: word analysis, large text block scrutiny, linguistic feature analysis, and manual text manipulation. In this study, the researcher used word analysis and large text block scrutiny to begin looking for themes. While constructivist accounts of knowledge contend that mind maps are inherently biased to researcher experience and view, Creswell and Plano Clark (2007) recognized that meaning is best understood through personal history and experience. The researcher finds graphic representation of codes, relationships, concepts and themes extremely useful in understanding, analyzing, and synthesizing information. Visualization and creation allows for deep immersion with data and innovation during interpretation, conjecture, and synthesis.

As discussed by Krathwohl (2009) for preplanned studies, the initial coding schemes started with deductive codes taken from the survey and literature around technology, teacher leadership, and TPACK. Initial deductive investigation explored conceptual schema related to technology adoption and use, opportunity, conditions and practice. However, there is an emergent component to this study, embracing the reaction and interactions of teachers with their learners, colleagues, administration and community that indicated the use of inductive coding as well. According to Krathwohl (2009), inductive coding is used to tease out important concepts and the underlying factors by looking for parallel behaviors or perceptions. Inductive codes addressed concepts of professional identity, technology stance, recognition and opportunity. NVivo is documented to help researchers organize and recognize key words and phrases as well as organize themes (Leavy, 2017). This platform was used for coding and memos initially. This was helpful in organizing the data files and identifying initial coding frames. The

second round of coding simply added more text to the existing frames and a modicum of actual code merging. Rather, codes were then organized into groupings. From here, the researcher went to a digitized hand coding system, leveraging a personal organizational system including Google documents, notes, memos, mind mapping and graphics to examine coding relationships and to create frames of the experience (Wheeldon & Faubert, 2009) as well as continually referring to the conceptual frame. This helped with ideation around concepts, categories, and themes as well as sorting and refining the categories and themes.

Study Timeline

The timeline for this study embraces approximately one full year that included pilot survey creation, distribution and data analysis, identification of interview candidates, interview transcription, and analysis of both the quantitative and qualitative data sets. Research and preparation began in September of 2019, with committee formation and approval allowing data collection to proceed starting January, 2021. Data was collected by mid-April, with preliminary analyses driving concurrent interview protocol and discussions forward.

Quantitative Component

The researcher developed a test survey to examine the consistency and quality of questions as well as information from the data during December 2020. The pilot was sent out to 50+ colleagues. Cronbach alpha results helped to refine constructs and simplify questions to reflect the data that the researcher desired to explore. The researcher distributed 3 separate pilots with a minimum of 25 responses each time for evaluation. Each pilot run confirmed the solidity of the technology related questions, which was no surprise as they were taken from the literature as vetted instruments for TPACK studies. However, these pilots refined the researcher view on the TPACK questions such that rather than all 7 domains, the researcher decided to only include two subdomains (technological and technological and pedagogical knowledge) and the full TPACK domain. These pilots also exposed weaknesses in the other constructs, helping the

researcher pare down the number of questions in each construct to the top five questions for best consistency and results.

The study survey was open to approximately 200-225 current and past University of Maine, Instructional Technology program (EDT) students. It was found that there were 196 eligible participants, 32 graduated students and 164 current students in one or more EDT programs. While the goal of 45% response rate (approximately 80 participants) was set at the start, the researcher used 3 calls to reach a 61% response rate. The survey was first sent out via email on March 8, 2021. By March 18th, the response rates sat at 34%. Two reminders were sent out - again via email - on March 29, 2021 and April 19, 2021 to bring the response rate up to 61% by May 1, 2021.

Qualitative component

The researcher put out a call for volunteers via email and through course LMS to be interviewed for this study in December and early January, 2020. By January 15, 2021 10 candidates had been identified. The researcher began scheduling interviews beginning January 18, 2021. Throughout January and February another 10 were identified and by March 4, 2021 a total of 18 interviews were completed. Interviews were recorded on Zoom. The researcher found that the Zoom transcripts were reasonably accurate. However, for better results, the audio files were sent to REVV.com for transcription. These were the transcripts uploaded to NVivo and used for coding and qualitative data analysis.

Positionality

This concurrent triangulation mixed methods research explored the experiences of teachers in their virtual settings as they engaged with and instructed learners as well as their colleagues and administrators. For this study, teacher leadership is defined as activities and behaviors that influence and empower those outside the classroom. The analysis embraced effective instruction as ground zero and worked to make correlations and conclusions around

individual characteristics and the effects of interaction, recognition, and opportunity amidst the context of COVID-19. Underpinning the entire study is of course, the use of technology.

I teach and advise for the Instructional Technology programs, giving me expansive purview with accompanying dedication, goals and possible blindness. I may be too close to the trees to see the woods. The participants in my study were the EDT students with whom I have developed deep connections and admiration. Because interviewees were from this pool, I attempted to remain mindful as I collected information from as many people as possible - not just those with whom I have more communication. A myriad of students volunteered to be interviewed and I was able to base participation on demographics for diversity purposes. I feel comfortable that the interviewees covered a wide swath of age, experience, environments, and incorporated demographic factors.

Having lived in a number of states and environments as a non-white female, I have seen and experienced racism, sexism, and ignorance. Maine is a mono-culture, with the color becoming blindingly more white the farther north you travel. I have worked with community members who consider anyone not born in the area an “import” and a school with an international population that comprised 25% of the student body. I have also seen the erasure of these differences and disability through virtual introductions and interactions. Technology allows for commonality to be found through interests, goals, and searching as opening salvo. Race, gender, and ability follow as lenses as appropriate or needed.

Access and equity issues will need to be addressed. Having lived in Piscataquis county, the poorest county in Maine as well as living with satellite internet, I can empathize with the difficulties and obstacles. I have also worked in a school with a strong 1:1 program and led both honors and at risk students to success, both populations that may have faced either access and or equity issues. It is within my purview to view technology as the great leveler, when used properly. I embrace a constructivist approach to learning and have seen the differences this can for students and amongst colleagues. It will be critical for me to remain neutral when

interviewing and collecting the narratives of individual experiences. Using the survey instrument to start the data collection was helpful in maintaining a balance before heading into the interviews to tease out more and deeper connections.

Validity and Trustworthiness

More than nine months had passed since the pandemic precipitated the shift to remote learning in pK-12 environments and the study began to collect data. Teachers' memory of the exact sequence of events and timing may be inaccurate or emotional. Due to the heavy preponderance of participants in both phases of this study who are current in the EDT program, there could have been an added lens to the data that was not accounted for and led to conclusions that are not applicable to a larger audience. The researcher worked to avoid such conclusions. A positionality statement will help minimize bias. However, teachers who were not enrolled in the EDT program last spring were included as interviewees and survey participants. There were also questions around technology confidence and stance throughout the process to identify lenses or attitudes that may have affected observation and conclusion. One main limitation of this study is that it has a very broad focus and the number of participants may not be large enough to draw concrete conclusions about technology and a relationship to teacher leadership that extends beyond the community explored in this study.

Ethical issues

It was important to remain objective and keep the researcher's views on technology adoption and use out of the data collection and analysis. To combat this, question development and analysis employed the well accepted framework of TPACK and Sherry and Gibson's model of adoption and use. In addition, Krathwohl (2009) proposes several ethical concerns including deception, confidentiality, privacy, and consent. EDT students were notified of anonymity in the survey as well as participation bearing no consequence to course or program level participation. The researcher is part of an instructional technology program whereby positive findings around

the relationship between technology and teacher leadership could lead to increased enrollment or use in marketing. This was not the goal. All conclusions are supported by evidence.

Storage and confidence

· Survey data from classroom teachers both informed and supported the data and interpretation of interview data. All participant responses were coded with a number based on the order in which they completed the survey. The data was collected anonymously via Qualtrics and downloaded to the researcher's computer for the purposes of analysis. The data, which includes multiple choice responses, will be stored in the researcher's office indefinitely and on Qualtrics, a password protected website indefinitely. The survey data will be reported as aggregate data when (if) published. There is no data key by respondent that is linked to identifiable information.

For interviews, all interviews were recorded using the Zoom platform. All digitized data will be kept on the researcher's computer indefinitely. The researcher will work to keep the identity of the interviewees obscured in the data files by identifying participants by number. However, it is not possible to ensure anonymity for interviewees. Participation in this study will have no effect on course or program level position or stance (EDT). A positionality statement has been included in this document to disclose researcher stance in relation to this particular population as well as the content and context of this study.

Triangulation

In a concurrent triangulation mixed methods study, the data is collected from each method separately and merged either during analysis or interpretation (Creswell, 2014). A triangulation protocol involves the integration of information after all sets of data have been analyzed individually. There are four types of triangulation identified in the literature: methodological, data, theoretical, and investigator (Denzin, 1970). This study will employ methodological triangulation and data triangulation, involving the two data collection techniques of interviews and a survey as well as the multiple data types of text, codes and

themes, numerical, descriptive, and inferential. Triangulation works to increase confidence in the data, to create innovative ways of understanding the phenomena and to provide clearer pathways in unpacking the experience (Patton, 2015). Data were methodologically triangulated and compared. While the data collection happened concurrently and mostly independent of one another, there was potential for crossover. Preliminary analysis of the survey data did plant thematic seeds that directed interview discussion and deeper investigation of certain areas. However, the interview protocol was semi-structured and initial protocols were followed. Simply, this initial analysis helped shape deeper probing and secondary, reactionary questions. Both data sets were used during the interpretive phase of this study to provide a broad expanse of information around the relationship between technology and teacher leadership. The interview data was able to provide rich narrative and details around the experience while the survey brought clear relational and descriptive data to the table. The researcher merged the narratives, observations and statistics to develop and illuminate the relationship in as much detail as possible.

CHAPTER 4

FINDINGS

This mixed methods study explored the experience of teachers as they navigated the dynamic, ever shifting pandemic conditions to identify how elements of technology interacted with the development of teacher leaders. The term emergency remote teaching (ERT) will be used to define the learning and educational environment beginning in March, 2020 when schools buildings were closed and education was forced to move into virtual spaces without warning, training or time to prepare. The main research question is: What role, if any, did technology play in the development of PK-12 teacher leadership during the forced shifts to remote learning caused by the COVID-19 public health crisis? The two secondary research questions are: 1) How did technology factors during emergency remote teaching (ERT) interact with the individual and contextual factors that are traditionally touted as developmentally critical? and 2) What organizational conditions support the development and continued growth of teacher leaders? Participants in this research were enrolled in or graduated from at least one of the Instructional Technology programs (IT) at the University of Maine when the survey and interviews took place between January to March, 2021.

Quantitative Data

All students and graduates in the Instructional Technology programs were invited to complete a survey in January, 2021 through email and course LMS request. Of the 196 eligible, those that work with students in education, a total of 121 IT students and alumni completed the survey for 62% participation. Table 4.1 displays participant demographics and response statistics. The survey was made up of Likert scale questions that were based on a four point scale (1-Strongly Disagree, 2-Somewhat Disagree, 3-Somewhat Agree, 4-Strongly Agree). There were six constructs in this study: (1) technology, (2) technology and pedagogy, (3) TPACK, (4) actions and behaviors (individual), (5) recognition and opportunity (contextual), and (6) sense of value.

Table 4.1 Survey demographics and response statistics. This table outlines the participant demographics and overall responses for the survey.

	Number of responses	Overall Response %
GENDER		
M	87	71.3
F	32	26.2
Other	2	1.6
AGE		
20-29	17	13.9
30-39	37	30.3
40-49	31	25.4
50-59	36	29.5
EXPERIENCE		
Novice (1-4)	24	19.7
Early Mid (5-12)	35	29.5
Late Mid (13-19)	27	22.1
Veteran (20+)	34	27.9
LEARNER		
Elem	23	18.9
MS	29	23.8
HS	24	19.7
HE/Adult	14	11.5
pK-8	14	11.5
ALL/Other	16	13.1
CONTENT		
Elem Grade	32	26.2
Humanities	30	24.6
STEM / Media	44	36.1
Electives	15	12.3
TECH ENVIRONMENT		
1:1 Device	88	72.1
NOT 1:1	33	27.1
TECH ABILITY		
Beginner	33	27.0
Intermediate	71	58.2
Advanced	17	13.9
TENURE IN IT		
NEW	28	23.0

Table 4.1 Continued.

TENURE IN IT (continued)		
Early (2-3)	39	43.0
Mid (4-7)	22	18.1
Veteran (8+)	17	13.9
Graduate	14	11.5
IT PROGRAM		
EdS	21	17.2
MEd	49	40.2
Certificate	12	9.8
Multiple programs	36	29.5

The survey instrument scored an overall Cronbach alpha (α) of 0.922 and the Cronbach alpha for each construct can be seen in Table 4.2 (below). When sharing data around these six constructs, an average mean for the overall construct is used.

Table 4.2 Survey construct means. This table shows the survey constructs and their means.

	SURVEY	Technology		Technology & Pedagogy		TPACK		Action & Behaviors		Recognition & Opportunity		Sense of Value (self - teacher)	
α	0.922	0.888		0.903		0.857		0.732		0.891		0.855	
	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SURVEY	121	3.47	0.53	3.55	0.47	3.46	0.49	3.43	0.49	3.03	0.66	3.04	0.60

Qualitative Data

Interviews provided insight around the behaviors, interactions, external contexts and decision making processes that were part of the teacher pandemic experience. Despite the ever shifting nature of the educational environment, particularly between March to June, 2020, (ERT continued and teachers established new methods, developed as professionals, and interacted with their learners, colleagues, and administrators. The extensive and diverse range of individual, environmental, and administrative reactions to pandemic fluctuations provided an expansive view of the teacher experience. Interview demographics can be seen in Table 4.3.

Table 4.3 Demographics of interview participants. This table reviews the diverse demographics of the participants in this study.

Interview ID	Gender Identification	Teaching Experience	Tenure in IT
1	F	Veteran	Late
2	M	Late Mid	Early
3	F	Late Mid	Early
4	M	Novice	Late
5	F	Late Mid	Mid
6	F	Early Mid	Mid
7	F	Veteran	Graduate
8	M	Novice	Early
9	M	Late Mid	Mid
10	M	Early Mid	Early
11	F	Early Mid	Early
12	F	Early Mid	Mid
13	F	Veteran	Graduate
14	M	Early Mid	Mid
15	M	Late Mid	Late
16	F	Early Mid	Early
17	M	Novice	New
18	M	Early Mid	Late

Overview

This chapter will be sectioned into two parts. The first section focuses on survey data to investigate the role of technology during COVID-19. Data were summarized using descriptive statistics (frequency and mean) to report on the complex and numerous ways that technology impacted the experience and growth of teachers. Additionally, data were analyzed using inferential statistics (independent *t*-tests and one way ANOVA tests) to enumerate the significant differences in relationships to examine the role of technology through the traditional lens of individual and contextual factors.

The second section presents the qualitative analysis of interviews that unpacked the

teacher experience in generous detail. Five rounds of coding revealed themes that begin to assemble the key factors leading to teacher growth and leadership skill development during school closures and throughout the pandemic. The first theme uncovered that technology stance and attitude greatly impacted early teacher leadership during Covid; more than classroom or instructional experience. The second theme exposed that interactions with colleagues and administrators acted as gateways to growth and ownership of leadership attitude and activities. Teachers were inspired to raise their voice amongst colleagues and beyond or they felt discouraged. The third theme of administrative openness and flexibility speaks directly to the organizational conditions that encouraged or discouraged the continued growth and development of teacher leaders.

Part 1: Role of Technology

Survey data offered insight into answering the main research question: What role, if any, did technology play in the development of PK-12 teacher leadership during the forced shifts to remote learning caused by the COVID-19 public health crisis? The survey collected participant demographics and information around technology, teacher action and behavior in response to the pandemic, their interactivity with colleagues and administration, and perceptions of their sense of worth as a result of individual and environmental influences during the pandemic.

To highlight the interactivity of technology within the categories traditionally touted as developmentally critical in teacher leadership, the analysis is separated into two discussions. First, the technology constructs and the action and behavior construct will address individual factors. Second, the recognition and opportunity construct as well as the sense of value construct will speak to contextual factors. These findings will begin to unpack the interactivity of technology with teacher leadership development within these classifications and how technology itself may need to be considered its own category of influence.

Individual Factors in Leadership Development

Technology Constructs. The technology related constructs are aligned with Mishra and Koehler’s (2006) TPACK framework domains of knowledge. The technology construct includes questions around the utilization of technology by users such as “I can use technology easily” and “I know how to solve my own technology problems” and “I frequently play around with technology.” When incorporating technology with pedagogy, the questions comprise the utilization of technology to enhance the learning experience for students. These statements included “I can choose technologies that enhance the teaching approaches for a lesson” and “I can adapt the use of the technologies to different teaching activities” and “I can use a variety of platforms and tools to deliver online or hybrid instruction.” Note that the use of technology is focused on pedagogy, not content. The TPACK construct extends the utilization of technology in the enhancement of the learning experience specific to content. The statements encompass pedagogy as well as content specifics such as “I can use technology to create effective representations of content that depart from textbook knowledge” and “I can use technology to plan effective instruction around specific topics in the curriculum” and “I can use digital assessment to modify instruction” and “I can meet the overall demands of teaching in hybrid and online learning environments.” Cronbach Alpha results for all three of the technology related constructs show high consistency and are displayed in Table 4.4. Overall, teachers in the Instructional Technology programs felt strongly positive in all technology constructs, with means > 3.0 for all domains. Students were most positive about their utilization of technology to enhance learning (technology and pedagogy M=3.55). Both technology knowledge (technology

Table 4.4 Cronbach alpha results for technology related constructs. Cronbach alpha results, number of participants, means, and standard deviation for the technology related constructs.

	SURVEY	Technology		Technology & Pedagogy		TPACK	
α	0.922	0.888		0.903		0.857	
	N	Mean	SD	Mean	SD	Mean	SD
SURVEY	121	3.47	0.53	3.55	0.47	3.46	0.49

M=3.47) and the leveraging of technology to provide effective instruction focused on specific content (TPACK M=3.46) during ERT were similarly strong.

Gender and Age. In looking at gender, we are able to see differences between how female and male participants responded (Table 4.5). Male participants had a higher mean (M=3.59) than female participants (M=3.43) for the technology construct. However, females had a higher mean (M=3.49) for the TPACK construct than males (M=3.41). Female (M=3.56) and male (M=3.54) participants were nearly equal for the technology and pedagogy construct. For age groups, the 20-29 age group (Table 5) had the highest mean (M=3.59) for the technology construct and 50+ had the lowest (M=3.42). However, for the technology and pedagogy construct, the 50+ group had the highest mean (M=3.62) and 20-29 had the lowest (M=3.41). This was also true for the TPACK construct, whereby 50+ had the highest mean (M=3.49) and 20-29 had the lowest (M=3.42). The TPACK construct had a tight upper range with 30-39 (M=3.47) and 40-49 (M=3.48) reporting very similar means to the 50+ age group.

Table 4.5 Gender and age results for technology related constructs. This table shows the Cronbach alpha, number of respondents, mean, and standard deviation for gender and age under the technology related constructs.

	SURVEY	Technology		Technology & Pedagogy		TPACK	
α	0.922	0.888		0.903		0.857	
	N	Mean	SD	Mean	SD	Mean	SD
SURVEY	121	3.47	0.53	3.55	0.47	3.46	0.49
GENDER							
F	87	3.43	.513	3.56	.477	3.49	.467
M	32	3.59	.583	3.54	.455	3.41	.507
Other	2	-	-	-	-	-	-
AGE							
20-29	17	3.59	.482	3.41	.497	3.32	.442
30-39	37	3.44	.548	3.54	.437	3.47	.478
40-49	31	3.49	.502	3.53	.512	3.48	.492
50+	36	3.42	.583	3.62	.456	3.49	.520

School and Technology Environment. The school environment refers to the school based on learner age. Elementary refers to pK-5, middle school to 6-8, high school 9-12; other is comprised of variations that did not fit into the categories such as pK-3, K-12, and all. Across the technology constructs for the school environment demographic (Table 4.6), the “other” category reported the highest means (technology M=3.74, technology and pedagogy M=3.66, and TPACK M=3.61). For the technology construct, pK8 (M=3.57), higher education/adult learners (M=3.47) and high school (M=3.48) environments were not far behind. Middle school (M=3.36) and elementary (M=3.39) were similar and brought up the rear. For the technology and pedagogy construct, elementary (M=3.62), high school (3.59) middle school (M=3.54), and pK8 (M=3.54) environments were not far behind the other category. Higher education / adult learners reported the lowest mean (M=3.22). For TPACK, elementary (M=3.53) and middle

Table 4.6 School and technology environment results for technology related constructs. This table shows the Cronbach Alpha, number of participants, mean and standard deviation for school and technology environments and device for the technology related constructs.

	SURVEY	Technology		Technology & Pedagogy		TPACK	
α	0.922	0.888		0.903		0.857	
	N	Mean	SD	Mean	SD	Mean	SD
SURVEY	121	3.47	0.53	3.55	0.47	3.46	0.49
School Environment							
Elem	23	3.39	.469	3.62	.417	3.53	.472
MS	29	3.36	.599	3.54	.457	3.50	.465
HS	24	3.48	.632	3.59	.462	3.38	.601
HE/Adult	14	3.47	.541	3.22	.637	3.30	.548
pK-8	14	3.51	.469	3.54	.499	3.34	.426
ALL/Other	16	3.74	.356	3.66	.332	3.61	.330
Technology Environment							
1:1 Device	88	3.47	.550	3.56	.456	3.49	.459
NOT 1:1	33	3.48	.474	3.52	.512	3.38	.555
DEVICE							
iPad	23	3.46	.567	3.67	.466	3.64	.451
Chromebook	31	3.42	.580	3.57	.399	3.47	.447
Laptop	31	3.49	.556	3.43	.496	3.37	.468

school (M=3.50) environments had a strong showing. High school (M=3.38) and pK8 (M=3.34) environments were next and higher education/adult learning once again lowest (M=3.30).

For the technology environment demographic (Table 4.6) , iPad environments had the highest means for technology and pedagogy (M=3.67) and TPACK (M=3.64). Laptops had the highest mean for technology (M=3.49) but lowest for technology and pedagogy (M=3.43) and TPACK (M=3.37). Environments with a 1:1 ratio had a higher mean for TPACK (M=3.49) than non 1:1 environments (M=3.38). The means were very similar for technology whereby 1:1 ratio mean was M=3.47 and non 1:1 was M=3.48. For technology and pedagogy, the 1:1 mean was higher (M=3.56) than the non 1:1 ratio (M=3.52).

Teaching Experience. When analyzing data through the lens of teaching experience, novice teachers were confident in the technology construct but less confident in the technology and pedagogy or TPACK construct (Table 4.7). The mean for technology stayed relatively flat from novice (M=3.50) to early mid-career (3.51) to late career (3.52), but then decreased for the veteran teacher (M=3.37). For the technology and pedagogy, means jumped from novice (M=3.24) to more experienced teachers with early mid-career teachers (M=3.62), late mid-career (M=3.64) and veteran teachers (M= 3.60). The novice teacher mean for TPACK (M=3.09) was significantly lower than veteran teachers with 20+ years in the classroom (M=3.54).

Technological Ability. In contrast, investigations of technological ability and the technology related constructs show an inverse relationship (Table 4.7). Those that evaluated themselves as a beginner, showed the highest mean for technology (M=3.99), technology and pedagogy (M=3.78) and TPACK (M=3.67) compared to those that self-evaluated at intermediate in technology (M=3.45), technology and pedagogy (M=3.55), and TPACK (M=3.46). Interestingly, the teachers that appraised themselves as advanced technology users scored the lowest means for technology (M=2.78), technology and pedagogy (M=3.06), and TPACK (M=3.01).

Table 4.7 Experience and self-evaluated technological ability results for technology related constructs. This table shows the Cronbach alpha, number of participants, mean, and standard deviation for experience and technological ability for the technology constructs.

	SURVEY	Technology		Technology & Pedagogy		TPACK	
α	0.922	0.888		0.903		0.857	
	N	Mean	SD	Mean	SD	Mean	SD
SURVEY	121	3.47	0.53	3.55	0.47	3.46	0.49
EXPERIENCE (years teaching)							
Novice (1-4)	24	3.50	.441	3.24	.433	3.09	.461
Early Mid (5-12)	36	3.51	.582	3.62	.405	3.57	.472
Late Mid (13-19)	27	3.52	.509	3.64	.434	3.54	.440
Veteran (20+)	34	3.37	.572	3.60	.516	3.54	.453
TECHNOLOGICAL ABILITY (self-evaluated)							
Beginner	33	3.99	.364	3.78	.396	3.67	.474
Intermediate	71	3.45	.438	3.55	.447	3.46	.447
Advanced	17	2.78	.429	3.06	.330	3.01	.384

Tenure in Instructional Technology (IT) program. Finally, when examining the data by number of semesters enrolled in the Instructional Technology programs (Table 4.8), there is a great difference between a new student (first semester) and those that have been

Table 4.8 Tenure (number of semesters) in the Instructional Technology (IT) program results for the technology related constructs. This table shows the Cronbach alpha, number of participants, mean, and standard deviation for the tenure in IT programs for the technology constructs.

	SURVEY	Technology		Technology & Pedagogy		TPACK	
α	0.922	0.888		0.903		0.857	
	N	Mean	SD	Mean	SD	Mean	SD
SURVEY	121	3.47	0.53	3.55	0.47	3.46	0.49
TENURE (semesters in Instructional Technology program)							
NEW	28	3.18	.600	3.20	.407	3.10	.485
Early (2-3)	39	3.58	.461	3.51	.481	3.47	.462
Mid (4-7)	22	3.54	.488	3.73	.434	3.57	.446
Veteran (8+)	17	3.49	.525	3.75	.304	3.68	.368
Graduate	14	3.60	.555	3.79	.411	3.64	.438

involved longer. The new student mean for technology (M=3.18) shows the greatest difference with graduates (M=3.60). This holds true for technology and pedagogy where the new student mean (M=3.20) shows the greatest difference again with those that have graduated (M=3.64).

In analyzing the *technology construct* through the lens of years in the Instructional Technology programs, all students reported strongly positive, with $M > 3.0$. In detail, new students who were just starting the program with a single course in progress were the weakest positive (M=3.19). It is no surprise that graduates reported the highest mean (M=3.60). Interestingly, they were followed by early students with 2-3 courses (M=3.58), then mid tenure with 4-7 courses (M=3.54) and last, although only slightly were the veteran students with 8+ courses (M=3.49). A one-way ANOVA revealed that there was a statistically significant difference in the technology construct between at least two groups ($F(4, 115) = [2.941], p = 0.023$). The Bonferroni post hoc comparison found that the effect of the number of semesters enrolled on technology utilization between new and early tenure students was significant ($p=0.024$, 95% C.I. = [-0.77, -0.03]). This test also found the difference between new and other, later tenured students was not statistically significant.

For the *technology and pedagogy construct*, there was a clear progression from the lowest mean of the new student (M=3.20) to the highest mean of graduates (M=3.79). There is a jump between new and early students (M=3.51). Both mid (M=3.73) and veteran students (M=3.75) means are very close to that of graduates. A one-way ANOVA revealed that there was a statistically significant difference in the technology and pedagogy construct between at least two groups ($F(4, 115) = [7.770], p < 0.001$). The Bonferroni post hoc comparison found that the effect of the number of semesters enrolled on the technology and pedagogy domain between new and mid tenure students was significant ($p < 0.001$, 95% C.I. = [-0.88, -0.18]) between new and veteran students was ($p < 0.001$, 95% C.I. = [-0.93, -0.18]) and between new and graduates was ($p = 0.001$, 95% C.I. = [-0.99, -0.19]). Specifically, students in their first semester did not feel

as confident utilizing technology to enhance their teaching as compared to those that had been in the IT program for longer.

With *TPACK*, the greatest difference is between new students (M=3.1) and the veteran students that have completed 8+ semesters (M=3.68). One-way ANOVA disclosed that there was a statically significant difference in the TPACK construct between at least two of these groups ($F(4,114) = [6.378]$, $p < 0.001$). The Bonferroni post hoc comparison found that the effect of the number of semesters enrolled in IT programs on TPACK between new and veteran students was significant ($p = 0.001$, 95% C.I. = $[-0.98, -0.19]$). The veteran mean for TPACK is very close to that of the graduate (M=3.64), while the early tenure students with 2-3 semesters (M=3.47) and the mid tenure students with 4-7 semesters (M=3.57) show lower means. The Bonferroni post hoc comparison also found that TPACK mean difference between new and early students was statistically significant ($p = 0.012$, 95% C.I. = $[-0.70, -0.05]$) as well as between new to mid tenure students ($p = 0.003$, 95% C.I. = $[-0.85, -0.11]$) and between new students and those that have graduated ($p = 0.003$, 95% C.I. = $[-0.97, -0.12]$).

Action and Behavior Construct. The action and behavior construct explores the individual activities of teachers in response to ERT and throughout the prolonged effects of the pandemic. Survey statements include “I created resources for colleagues” and “I interacted with educational communities outside my school or district” and “I researched and explored best practices for remote education on my own time” and “I shared my work or opinions with administration without being asked” for assessment on a Likert scale from 1-4. These descriptive and inferential data contribute to the understanding of individual factors in teacher leader development. The consistency and mean results are reported in Table 4.9 below.

Table 4.9 Cronbach alpha and mean results for the action and behavior construct.

	SURVEY	Action & Behaviors	
α	0.922	0.732	
	N	Mean	SD
SURVEY	121	3.43	0.49

Gender and Age. Table 4.10 below shows that there were many more participants that identified as female (N=87) than male (N=32) and those that identified as females (M=3.48) reported higher means than male participants (M=3.28). By age, the 40-49 year old class had the highest mean (M=3.53), followed closely by 50+ (M=3.52), while the 20-29 year old group had the lowest mean (M=3.18). The 30-39 year old group was in between (M=3.38).

Table 4.10 Gender and age results for the action and behaviors construct.

	SURVEY	Action & Behaviors	
α	0.922	0.732	
	N	Mean	SD
SURVEY	121	3.43	0.49
Gender ID			
F	87	3.48	.462
M	32	3.28	.533
Age			
20-29	17	3.16	.408
30-39	37	3.38	.502
40-49	31	3.53	.434
50+	36	3.52	.509.

School and Technology Environments. Turning the lens to environmental factors that contributed to the individual action and behavior construct such as school environment (Table 4.11), teachers that worked in Higher Education or with adult learners had the lowest means (M=08), followed by high school (M=3.25) and middle school (M=3.40). Elementary (M=3.53) and K8 (M=3.50) were next and very similar. The highest mean was reported by those in the other category (M=3.83). In terms of content, responses fell into 4 categories: elementary grade, humanities, STEM, and electives. Those in the electives category (M=3.50) had the highest mean. Elementary grade and STEM were close behind with the same mean (M=3.45). Teachers in the humanities reported the lowest mean (M=3.35).

Reporting by type of device (Table 4.11) revealed that iPad environments (M=3.51) had the highest mean as compared to laptop (M=3.30) and Chromebook environments (M=3.31),

Table 4.11 School and technology environment results for action and behaviors construct.

	SURVEY	Action & Behaviors	
α	0.922	0.732	
	N	Mean	SD
SURVEY	121	3.43	0.49
School Environment			
Elem	23	3.53	.481
MS	29	3.40	.450
HS	24	3.25	.530
HE/Adult	14	3.08	.542
pK-8	14	3.50	.321
ALL/Other	16	3.83	.252
Content			
Elem Grade	32	3.45	.477
Humanities	30	3.35	.520
STEM	44	3.45	.506
Elective	15	3.50	.390
Device			
iPad	23	3.51	.549
Chromebook	31	3.31	.386
Laptop	31	3.30	.604

which were very similar. When looking at student to device ratios, the mean for 1:1 environment (M=3.36) was lower than those in non 1:1 environments (M=3.61). Inferential analysis disclosed that the action and behavior construct was not statistically affected by gender, age, school or technology environment, or content. There were no statistically significant differences when analyzing results through these lenses.

Teaching Experience and Tenure in IT program. In terms of years in the classroom, the late mid-career teacher with 13-19 years reported the highest mean (M=3.60). Veteran teachers were not far behind (M=3.58) with novice (M=3.29) and early career teachers (M=3.30) at approximately the same mean for the action and behavior construct. These data are shown in Table 4.12.

Table 4.12 Experience and tenure in the Instructional Technology programs results for the action and behaviors construct.

	SURVEY	Action & Behaviors	
α	0.922	0.732	
	N	Mean	SD
SURVEY	121	3.43	0.49
Experience (years teaching)			
Novice (1-4)	24	3.30	.482
Early Mid (5-12)	36	3.29	.509
Late Mid (13-19)	27	3.60	.353
Veteran (20+)	34	3.54	.504
Tenure (semesters in Instructional Technology program)			
NEW	28	3.22	0.533
Early (2-3)	39	3.47	0.427
Mid (4-7)	22	3.45	0.552
Veteran (8+)	17	3.45	0.477
Graduate	14	3.70	0.321

When viewing the action and behavior construct means for students in and graduates from an IT program (Table 4.12), it is not surprising that new students had the lowest mean ($M=3.22$) and graduates had the highest mean ($M=3.70$). Early ($M=3.47$), mid ($M=3.45$) and veteran ($M=3.45$) student means were squarely between and very similar. Current or past enrollment in an IT program contributed to a difference in responses that was remarkable. While all students and graduates from the IT programs showed positive actions and behaviors during COVID ($M>3.0$ for all groups), a one-way ANOVA revealed that there was a statistically significant difference in the actions and behaviors of teachers between at least two groups ($F(4, 112) = [2.492], p=0.047$). Bonferroni post hoc comparison found that the individual actions and behaviors of teachers in response to ERT and throughout the prolonged effects of the pandemic between new students and graduates was significantly different ($p=0.029$, C.I. = 95%, [-0.93, -0.03]). Specifically, teachers that had graduated from an IT program had markedly increased activities of learning, creating and sharing than those that were in their first semester.

Communications through Social Networking/Media. Incorporated into technology utilization during remote learning, 89.4% of respondents disclosed that they accessed and communicated with others virtually, outside their immediate environment through social media. Interestingly, those that engaged in social networking/media for sharing and interacting with colleagues (M=3.54) showed a significant difference in their action and behavior construct from those that did not use social media at all (M=3.25). Please refer to Table 4.13.

Table 4.13 Networking media and self-evaluated technological ability results for the action and behaviors construct.

	SURVEY	Action & Behaviors	
α	0.922	0.732	
	N	Mean	SD
SURVEY	121	3.43	0.49
Networking Media Utilization (for communication)			
Yes	74	3.54	0.453
No	47	3.26	0.493
Technological Ability (self-evaluated)			
Beginner	33	3.57	0.461
Int Low	71	3.48	0.423
Int High/Adv	17	2.98	0.538

In contrast once again is the self-evaluated technological ability demographic. Those that rated themselves a beginner showed a higher mean (M=3.57) than those that evaluated themselves as intermediate (M=3.48) and advanced (M=2.98). The difference in means between those that communicated through social networking/media (M=3.54) and those that did not (M=3.26) was noteworthy. An independent T test showed the difference to be statistically significant ($p=0.002$), whereby teachers that used social networking/media had increased actions and behaviors. Specifically, teachers that communicated via social media had appreciably more activities of learning, creating, and sharing.

Technological Ability. To note, there was an inverse relationship between technological ability and the action and behavior response (Table 4.13). Beginner technology users had higher

means (M=3.57) than advanced users (M=2.98), with the intermediate user falling closer to the beginner (M=3.48). A one-way ANOVA signified that there was a statistically significant difference in their action and behavior ($F(2,117) = [10.579]$, $p < 0.001$). Bonferroni post hoc comparison found that the difference between beginner and advanced technology users was significantly different ($p < 0.001$, C.I. = 95%, [0.27, 0.93]).

Contextual Factors in Leadership Development

Recognition and Opportunity Construct. The recognition and opportunity construct explores the interactivity of teachers with their colleagues and administrators, targeting feedback and occasion to share or collaborate with others (Table 4.14). Statements such as “I was recognized publicly for supporting colleagues or creating resources for colleagues” and “I was asked to share my work with colleagues” were part of this construct for Likert (1-4) self-assessment. The recognition and opportunity construct means (average construct M=3.03) were lower than the technology (average construct M=3.47), technology and pedagogy (average construct M=3.55), TPACK (average construct M=3.46), and action and behavior construct (average construct M=3.43) means. While these previous constructs were related to individual elements, teacher perceptions of recognition and opportunity will involve contextual factors.

Table 4.14 Means for the constructs of recognition and opportunity construct.

	SURVEY	Recognition & Opportunity	
α	0.922	0.891	
	N	Mean	SD
SURVEY	121	3.03	0.66

Gender and Age. Gender data (Table 4.15) show that those who identified as female (M=3.09) had a mean higher than those of their male identifying counterparts (M=2.88). By age, the 50+ age group showed the highest mean (M=3.11) for the recognition and opportunity construct, followed closely by the 40-49 year old age group (M=3.09). The younger ages report very similar means, with 20-29 (M=2.93) and 30-39 (M=2.95) means nearly identical.

Table 4.15 Gender and age results for the recognition and opportunity construct.

	SURVEY	Recognition & Opportunity	
α	0.922	0.891	
	N	Mean	SD
SURVEY	121	3.03	0.66
GENDER			
F	87	3.09	.668
M	32	2.88	.640
AGE			
20-29	17	2.93	.600
30-39	37	2.95	.678
40-49	31	3.09	.680
50+	36	3.11	.658

School and Technology Environment. When analyzing the data through the contextual lens of the school environment (Table 4.16), high school teachers had the lowest mean ($M=2.73$) for the recognition and opportunity construct and the other category had the highest mean ($M=3.53$). Higher education/adult ($M=2.83$) and middle school ($M=2.94$) environments were <3.0 . K8 ($M=3.03$) was not far above, but the elementary ($M=3.23$) environment had the second highest mean. Specifically, teachers working with the younger age learners perceived increased recognition and opportunities. When looking at the technology environment, means for iPad environments ($M=3.16$) were higher than that for Chromebooks ($M=2.95$) and laptops ($M=2.88$) for the recognition and opportunity construct. Throughout Maine, it is more common to see iPads in the elementary environment. Specifically, iPad environments displayed higher means for external acknowledgement, appreciation, and occasion to share or collaborate with others. iPad environments ($M=3.28$) also showed the highest mean for the sense of value construct as compared to that of the Chromebook ($M=2.84$) and laptop ($M=3.11$).

Table 4.16 School and technology environment results for the recognition and opportunity construct.

	SURVEY	Recognition & Opportunity	
α	0.922	0.891	
	N	Mean	SD
SURVEY	121	3.03	0.66
School Environment			
Elem	23	3.23	.654
MS	29	2.94	.648
HS	24	2.73	.623
HE/Adult	14	2.83	.632
pK-8	14	3.03	.548
ALL/Other	16	3.53	.560
DEVICE			
iPad	23	3.16	.627
Chromebook	31	2.95	.655
Laptop	31	2.88	.698

Teaching Experience and Tenure in IT program. When analyzing the data through the lens of experience, the number of years teaching showed a nearly direct relationship between the novice to veteran teacher for recognition and opportunity (Table 4.17). In this construct, novice teachers showed the lowest mean (M=2.90), followed by early mid-career (M=2.95), veteran (M=3.13) and late mid-career (M=3.11) teachers.

When looking at semesters in an IT program, new students in the Instructional Technology programs show the lowest mean for both constructs (recognition and opportunity M=2.72 and sense of value M=2.93). However, for the recognition and opportunity construct, graduates report the highest mean (M=3.34) while for the sense of value construct, early students record the highest mean (M=3.21). Specifically, while new students felt the least noticed, graduates perceived greater appreciation. New students discerned lower value than those that were just ahead of them in program tenure, with these early students evaluating themselves feeling a greater sense of worth during the pandemic.

Table 4.17. Experience and tenure in the IT program results for the recognition and opportunity construct.

	SURVEY	Recognition & Opportunity	
α	0.922	0.891	
	N	Mean	SD
SURVEY	121	3.03	0.66
EXPERIENCE (years teaching)			
Novice (1-4)	24	2.90	.655
Early Mid (5-12)	36	2.95	.672
Late Mid (13-19)	27	3.15	.621
Veteran (20+)	34	3.11	.678
TENURE (semesters in Instructional Technology program)			
NEW	28	2.73	.566
Early (2-3)	39	3.16	.625
Mid (4-7)	22	3.08	.672
Veteran (8+)	17	2.91	.697
Graduate	14	3.34	.686
Technological Ability			
Beginner	33	3.25	.648
Intermediate	71	3.07	.625
Advanced	17	2.48	.548

Technological Ability. Examination of technological ability once again exhibits an inverse relationship between beginner to advanced users and both constructs. Beginner means are highest (recognition and opportunity M=3.25 and sense of value M=3.16) while advanced user means are lower (recognition and opportunity M=2.48 and sense of value M=2.85). Users self-identified their level of technological ability.

Sense of Value Construct. The sense of value construct (Table 4.18) was designed to examine the effects of contextual elements on the individual’s attitude and inspiration moving forward that impact leadership development and skills. Statements such as “I am valued by my administration” and “I am an important voice in decision making conversations” and “I am an important member in my school / district community” were part of this construct for Likert (1-

Table 4.18 Cronbach alpha and mean results for the sense of value construct.

	SURVEY	Sense of Value (self - teacher)	
α	0.922	0.855	
	N	Mean	SD
SURVEY	121	3.04	0.60

4) self-assessment. Like the recognition and opportunity construct, the sense of value construct means (average construct M=3.04) were quite a bit lower than the technology and action and behavior constructs. The sense of value construct will record perceptions even more strongly aligned to contextual factors.

Gender and Age. In terms of gender (Table 4.19), female participants (M=3.08) scored a higher mean than males (M=2.98). For age, all the means are clustered except for the 50+ year old group (M=3.19), with the highest average mean for sense of value. Means for the age groups 20-29 (M=2.98), 30-39 (M=2.98), and 40-49 (M=2.99) were nearly identical.

Table 4.19 School and technology environments results for the sense of value construct.

	SURVEY	Sense of Value (self - teacher)	
α	0.922	0.855	
	N	Mean	SD
SURVEY	121	3.04	0.60
School Environment			
Elem	23	3.17	.523
MS	29	3.04	.584
HS	24	2.96	.661
HE/Adult	14	2.72	.666
pK-8	14	3.13	.512
ALL/Other	16	3.16	.686
DEVICE			
iPad	23	3.28	.504
Chromebook	31	2.84	.547
Laptop	31	3.11	.598

School and Technology Environment. Means for the sense of value construct were among the lowest throughout the survey (Table 4.20). Once again, elementary teachers (M=17) and other (M=3.16) were the highest with higher education/adult learners at the bottom (M=2.72) and high school. Middle school (M=3.13) was not far from the elementary with K8 (M=3.04) falling in between teacher means close (M=2.96).

Technology environment means show that iPad environments (M=3.28) were once again highest for the sense of value construct, followed by laptop environments (M=3.11) and Chromebooks environments (M=2.84) bringing up the rear. Whether 1:1 (M=3.04) or not (M=3.06), the means for the sense of value construct were approximately the same.

Tenure in IT program and Teaching Experience. When looking at tenure in the Instructional Technology program, means for sense of value were low. They were about equal Table 4.20 Experience, tenure, and technological ability results for the sense of value construct.

	SURVEY	Sense of Value (self-evaluated, teacher)	
α	0.922	0.855	
	N	Mean	SD
SURVEY	121	3.04	0.60
EXPERIENCE (years teaching)			
Novice (1-4)	24	2.87	.558
Early Mid (5-12)	36	2.92	.639
Late Mid (13-19)	27	3.10	.596
Veteran (20+)	34	3.26	.555
TENURE (semesters in Instructional Technology program)			
NEW	28	2.93	.617
Early (2-3)	39	3.21	.600
Mid (4-7)	22	3.02	.592
Veteran (8+)	17	2.98	.659
Graduate	14	2.96	.550
Technological Ability			
Beginner	33	3.16	.596
Intermediate	71	3.03	.604
Advanced	17	2.85	.609

for new students (M=2.93) and graduates (M=2.96), as well as veteran students (M=2.98). Mid-career students were only slightly higher (M=3.02) and interestingly, early career students (M=3.21) had the highest mean.

Sense of value means increased directly from novice teacher (M=2.87) to early mid (M=2.92), late mid (M=3.10), and veteran teachers (M=3.26). Specifically, novice teachers perceived less acknowledgement, fewer opportunities, and the least sense of value at their schools and from administration than their more experienced counterparts. A one-way ANOVA signified that there was a statistically significant difference in the sense of value between at least two groups ($F(3,114) = [2.747]$, $p=0.046$). Bonferroni post hoc comparison found that the difference between a novice and veteran teacher was slightly significantly different ($p=.1001$, C.I. = 95%, [-0.83, 0.04]).

Technological Ability. Throughout the survey analysis, the technological ability demographic has shown inverse relationships with the constructs. Namely, those that assess themselves as beginners (lower ability) have reported mean averages that are highest in the constructs. For sense of value, the beginner users (M=3.16) once again top the charts. Advanced users (M=3.03) have the lowest means with intermediate users (M=2.85) firmly in the middle.

Part 2: Organizational Factors that Supported Continued Growth and Development of Leadership

To better understand the role of technology and development of leadership during Covid, teachers enrolled in or graduated from one or more IT programs were invited to engage in dialogue about their experience beginning with school closures and throughout the pandemic. Eighteen interviews were conducted over a period of 3 months between January and March 2020. The demographics are shown in Table 4.21.

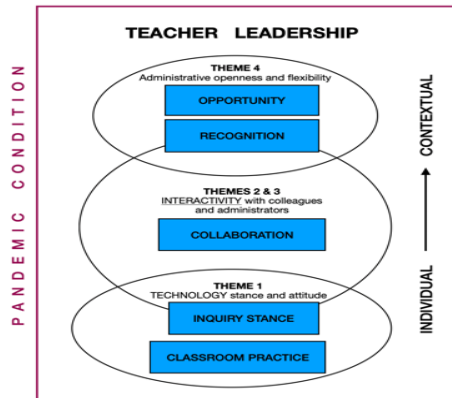
Through these interviews, several themes emerged that address the research question “What organizational conditions support the development and continued growth of teacher

Table 4.21. Demographics of interview participants (pre-interview survey data).

Interview ID	Gender ID	Device	Learner Grade	Content	Teaching Experience	Social Media	Tenure in IT
1	F	iPad	Elem	Grade	Veteran	Yes	Late
2	M	Chromebook	HS	ELA	Late Mid	Yes	Early
3	F	Chromebook	K8	Art	Late Mid	Yes	Early
4	M	Chromebook	adults	Special Education	Novice	Maybe	Late
5	F	BYO	Elem	Literacy	Late Mid	Yes	Mid
6	F	Laptop	Elem	Grade	Early Mid	Yes	Mid
7	F	iPad	Elem	Literacy/Math	Veteran	Yes	Graduate
8	M	Chromebook	K8	Social Studies	Novice	No	Early
9	M	Chromebook	MS	Math	Late Mid	No	Mid
10	M	Laptop	MS	Math	Early Mid	Yes	Early
11	F	Chromebook	All/other	French	Early Mid	Yes	Early
12	F	Chromebook	HS	Art	Early Mid	Yes	Mid
13	F	Laptop	MS	Humanities	Veteran	Yes	Graduate
14	M	Chromebook	Elem	Grade	Early Mid	No	Mid
15	M	Chromebook	HS	Social Studies	Late Mid	No	Late
16	F	None	All/other	American Sign Language	Early Mid	No	Early
17	M	Chromebook	HS	Science	Early Mid	No	Late
18	M	Chromebook	MS	Math	Novice	Maybe	New

leaders?” First, technology stance and attitude laid a foundation from which teachers were better prepared and ready to develop as leaders during the unprecedented shuttering of schools in March, 2020. Second, interactivity with colleagues and administration acted as a springboard for developing voice and establishing expertise. Technology savvy teachers were modeling effective communication and collaboration norms as well as expert navigation and utilization of technology in dynamic, virtual environments with learners and colleagues for administrators. Third, the openness and flexibility of administrations worked to enhance or discourage confidence, motivation, and empowerment as schools moved forward or did not. These three themes are depicted in Figure 1.

Figure 1. Relationship of themes to leadership growth



THEME 1: Technology Stance and Attitude

Classroom Practice to Develop a Constructivist Ideology. From novice to veteran, teachers with a strong penchant for continual improvement of classroom practice were following the surge of technology in education. Those that leaned into technology and pedagogy rather than resisting change or simply using device to “try technology” discovered that a strong technology stance and attitude is aligned with a constructivist lens where learners are active participants in creating knowledge; that students learn through self driven exploration and reflection. These teachers embraced curiosity, critical thinking, innovation, and trying new things. A novice but tech savvy teacher in his third year shared how technology was able to transform an activity, inspiring students to engage beyond expectations.

“The learning objectives stayed the same, but the level of interaction I got from the students was immense. Students did it begrudgingly when I just gave them papers and things to do. But when I told them that they could use social media... their heads exploded. It was really cool to see part of the assignment that I didn't even ask them for, it wasn't even part of the assignment. They started interacting with each other's profiles as if they were different characters.”

These students were motivated in this assignment by incorporating familiar technology tools and methods of communication. With the traditional “papers and things to do” the learning was passive and not well received. In this technology rich activity, the students were creating profiles and communicating with one another as new identities on digital platforms. They were active participants in creating knowledge as well as directing the learning experience and thus highly engaged. In effective classrooms, not only are students enjoying themselves, so is the teacher.

“So we tried to have fun with it. And we tried to create meaningful math lessons, but put some things into it, have some guest speakers who were, you know, silly little characters, um, or jokes... And I remember that being kind of cool.”

Technology utilization is not just about device; rather, technology can transform pedagogy. Teachers with an inquiry stance of exploring technology and pedagogy were able to engage their students and were thus well situated to meet the challenges of remote learning. They were already curious, exploring and trying new strategies to promote ownership and autonomy. For one early mid career teacher, joining the Instructional Technology program and interacting with others in the technology community directed her natural curiosity along a serendipitous pathway.

“I knew there was more that I could be doing. And so when I started my classes [in the Instructional Technology program].....it was just like a light bulb went off....Cause now I know that there's reasons to choose technology and there's reasons to change my pedagogy to include the technology.”

As these early career teachers with strong technology stances planned their student activities, they embraced constructivist ideology of student ownership through experience, choice, and autonomy. They looked for relevant and meaningful activities outside the norm.

“I didn’t want to do the same old here's your worksheet, fill it in. I wanted to use [something relevant and engaging].... there's another way... I want the kids to be able to work with each other and see each other. So if one of my students finishes quickly, you know, cause then they get to choose whatever method they want.”

Another early career teacher tried using a familiar, digital communication platform with his students and found the learning truly transformed. “I was testing to see if that they could see from an alternate perspective, but online using social media, it became this whole other thing.” He found a way to engage and inspire student interaction. Even veteran teachers that integrated technology were able to embrace curiosity and creation. This veteran felt strongly about active participation for both her students and self “I don't need to just rely on YouTube to find a lesson on how to do something. [When I create the video] I can really target it towards exactly what I want, [the things] that my kids are working on.” She was creating and designing lessons that were meaningful and relevant to her 1st graders.

Some were hesitant about student screen time yet leveraged their strong inquiry stance to question and seek out new ideas, to explore technology and pedagogy long term. COVID-19 and ERT acted to accelerate the push. One late mid-career teacher was dabbling in encouraging student autonomy and reflection.

“I was trying to do some, a little bit more of a flipped classroom where I would teach more via kind of a video or a lesson film that hopefully the students would watch and then come to class and we could do a discussion from there.”

This strategy leveraged technology and added to student screen time in accessing content, but promoted student responsibility, encouraged critical thinking, inspired peer to peer discussion and sparked student autonomy. Embracing instructional technology and constructivist ideology is not approval for a completely digital curriculum.

“I do have the opportunity to at least teach it in a way where I can put balance to it and have a little bit of say in how kids use it in a positive way and just kind of share my ideas of balance.”

A strong technology stance and attitude opens the door to find the perfect blend of digital and analog activities to promote active, student driven learning that is relevant and meaningful for each learner. Teachers are active participants in their growth as well.

Effective Instruction as a Springboard to Innovation. These effective teachers who had embraced technology and thus constructivist ideologies stepped up to the plate to meet the needs of students quickly. Be they novice or veteran, teachers with student centered cultures in the classroom were ready to continue exploring strategies to engage, inspire, and promote autonomy in the newly forced, virtual environment of ERT. These were critical challenges during COVID-19. One novice teacher leveraged the student-centered, technology rich culture he had already developed in his traditional in person classroom.

“My class was taught in an independently paced fashion. So kids worked at their own speed at their own level through what we called choice boards [and] that had mostly been able to be the same. However, a lot more of the tracking mechanism was posted online [when learning became remote].”

Although he did not have many years in the classroom, this novice was not thrown into chaos by unplanned school closures. Rather, he found the unexpected task exciting and fun. Teachers of all experience were meeting students where they were at, engaging them and staying connected. “I just started creating different cultural discussion boards on canvas and different cultural activities that were basic enough that they could do on their own.” While some administrators did not want new material covered, it was imperative to stay connected to students.

“I made screencasts, I showed two different ways to do multi-digit multiplication... I went onto YouTube and found authors were posting their read alouds and their stories and copyrights were loosened. So [I had students listen and asked] what do you think it's about? How do you feel when you read it?... just basic open-ended comprehension and exposure.”

Through exploration, this mid late career teacher found that copyright rules had been loosened during ERT for literacy education. She created, she explored, she tried new things. Her effective teaching, constructivist classroom and mindset opened the door to deeper innovation and leveraging of digital resources, communities, and tools.

Leveraging familiar tools and modes of communication, teachers with strong technology stance and attitude simply continued to explore and grow.

“I went on and did a Flipgrid video because we used Flipgrid in our classrooms. So I knew [my kindergarten students] all knew how to use it... [I was] telling them what was going on and that, you know, we were going to be staying in contact some way somehow. I emailed it to the parents that I had their emails and lo and behold, I got a reply from one of my students that next morning.”

The immediate response sparked an emotional reaction, where this veteran teacher was driven to champion the use of Flipgrid (and Seesaw) to stay connected with elementary students. She went on to create tutorial videos for colleagues and rally her administration to embrace a digital presence rather than paper packets and analog learning.

Tech savvy, novice to veteran teachers were ready and eager to innovate in the face ERT. Having led in their classrooms, these effective teachers were well situated to share their expertise with colleagues and beyond. Thus, it was not the years in a classroom that best positioned teachers to face the challenges of ERT; it was technology stance and attitude. One teacher who was in his third year of teaching shared,

“I'd actually been certified to teach and train other people using the G suite so when it came to the planning stage and things like that, trying to get people caught up, I was paired up with a couple of the older teachers [who were less technologically skilled].”

This novice teacher's technological knowledge elevated his value and sense of worth during COVID-19. Even those early in their career but possessing technological ability and constructivist ideology gained confidence, raised their voice, and thus grew as leaders.

Leaders of Innovation Embrace an Expanded Role. Because connecting and teaching in a virtual environment requires technological acuity in skill, pedagogy, and practice, effective teachers who had developed cultures of choice, creativity, and autonomy in their student-centered classrooms weathered this rapid shift more easily than others. These effective teachers modeled successful, productive communication and collaboration norms and many were called upon to share their expertise to support colleagues and administrators. As leaders of innovation in the classroom, they were prepared and ready to expand their influence beyond their learners; to take on more responsibility.

While the novice teachers showed less confidence than their more experienced counterparts, their stance and attitude toward technology embraced a willingness to explore, learn, and take risks as they moved into virtual environments. A veteran teacher shared that “I'm the type of person that goes overboard and does way more than is expected....so [when schools shut down] on my own time, I looked into Schoology.” On the other end of the spectrum, a novice teacher who was in his 3rd year enjoyed the challenge: “I had to teach myself a few different resources that I hadn't used before, but it was kind of interesting.” A teacher in her 6th year of teaching stated, “And my thoughts were, I can learn. I mean, once I found out we were getting Google classroom, I just started learning it.” These tech savvy teachers enjoyed learning, exploring and trying new ideas as with this late mid career teacher: “Whatever I've done for most of my teaching life has really just been what I've come up with on my own.” They embraced

an active participation in their own growth, pushing themselves and innovating. COVID-19 and ERT provided the catalyst for expanding their work, influence and responsibilities outside the confines of the classroom. They had the expertise and the penchant to volunteer, to contribute, and to support others.

Whether in the first, eleventh or 25th year in the classroom, teachers with a positive stance and attitude toward technology possessed knowledge and skills to facilitate the unplanned shift to virtual environments. Additionally, realizing the speed with which technology shifts and flexes, embracing a positive technology stance and attitude necessitates being curious, exploring platforms and strategies, trying new pedagogies and methods to enhance the learning experience, and incorporating the constructivist lens of learning through experience. These effective teachers weathered the unplanned and rapid shift to ERT not only gracefully, but armed with a growth mindset and philosophy of sharing. During Covid, technological skill, and even more importantly technology stance and attitude took down walls and built confidence through creation, sharing, and collaboration. A teacher in his 2nd year stated “being comfortable in computer stuff took down a lot of barriers for me.” Another early mid-career teacher shared a rewarding experience.

“I saved his job because he was a guy who's older already towards retirement and thought that he would be able to get by without doing technology [pre-pandemic]. And then he's remote...So, I've helped him a lot. And that's been, that's been really rewarding and fun. He just needed some very basic things, but it's given me an opportunity to really help him out. And you just get so excited about the learning, which is great.’

Education has been forever changed and technology, on many levels, has taken on a larger role. Not only was teacher technology stance and attitude a major player during COVID, the technology stance and attitude of administrators also held great influence over the growth and

development of teacher leadership. “So many people were using Google classroom... our administration did ask us to make sure we had Google classroom set up for all of our classes.” They were open to possibilities. This novice teacher also recognized the importance and his own role in helping others.

“I ran a couple workshops on Google classroom. I invited some other schools locally to attend too, so got quite a few people there. ..I had kindergarten up through eighth grade all there. I recorded that and posted it up on my YouTube channel after so they could access it. Then I also made a couple extra support videos that were just a little more streamlined if people didn't want to go to the workshop. That was just cause I wanted to, because I knew people were having a hard time.”

He saw the need, knew he had the expertise, and embraced the work. Early career to veteran teachers with technological ability, gave their time and efforts in numerous ways outside their job description. They embraced expanded roles and their leadership skills equally grew.

THEME 2: Interactivity with Colleagues

Becoming Visible. For novice teachers, their technological skills were often not known but certainly registered and welcomed as their expertise and curious nature were critical when schools were thrown into chaos in March, 2020. Teachers that had been in the classroom longer were often already in positions of technology support or questions. One 6th year math teacher purported, “That's always how it's been, if you need to learn how to do X or Y go talk to [Sam], he'll figure it out.” He was always ready and willing to spend time outside his normal duties to support others. A technology savvy, veteran teacher felt a little more put out by the inundation: “We were bombarded with questions every day, like 50 questions each of us a day.”

Technological acuity acted as the catalyst for teachers at all experience levels to develop as teacher leaders as they led their colleagues, created or designed protocols and systems, and

made suggestions to promote forward progress.

When these teachers had a strong technology stance and attitude, their curious nature expanded to embrace learning and sharing with a larger audience. Some extended their exploration and discussions beyond their usual boundaries.

“I have a bunch of Facebook groups that I follow that are education related. And I also follow a bunch of educators on Twitter that I learned all about in your class. So that’s how I found out about Jamboards and my kids loved it. They love to do the jams..”

This early mid teacher became so proficient and creative with Google Jamboards (a platform that became exceedingly popular during the pandemic), she was asked to run a workshop for educators outside her school. Flattered and excited, her voice was heard by hundreds of other educators through both in person and virtual formats of professional development; huge strides as a teacher leader. By entering these larger collaborative spaces, the novice to veteran teacher was able to raise their voice, connect with and impact a larger, sometimes global community, and make a full step into teacher leadership. These steps are all firmly rooted in the sphere of individual choices and control.

Finding Voice and Amplifying Impact: Collaborative Spaces. Beginning with collegial interactions, effective teachers with strong technological acuity were positioned to support others with their knowledge, skills, and attitude. As mandates and reactions to unprecedented school closures continued to shift and flex, teachers were left scrambling to stay connected with their administrators, peers, and students. However, teachers with strong technology dispositions transitioned to the virtual world with more fluidity and ease. Whether an early mid career teacher, veteran, or novice, many of these effective teachers wanted to share their expertise and support others. “I brought some of my experience into it to kind of help make this transition easier for the less tech savvy teachers.” They were already comfortable in virtual

environments and expanded into collaborative spaces to learn and continue growth as a teacher leader. A novice teacher with advanced technological ability did not feel overwhelmed with the unprecedented, rapid shift to ERT; rather, rising to the occasion and finding joy in learning.

“I had some extra time and I just really wanted to make sure all the teachers were able to do what they wanted. I had to teach myself a few different resources that I hadn't used before, but it was kind of interesting.”

Novice to veteran teachers embraced their technological knowledge and skills, especially TPACK, to find their voice. Amidst the chaos created by the pandemic, they realized that their technological acuity, effective classroom norms, and innovative thinking could participate in moving their colleagues, administrators, and schools forward.

Gaining Confidence: Doing Without Being Asked. As their voice grew stronger, novice and early mid-career teachers not only gained confidence but leaned into sharing and bringing their expertise to the table. They spoke up and enjoyed stepping into teacher leadership roles without being asked. One reserved teacher in her sixth year found her voice during the pandemic. “I was happy to share what I was doing....to help out anyone that wanted it. I didn't ask people, I just offered it, you know?” Another early mid-career teacher broke out of her shell and her confidence swelled. “And since I was pretty comfortable with getting engagement through resources like zoom or Google meets, that felt like a pretty natural thing for me to kind of work on and help people with.” As well, more experienced and veteran teachers continued to be role models and work to support others. An 11th year teacher shared: “[My team] talked about just putting together a tech tutorial classroom where we could teach other teachers how to use these tools from home.” One veteran who had more than 20 years in the classroom, worried about her less tech savvy colleagues. She took the lead, gathering a few intermediate to advanced technology users to create artifacts for teachers in need as well as guide the direction of technology utilization during ERT. “So every week we met at my house and we put together a

training website for our staff.”

When encouraged, teachers with technological knowledge or expertise were willing to design systems to move school communities forward.

“[We, as technology leaders] created a school-wide schedule that had links to all the specific zoom meetings that we continue to use now that we have some remote students.....[and trained others] how to use the actual resource in class.....we were constantly just trying to bounce ideas off each other and figure out better ways to do that.”

Because technologically savvy teachers were already comfortable with students centered, strong TPACK teaching, they shifted to remote learning more easily. They were not as panicked and had more time; willing to apply these strategies on a larger scale.

THEME 3: Interactivity with Administrators

Top-down Approach. During the early phase of unprecedented school closures, decisions were constantly in flux as administrators responded to the growing and ever changing health threat as well as the developing needs of the community. In some cases, the administration took a top down approach, broadcasting decisions and mandates made behind closed doors. An advanced technology user but novice teacher felt that the top down approach did not help move their school forward. Being in his 3rd year of teaching, he felt he had much more to offer but was not given the opportunity to help move his school forward during ERT nor work successfully with students due to the administrative mandates. “They hire teachers, and then they ignore them for the entire year, so they didn't know what skills and abilities we had.”

Another advanced technology teacher who was heavily involved in supporting colleagues felt burned by administrators for attempting to bring knowledge and feedback into decision making discussions.

“I did not volunteer [to provide training in the summer]. I was pretty frustrated at that point because I got singled out pretty hard in the [district level] conversations for asking questions from my team because it seemed like I was being - antagonistic might've been the word used.”

When novice to veteran teachers with technological skills and expertise were unable to provide feedback or share their knowledge and were in fact discouraged, they became frustrated and withdrew from activities of leadership; their growth was crippled. For many, frustrations rose to the level of questioning their career path. “There are a lot of people who have talked about why would I do something this difficult and challenging for the amount of money that I [used to get] for it [under less challenging conditions]?” Their dedication and passion for growth and professional development was stymied and shifted to considering other options.

Importance of Communication and Open Ideation. In other districts, administrators included teachers in the decision making by providing opportunity for open ideation, through gathering information and experiential data, by asking for opinions and expertise, and opening the door to two way feedback cycles. When teachers with strong technological ability were part of the decision making, they felt valued and were more likely to embrace mandates whether they agreed or not. They wanted their opinions to be taken into consideration, no matter what the outcome.

“I have always felt that my admin values my opinion, and not just mine, everybody's opinion. So they were going to listen to us to some degree, but then they had to say, okay, well these suggestions sound good, but for other reasons, we need to do these things. I [felt] listened to.”

With open ideation and strong communication, relationships were strengthened and teachers were inspired to share their expertise, collaborate, and support one another. “Our building administrators, our principal and assistant principal are very, very good. I met with them at

least once a week.”

Due to the unprecedented nature of the pandemic challenges, it was important to teachers that they felt informed and aware of concerns and potential shifts in direction. Novice teachers in particular felt bolstered by the awareness. Further, when they felt a personal spotlight, they were inspired to extend their boundaries to support their more professionally experienced, but technologically challenged compatriots. They were motivated to share their expertise and expand their responsibilities to participate in forward motion.

“I appreciated having the constant communication from admin and I thought they did a pretty good job being supportive....I was really happy with how they handled it in the spring... I did a lot of impromptu tech support during those PLC meetings.”

Early mid-career teachers developed confidence through interactions with administrators and requests to share their expertise and work with others. Numerous interviewees reported excitement and inspiration from the recognition and new opportunities. A teacher in her sixth year exclaimed, “I’m excited about education and where I hope, you know, I see myself in the future and moving things.” Inspired, this 4th grade teacher was offered a new position as the technology integrator and she accepted, ready to continue her growth as a teacher leader for her school.

Alternately, when administrators did not provide direct communication, teachers were frustrated and likely to lose respect for their administration and falter in their own drive. “..we had to keep doing some stuff that didn't make sense... because our admin really just didn't understand the technology and how it could possibly work.” In these cases, teachers, especially veterans, were not only frustrated, but often retreated from collegial discussions and focused on doing their best under the mandates that did not make sense. They were less likely to grow or volunteer their time or expertise to support others or move the situation forward.

“We have five administrators and I only heard from our main principal and he just sends out a mass email update probably once a week. Everybody was in survival mode to just get through the year and [administrators] didn't really check up on anybody to see how anybody was doing. [I was] basically thrown into isolation.”

At the least, teachers wanted to be informed and aware of the factors driving decisions, even if they were not involved with the final verdict. As conditions continually shifted, this became more important. “It feels like because things [were] so hard and the messaging for teachers [was] so inconsistent, you know, from everyone.... it's been frustrating.” When there was limited communication, novice and early mid-career teachers felt separated and at times disillusioned with the education system. An early mid-career teacher did not feel she could grow or develop at her school based on the lack of administrative communication. She decided to pursue other opportunities.

“I think COVID just opened up the doors for people to see that there really needs to be structure if there's going to be an online program... My outlook on K-12 has not gotten better... I've seen a lot of dysfunctionality... I plan on resigning.”

She did not feel supported nor able to advance herself. This early mid-career teacher planned on redirecting her energies and diverging from her original professional path. A more experienced teacher who was in his 11th year shared concern over teacher loss.

“[My administration was not] willing nor able to actually rethink how education works....I am really genuinely nervous about the loss of talent and enthusiasm that we're gonna have from teachers all across the country, moving into the next few years.”

Teachers that encountered one way communication, conveyed exasperation, feelings of despair and hopelessness during the pandemic and around the future of education.

Inspiration through Recognition and Feedback. Teachers who felt informed and had access to administrators to whom they could bring ideas or feedback were more likely to express positivity around their pandemic experience. As teachers that were technologically capable transitioned more smoothly into ERT, they were able and willing to support and lead their students, colleagues, and administrators in moving their schools forward. Regardless of experience teaching, these technology savvy and comfortable instructors opened their doors to answer questions, put in extra time and effort to build structures for communication, and design systems for student success across classrooms. They gained confidence; they raised their voice; they were inspired to grow professionally and take on more responsibility without compensation. “We [didn’t] feel limited, you know, if we [had] an idea it was listened to.”

This 3rd year, advanced technology user had gained the confidence to speak up and bring ideas to the table. He had been recognized for his technological ability already and with an open administration, he stepped up to design and create an innovative alternative for the school’s 8th grade promotion ceremonies.

“Normally the assistant principal would help with all the eighth grade promotion activities. So it was kind of a combination of them not having him and knowing that I could do it...I think they made some signs or something for kids. And they were having teachers pair up and bring those signs out really early in the morning. I didn't really want to do that. I wasn't really comfortable riding with anyone. So I basically said, I'll make your whole promotion for you, that was my kind of wheelhouse.”

Although inexperienced in the classroom, under these conditions and with recognition and open minded administrators, this teacher stepped up to innovate and lead his school. His talents were

appreciated. However, these individual decisions and interactions were enhanced or diminished by contextual factors, namely the interactivity and actions of their administrators. When these dynamic, generous individuals were recognized and called upon to share, they stepped up to fill gaps and move their schools forward. When communication and interactions were limited or non-existent, teachers lost their inspiration and desire; their potential growth as a teacher leader was forestalled. One expert technology user that had been leading collegial conversation and collaboration was deemed belligerent and difficult when bringing team questions to administration. He stopped participating and shut down, choosing to focus his energies elsewhere. “By the time we got through that rollercoaster, I was ready to not do a session.” He stopped engaging with or supporting colleagues and stepped down from all leadership positions. The development of his leadership was frustrated and potentially extinguished.

THEME 4: Administrative Openness and Flexibility

As in the discussion above, the relationship between teacher and administrator(s) is extremely important. During Covid, teachers with more advanced technological ability were transitioning smoothly into ERT; thus modeling successful, productive communication and collaboration norms with learners, colleagues, and potentially administrators. In addition, whether a novice or veteran teacher, these effective teachers had the skills and knowledge to facilitate ideation and potentially participate in or provide much needed expertise for decision making. Based on their already curious and collaborative nature, many were acknowledged as experts and or provided support for colleagues without being asked. How and if administrators recognized, embraced, or called upon individuals with knowledge acted as gateways for leadership growth and professional inspiration. Interviewees perceived this gate as open wide to closed completely and locked.

Recognizing New Ideas in Times of Unprecedented Challenges. Administrative openness and flexibility embraces more than communication. One veteran teacher was able to articulate her feelings about the importance of administrative stance and attitude to growth. “I

feel like admin maybe is responsible for helping teams [of faculty] develop a collaborators mindset, which means giving and receiving feedback, critical feedback, because that's how you grow.” During the unprecedented challenges of the pandemic, administrators that were inflexible, with a top down approach propagated confusion and malcontent. Additionally, those that focused on getting back to “normal” were not able to move their faculty or systems forward.

“Our superintendent, um, was pretty notorious for really wanting to get back in the building in the spring. So we never had a ‘for the next two months plan.’ It was always, we're going to reevaluate April 1st and then we're going to reevaluate April 15th and then we're going to reevaluate May 1st..”

This created angst, lackluster collaboration and loss of creativity. Looking back rather than forward limited innovation, growth, and in fact prompted more frustration and acted to diminish motivation. “...the people who have tried the hardest were getting burnt out really, really quick.” Teachers shared that doing their job and connecting with students and families in virtual environments needed a completely different structure.

“We haven't changed our incentive structure [for kids who are at home]... and we've lost a lot of our incentives that we use for students at school as well, that aren't grades. And so I feel like we've actually gotten worse because we haven't reinvented how we think about that.”

Many teachers with advanced technology expertise felt there needed to be a larger scoped approach to the educational paradigm in the face of the pandemic environment. They had expertise and ideas to share. “I think it's probably unprecedented that so many people felt out of their element and that they needed to be willing to let go of what they've always done. Not seeing the start of that conversation is kind of a personal attack.” Teachers wanted to be part of the conversation.

In contrast, administrators who were willing to listen and engage in open ideation with faculty generated a collaborative spirit and inspired teachers to participate, stretch themselves, and offer their expertise and time willingly.

“Instead of dictating to us what this plan should be, [they allowed] us to come up with it freely, listening to our feedback and then putting it into action... [which is why] my school was so successful in the spring with virtual learning. They did everything right.”

If administrators were willing to flex and embrace new ideas, suggestions from faculty feedback and open ideation, teachers extended themselves, searched for solutions, and felt positive. “We had to learn this on the fly, but quickly we started to share our experiences with administration.” Education was deeply impacted by the move to virtual environments and technology was and continues to play a major role in the continuing transition. Technology was not simply a substitute tool for analog activities and dissemination of facts. “I appreciate technology in a different way, I [now] see it as a powerful tool versus just something else that presents the same material in a different way.” Technology was used to transform learning into an experience that is customizable, relevant, and individually meaningful. “Technology was a way to kind of empower the students.” Technologically advanced teachers that had embraced constructivist paradigms in the classroom wanted to employ this approach both in school wide ERT measures and decision making frameworks.

Leading from the Trenches: Empowering Others with Opportunity. An early mid-career teacher felt her principal not only listened to the concerns and needs of the faculty, but took action to implement proposed suggestions and ideas. “He's like a hundred percent behind the teachers, you know, he listens to our concerns and he does stuff.” This teacher felt empowered by the openness and actions of her administrator. This type of administrative attendance and action oriented responses act to boost confidence, nurture growth and cultivate efforts to learn and develop in the service of self and others. “Administration actually really liked

our videos and they shared it with the school board.” Teachers were bolstered by recognition and doubled down on their efforts, sharing, and growth as a teacher leader. “I take initiative. I'm not someone who's just going to talk about an idea for four months.” They were inspired and buoyed when their actions were recognized and acted upon. “I can't wait to tell you about [my work] because I love what we did.” Administrative openness and flexibility played a key role in response to school closures, influencing teacher engagement with the process, professional development, and willingness to volunteer time and effort to others.

“These meetings were probably some of the most productive we had in that admin kind of took the feedback from us, took the feedback from the sister schools, where [we all] said what worked and what didn't. And in three days we came up with a plan..”

When feeling valued for skills, opinion, or capabilities, teachers were empowered to step up to provide their expertise, research and evaluate potential solutions, and contribute time and effort as needed.

“We have a more open-minded administration now to creativity and doing things differently. And that's one of the things I love about this school is because I can be creative and they're gonna, they'll be really pleased with it. It's just, I didn't realize how I could be creative until I took off with the technology.”

Given encouragement and offered a seat at the table, teachers with technology and other expertise grew in confidence and were empowered to innovate.

Closing Doors and Discouraging Growth. When administrators were not open and flexible, as seen when they chose not to listen to faculty input or feedback, attitudes and growth were less positive. “We just kept on piling stuff on our own plates...I think we're worth a lot more than [just recognition], especially because it's on top of what we were already responsible for.” In many of these cases, teachers did not feel valued. “The decisions from the upper levels of our administration did not feel like they had teacher's best interest at heart, or at least listening

to teacher concerns.” Teachers felt discouraged and many resigned, moved to another school, or considered a career change.

In the face of unprecedented challenges, teachers with expertise had much to offer. Novice to veteran teachers were frustrated when administrators made decisions behind closed doors. One veteran teacher with more than 20 years in the classroom shares, “Our admin refuses to acknowledge that we needed a tech integrator or that a tech integrator is even a valuable position.” Another tried to persuade her administrator to please consider anecdotal evidence, but was denied. “Initially admin who's a little old-fashioned thought we were just going to go paper packets. And we had some very quick conversations about, we have these resources available and we can actually deliver far more content.” Despite trying to engage her administrator in such discussion, her feedback was not considered during decision making. Such inflexibility acted as a block to creativity, growth, and inspiration.

An early mid-career teacher became disillusioned with education. “I felt extremely frustrated with the lack of flexibility around these requirements and felt forced into “dumbing” down my activities and work in general with students...” The negative impact on growth and development was especially influential with novice and early mid-career teachers who were experiencing administrative reaction to emergency issues for the first time. Inflexibility and lack of open ideation or communication were not conducive to growth nor inspiring. “My outlook on K-12 has not gotten better... I [saw] a lot of dysfunctionality.” A novice teacher that was an advanced technology user explained his stance. “I remember being frustrated with the hand wringing going on and especially, I felt like I could probably help come up with a solution, but it wasn't my place.” He did not feel valuable despite having knowledge or skills that could be useful; he was neither inspired nor encouraged to develop voice or leadership.

Summary

Through interviews with teachers enrolled or graduated from the Instructional Technology programs, several themes emerged that address the research question “What

organizational conditions support the development and continued growth of teacher leaders?”

First, it was clear that those teachers with a strong inquiry stance were better positioned to embrace remote education. Their positive stance and attitude toward technology situated novice to veteran teachers in positions of early leadership, whether supporting colleagues, designing and creating protocols and systems for communication and learning, or sharing expertise and knowledge for decision making at all levels.

Second, while moving to virtual environments broke traditional methods of communication and activity, teachers with strong technical abilities were able to interact with colleagues, locally and through virtual channels, such as social networking/media. These connections acted to increase confidence, develop voice, and expand impact. Further, when the relationship, communication, or feedback with administration was strong, teachers' confidence expanded even further and opened the door to numerous professional development and career opportunities. During Covid, recognition and opportunity were driven by technological ability rather than teaching experience on the individual front but also depended on administrative relationships and other contextual parameters outside the control of the teacher.

Third, teachers with administrators willing to listen and incorporate teacher voice in ideation as well as decision making found their environments to best meet the needs of the community. In these cases, teachers gained confidence and stepped up to further their own knowledge, abilities, and roles. This is where leadership growth was most pronounced and helped to identify the organizational conditions that support the development and continued growth of teacher leaders. The growth of novice and early career teachers with strong technological expertise and skills was especially impacted while the continued development of later career and veteran teachers was either strengthened or diverted toward perceptions of burn out.

CHAPTER 5

DISCUSSION

The purpose of this study was to explore the influence of technology on teacher leadership during pandemic conditions through the traditional lens of individual and contextual classifications. Findings can be summarized into three broad themes. First, data analysis indicated that teacher stance and attitude toward technology were more influential than device or technological environment to situate individual teachers into positions of potential leadership. Second, the recognition of a teacher's TPACK strength and technological knowledge by colleagues and administrators acted as gateways for the formulation of leadership identity that inspired innovation and collaboration. Conversely, when teachers were not recognized or were potentially reprimanded for actions, they were discouraged from further engagement and growth. Direct communication from administrators and two-way feedback loops were critical facets for perpetuation of leadership identity. Third, novice to veteran teachers with strong technological acuity were most empowered by administrators that engaged in ideation with faculty and were both flexible and open to new ideas amidst the unprecedented challenges of COVID-19. Their identity as leaders and agents of change were solidified through administrator-provided opportunities to contribute, inform, and direct initiatives. This was critical for deep and lasting evolution of leadership. When TPACK strong teachers embraced their leader identity, were encouraged by colleagues, and furnished opportunity to practice leadership, teachers reported student success, strengthened community, and newly cultivated environments of innovation, versatility, and resilience. In looking at historical models for teacher leadership, technology shared a critical yet complex relationship with the traditionally accepted individual and contextual classifications to shape the development of teacher leaders during ERT, followed by the incredibly difficult challenges of remote, hybrid and flex learning environments. Given these findings, it is likely the educational paradigm, specifically how schools should improve instructional strategies to maximize student engagement, will be forever impacted, with some

schools continuing "business as normal" and others using the opportunity to evolve in real time as the 21st century progresses.

Technology as the Keystone in COVID-19 Construction of Teacher Leaders

To answer the research question "What role, if any, did technology play in the development of PK-12 teacher leadership during the forced shifts to remote learning caused by the COVID-19 public health crisis?" the next section will address the adroit utilization of technology in the classroom as a clear pathway to effective instruction, especially under the guise of ERT. This situated teachers with positive technology attitudes and TPACK strength into positions of early leadership. Naturally curious and creative, these teachers embraced classroom constructivist ideologies for themselves, researching and trying new best practices for remote environments and thus positioning themselves to lead others forward.

Effective Instruction: The Bedrock of Teacher Leadership

Starting with the technology related findings, positive teacher technology stance and attitude led to effective instruction especially pertinent to the rapid and unplanned school closures that kicked off the pandemic pressures on education. Teachers who had embraced technology in their classrooms were engaged in student-centered, inquiry based, and digitally-rich activities that encourage student creativity and ownership. In so doing, these effective teachers had already developed a culture of open ideation, curiosity, and autonomy. Effective instruction, seen as the capacity to empower learners, is a foundational attribute for teacher leaders (Katzenmeyer & Moller, 2009; York-Barr & Duke, 2004). The traditionally accepted 'domain level' knowledge that characterizes teachers ready to develop as leaders includes subject matter, curriculum, pedagogy and pedagogical content knowledge (Smylie & Eckert, 2018).

Over the last two decades the field of education has observed the growing importance of incorporating technology in the classroom (Mishra & Koehler, 2006), Lowther et al. (2008) posited that the three most important characteristics to develop quality learning experiences with technology are autonomy, capability, and creativity. Data analysis confirmed that neither

device nor student to device ratios necessarily governed technology utilization in the classroom. Rather, individual stance and attitude were driving factors in TPACK strength, classroom culture and effectiveness of instruction. Students in technology rich classrooms possessed learnings around their own strengths, applications of learning, and autonomous behaviors. No matter what the learner age or content focus, students in these technology integrated, constructivist classrooms adjusted to remote learning with more ease than those that had not experienced choice, autonomy, nor the freedoms of creative expression of knowledge or understanding. The pandemic, ERT conditions that began in March, 2020 both validated and heightened the significance of TPACK for teachers and technological acuity for all personnel throughout the educational system. Teachers who were leading in their classrooms, with cultures of creativity and ownership of learning, had empowered their students and themselves. Thus, they were situated on a bedrock of expertise and experiences upon which to construct their leadership.

Teacher Leaders as Lifelong Learners, Curious and Creative

Especially successful teachers extended this TPACK, constructivist lens of active learning (Jonassen, 1999; Mishra & Koehler, 2006; Papert, 1980; Piaget, 1968) to themselves. They explored new technology tools and strategies, created resources, and collaborated with colleagues and experts. Data analysis supported this in reporting a lack of statistical significance based on device or student device ratio. Rather, the impact on effective technology use depended on the individual, where research participants recorded strongly positive for individually based technological stance and attitude seen in the questions asking about learning technology easily, frequently “playing around” with technology, and confidence in knowing how to solve technology problems. Buchanan et al. (2020) purported that this type of personal inquiry stance that models lifelong learning is equally important to the teacher leader foundation as domain level knowledge. Respondents were also involved in graduate work in instructional technology, engaging in exploration and collegial collaboration. They displayed curiosity and innovation,

further evidenced in strongly positive responses for questions around adapting the use of technologies to different teaching activities and using technology to create effective representations of content that depart from textbook knowledge.

Effective teachers were well positioned to transition their students into remote spaces, despite the rapid and unplanned nature of pandemic conditions. They were confident in their ability to use a variety of platforms and tools to deliver online or hybrid instruction and felt strongly positive that they could meet the overall demands of teaching in hybrid and online learning environments. Well positioned and feeling confident, effective teachers moved into ERT more easily than their compatriots. As such, these constructivist teachers with strong technology stances were able to model productive communication and collaboration norms for colleagues and administrators. The foundational layer of teacher leadership begins with the individual and manifests through the development of skills needed for effective instruction, strong practice and pedagogy that empowers learners (Katzenmeyer & Moller, 2009; Smylie & Eckert, 2018). It is further supported through a strong inquiry stance (Buchanan et. al, 2020) whereby teachers adopt a constructivist posture for themselves, continuing to explore and learn alongside their students. Technological ability, stance and attitude were the key individual and foundational components for teacher leadership as schools were closed in March, 2020.

**The Influence of Interactivity on Leadership Growth and Impact: the
Segue from Individual to Contextual Factors**

In answering RQ2, “How did technology factors during emergency remote teaching (ERT) interact with the individual and contextual factors that are traditionally touted as developmentally critical?” teachers with technology rich classroom cultures and constructivist ideologies leveraged individual technology strengths in their first steps of leadership evolution. They were leading in the classroom and moving into collaborative spaces, consorting with local and far flung colleagues to learn, share, and build connections. They were enhancing their knowledge and equally important, their position of strength to generate innovative ideas and

offer support in their local environments. As their leadership identity evolved, their impact expanded. Once forged, leadership identity was advanced or discouraged through administrator actions.

Developing Voice: Moving into Collaborative Spaces

Learning and leading are inextricably woven together, whereby TPACK strong teachers had the knowledge and attitudes conducive to expanded roles and responsibilities (Barth, 2001; Buchanan et al., 2020; Darling-Hammond et al., 1995; Steffy et al., 2000). As such, they were ready to exercise creativity in collegial and organizational work to face the unprecedented challenges wrought by ERT. The action and behavior mean from teachers at all levels of experience was strong and even novice teachers reported strongly positive for activities such as exploring and researching best practices for remote education on their own time, creating resources for colleagues, and sharing their work or opinions with administration without being asked. These teachers had embraced technology as part of their instruction, reaching the final stages of Sherry and Gibson's (2002) Learning Adoption Model, which examines the adoption of technology through teacher perception. TPACK strong teachers were experienced and ready to act as "reaffirmers," confident and willing to share their work and strategies with colleagues. They were (re)affirming the value and power of TPACK related tools and framework to lead their schools forward during ERT.

Technology savvy teachers also leveraged online collaborative spaces to explore, learn, share and innovate. Cheung et al. (2018) recognized that for continued development of leadership, teachers required common vocabulary and identification of necessary skills rather than specific content. Crossing proximal and traditional boundaries of content and learner age, online collaborative spaces allow for networking, cross pollination and ideation around technology and TPACK. Leveraging virtual collaborative spaces, novice to veteran teachers developed and raised their voice. Their influence grew exponentially as it expanded across district lines, geographical boundaries and time zones.

Encouraging the Leader in Every Teacher

During school closures, technology savvy teachers jumped onto networking platforms, created tutorials and resources, offered to mentor the less technologically advanced, and volunteered to design systems. They provided workshops and digital supports without being asked, engaged in global collegial conversations, and they availed themselves to answer questions from colleagues and administrators. Through deepening competence, encouragement from others, and the potential opportunity to practice leadership, teachers can embrace teacher leadership identities (Sinha and Hanuscin, 2017). When there was feedback or appreciation, these teachers prospered and continued creating, sharing, and interacting; their motivation, influence and impact surged. The encouragement for taking initiative promoted leadership development (Katzenmeyer & Moller, 2001). This was particularly true for novice teachers, whose skills were often unknown. Earlier career teachers were not as confident nor woven into the community fabric as deeply as their more experienced counterparts. When encouraged and recognized, teachers were more positive about their COVID-19 experience as well as their future in education. Motivated and buoyed, these recognized and supported teachers used positive vocabulary such as “interesting” and “happy [to share]” and “really rewarding” and even “fun” to describe their work, growth, and experience during COVID-19.

In contrast, teachers who did not feel encouraged nor encounter quality communication with colleagues and administrators were frustrated, disillusioned with pK12 education, and felt isolated. Discouraged, they withdrew. They felt “thrown into isolation” and quickly disengaged to focus their energies where needed and appreciated; their desire to embrace an expanded role was quashed. The unprecedented nature of COVID 19 conditions decimated community norms and thus, thrown into separated and virtual environments, how and when administrators communicated with their community played a defining role in the pandemic experience. Administrative communication was an essential contextual factor in the growth and development of teacher leadership, working to either bolster or deflate budding teacher leaders.

Embracing Innovation Beyond the Classroom

To support the development of teacher leaders, it is critical that they are not only recognized but afforded the opportunity by formal leadership to share their expertise, gather data and anecdotal evidence, and participate in ideation (Fernandez & Shaw, 2020; Margolis & Huggins, 2012). Teachers with an eye on both their practice and larger systemic initiatives can provide great leadership and perspective for administrators (Margolis, 2012); never was this more true than during the pandemic. For growth, teacher leaders require opportunities to act as agents of change (Sleeter, 2013) as well as system level infrastructure that cultivates collegial learning and leading (Cheung et al., 2020). This research study concurs; during the pandemic, technologically savvy teachers held great perspective. As well, those who were recognized and provided with opportunity to lead and participate in ideation were inspired and they flourished. They embraced expanded roles in which they could contribute to the advancement of their faculty colleagues and the school system at large.

Cheung et al. (2018) posited that teachers develop leadership and embrace their role as leaders when they identify themselves as agents of instructional change in their schools. TPACK strong teachers had the expertise and experience to participate in ideation. They gained confidence and inspiration through encouragement to develop, then raise their voice and extend their influence through local and virtually expansive collaborative spaces. Teacher leadership was founded in the classroom and launched through interactions with ever widening circles of colleagues and administrators to larger effect and influence. Subsequent recognition and opportunity acted as gateways to continued growth and impact.

Administrative Contribution in Supporting Teacher Leaders to Reach and Sustain Full Potential

Lastly, it is important to reflect upon insights gained through school closures and continued pandemic conditions around teacher leadership development. RQ 3 asks “What organizational conditions support the development and continued growth of teacher leaders?”

The public health crisis of COVID-19 threw education into an unknown abyss of challenges with ever shifting parameters, from remote teaching to access and resource inequities to socioemotional needs of both students and education personnel. Schools and districts are entering a third year of uncertainty. Technologically advanced teachers who had developed leadership identities were inspired and continued to evolve when given space and support to ideate and take initiative; they flourished when actively participating in decision making, contributing to ideation, designing systems, and leading initiatives. During these unprecedented times, technologically strong teacher leaders had the potential to catalyze educational changes that were effective and productive during ERT and in preparation for potential shifts to our educational paradigm in the beyond. Administrator feedback and action held invaluable consequence and import.

Flexibility in Times of Uncertainty

During the unprecedented challenges of ERT, technologically fluent teachers possessed expertise and anecdotal evidence to participate in ideation and to inform decision making. In concert with formal leadership that understood, recognized and provided opportunity (Leithwood et al., 2020), effective teachers developed as teacher leaders who impacted decision making, outcomes, and work during COVID-19 (Fernandez & Shaw, 2020; Harris, 2020). Open ideation and feedback from administrators worked to empower teachers. Conversely, when teachers were not included in discussion, reprimanded for “rebellious” behaviors by attempting to be innovative, or simply ignored, they felt discouraged and their growth and leadership were quashed. Administrators that leaned into open ideation acted to encourage and inspire their faculty. Leithwood et al. (2020) posited that this style of context responsive leadership, which integrates the functional and the personal (understanding and developing people) was critical in identifying the ever evolving needs of the community and realizing the equally dynamic scope of organizational goals. This organizational lens was ever shifting in focus and widening in horizon and compass throughout the pandemic and continues to adjust. Schools and districts must

continually revise not only their route but trajectory through these adaptive challenges.

Technologically and TPACK strong teachers were inspired and galvanized to action - to lead and participate in directing the future of their school. Leadership serves as a catalyst for unleashing the potential capacities that already exist (Leithwood et al, 2020), whether at the administrator-teacher leader level, the teacher leader-colleague level, or the teacher leader-student level. It began in the classroom with these effective teachers, then expanded into collaborative spaces with colleagues, and finally found final traction when administrators supported, listened, and took action, thus inciting the enterprising teacher leaders to innovate and affect change.

Conversely, when administrators were inflexible, did not extend or participate in bidirectional feedback, or listen to those who shared anecdotal evidence and expertise, the growth and inspiration were shut down; ingenuity and drive were arrested. If checked or ignored when providing evidence or asking questions, knowledgeable teachers withdrew and minimized participation, feeling defeated and disillusioned with their work environment. Administrators' technology stance and attitude played an equally important role in the development of teacher leadership as did that of the teachers themselves. This contextual factor was the make or break element in deep, long lasting leadership formation.

Agents of Change - Leading the Way with Administrative Support

Over the last decade, teacher leadership has become increasingly recognized as a catalyst for educational change as well as a key factor in guiding and sustaining curricular reform efforts (Sinha & Hanuscin, 2017; York-Barr & Duke, 2004). The pandemic of 2020 brought new considerations into focus. During school closures in March, 2020 and beyond, the importance of technological acuity at all levels of education was fully recognized. ERT brought factors around integration, attitudes, and the tenets of educational technology such as creation, choice, and autonomy into the foreground. When administrators engaged TPACK strong teachers in dialogue and feedback loops, they felt recognized and respected; they were motivated to take

their influence to the next level. When given encouragement and offered participatory opportunity, faculty rose to the occasion and they felt positive about their pandemic experience.

During the pandemic, TPACK strong teachers substantiated that initial leadership foundation is based more on expertise rather than professional years (Weiner & Lamb, 2020). Buchanan et al (2020) also purported that teacher leadership was not related to years of classroom experience; that novice and early career teachers could participate in developing leadership skills throughout their early years (and beyond) if they possessed an inquiry stance and willingness to embrace an expanded role and responsibilities. Innovation is a collaborative action - from ideation to execution (Torfin, 2016). Leadership is developed through a web of activities and experiences; forming through process rather than a single event. Smylie and Eckert (2018) argue that a teacher leader cannot meet their full potential on their own; apotheosis requires administrative participation. As these technologically savvy, novice to veteran teacher leaders developed through the pandemic, it was crucial for administrators to recognize their knowledge, proffer open ideation, and provide feedback as well as support toward new ideas and initiatives in the classroom and across their school community.

Wenner and Campbell (2017) found that principal support was invaluable to the success and growth of teacher leaders, and specifically, that it was enhanced with shared vision and purpose. So, too during COVID-19; teachers who felt in collusion with their administrators flourished. Teachers with technological expertise firmly embraced their leader identities, with double loop learning transforming school culture and attitude when allowed. Smylie and Eckert (2018) set the primary locus of and responsibility for teacher leadership development in the school and district, with a crucial focus of this development on the *practice* of leadership. As such, TPACK strong teachers who were developing and practicing leadership through local and extended collaborative spaces were encouraged or discouraged through the actions of their administrators. Feedback and recognition contribute to forming leadership identity (Sinha and Hanuscin, 2017), so when technology savvy teachers' capabilities were acknowledged and

ideation embraced through feedback from colleagues and administrators, a sense of their leader self was amplified. This facilitated confidence and encouraged teachers to continue their forward motion, to raise their voice across communities, to innovate and create, and finally, to catalyze creative and effective systems and strategies to meet the needs of their school and district communities. Such feedback and support led to teachers' penultimate step into leadership. Within the recent pandemic condition, contextual factors affecting leadership development and path include administrative technology stance and attitude, acknowledgment of expertise and value, open ideation, administrative flexibility and opportunity.

The pandemic focused a bright light on areas of curricular reform that include technology, equity and access. While featuring technology integration and constructivist ideologies for instruction, the scope of reform extends far beyond curriculum or the classroom. COVID-19 conditions and ERT accentuated the extreme importance of technology stance and attitude of both faculty and administrators as well as a cultural shift throughout the building to incorporate the constructivist ideologies of active learning, curiosity, and innovation for both teachers and administration. Overall, COVID-19 has necessitated improvements in the area of technological awareness, teacher training, access, and equity both in and out of the building.

CHAPTER 6

CONCLUSIONS

Based on survey results and interviews with participant teachers in the Instructional Technology programs at the University of Maine, there are some broad implications for the role of technology in the development of teacher leadership in schools during COVID-19, teacher leader continued growth moving forward, and the significance of incorporating technology into professional practice models. The pandemic shone a bright light on the utilization and stance around technology by students, faculty, staff and administrators across school systems for learning, communication, and development at the individual, classroom, school, district and even state levels. While cognizance and mastery of instructional technology was essential for teachers to be situated in positions of strength and knowledge as schools closed in March, 2020, a robust inquiry stance and constructivist lens widened the scope for teachers to lead outside the classroom. By engaging in collegial discussion and networking through collaborative spaces, teachers were able to find their voice, advance their craft, and expand both their reach and influence.

Pandemic conditions necessitated the adroit use of digital technologies and highlighted the importance of technological acuity. Over the last decade, teacher leadership has become increasingly recognized as a catalyst for educational change as well as a key factor in guiding and sustaining curricular reform efforts (Sinha & Hanuscin, 2017; York-Barr & Duke, 2004). As schools enter the third academic year affected by COVID-19, there is a strong possibility that our educational paradigm will face a new normal. Administrator stance and attitude around technology will hold profound consequences on the sustained development of teacher leaders and the future path of their school and districts. As such, it will be imperative to include TPACK strong, teacher leader voice and expertise to embrace the new normal within which education will have to evolve.

Implications for Practice

Drawing on adult learners engaged in graduate study at the University of Maine in Instructional Technology, this study explored the experience of TPACK aware teachers during the historically unique challenges of global school closures and beyond. From novice to veterans in the classroom and first semester to graduates of one or more Instructional Technology programs, these teachers were in various stages of technological acuity. TPACK strong participants embraced leadership roles amongst their colleagues and in advising administrators as they reacted to the ever shifting conditions wrought by the unprecedented stressors of lockdown environments and virtual interactivity. Stakeholders at all levels were dependent upon digital technologies for learning, communicating, conducting business, and facilitating supports.

COVID-19 exerted great pressure on the current educational paradigm and will most likely continue to do so for the foreseeable future. Francisco et al. (2020) report that this new normal is a “reality and certainty by which everyone seeking to improve education must accept.” Moving forward, training both in service and pre-service teachers will be critical to prepare for the shifts in classroom management, learner autonomy and communication norms that education will certainly need to embrace. Swallow and Morrison (2020) contend that the change in physical learning space altered the roles of both teacher and student in the co-construction of knowledge and cooperative activity of learning. Teacher technology stance and attitude are foundational influences in the 21st century classroom, where student voice, autonomy, and creative expression play major roles. Especially poignant during rapid school closures, TPACK strong teachers adjusted to ERT easily and were able to support students, colleagues, and administrators in the shift to virtual environments. Embracing the constructivist mindset for themselves, they ranged out into collaborative spaces to network, ideate, collaborate, share and learn. Through collegial discussion and open exchange, they developed voice and expanded their network and influence. As foundations of leadership, TPACK strong teachers should be

recognized by their colleagues and administrators and their expertise should be considered in post 2020-2021 changes and shifts in classroom practice, professional development, and school to district wide expectations, protocols, philosophy and systems.

As the pandemic continues to exert pressure, it will be critical for administrators to engage in dynamic, active cooperation with teacher leaders to meet the challenges of a new normal around effective instruction, communication, and community connections. Administrators must be open and willing to consider ideation with their TPACK strong teacher leaders and provide opportunity for practicing leadership and leading initiatives. Francisco et al. (2020) term the leadership required during COVID-19 “new normal leadership” whereby leaders must have the ability to be adaptive while staying strong to original intent and commitment; where leadership is about being an effective instructional decision maker and that a new normal leader is a good planner, vigilant and acts as an *initiator*. Leadership is tasked with vetting and embracing innovations and cultural shifts in the face of unprecedented challenges. There are aspects of leadership both at the teacher and administrative level to be unpacked. The unprecedented, adaptive challenges of the pandemic forced stakeholders at all levels to embrace virtual environments and digital modes of communication, collaboration and to conduct business. It will be important that we explore the methods of ideation, the forums for innovation and the opportunities and frameworks for both the development and leading of initiatives. For longevity and continued growth, teacher leaders must have the opportunity to practice leadership. They will be the voice and levers for change with the expertise and practical experience for effective and productive innovation.

Implications for Policy

This study confirmed that teachers were able to develop leadership first through individual characteristics and drive (York-Barr and Duke, 2004), followed by establishment of initial leadership identity through encouragement and recognition from their colleagues (Sinha and Hanuscin, 2017). In specific during the pandemic, technological acuity and TPACK

knowledge together were the keystone for individuals, with digital networking ability the contextual foundation for leadership evolution and growth. Administrator stance and attitude around technology acted as gateways for penultimate and sustained development. As such, it will be critical for professional practice models and teacher evaluation to incorporate facets of technological knowledge, pedagogical integration, and curricular goal setting.

Both state and local education policymakers can draw on the findings of this study to reflect on ways to embrace COVID-19's influence on a "new normal" across education and support the important work and innovation that TPACK strong teacher leaders can bring to the table. Mishra and Koehler's (2016) TPACK model might be considered as foundational for school, district, and state level modeling, supports, and teacher evaluation. Potential implications for policy include incorporation of technology in teacher effectiveness, performance, and professional practice models for both teachers (TPEG) and administrators (PPEG).

At the local level, discussion and goals around technological integration and growth should be considered part of teacher evaluation, particularly during the probationary period. More experienced teachers can include their technology growth objectives in yearly goal setting. In so doing, teachers are continually reflecting upon their utilization of technology (TPACK) and areas of strength around which they might share as well as identify areas of growth for continued advancement of their craft. Further, technological knowledge and integration should be incorporated into state level approved educator performance and effectiveness guidelines. The current published guidelines on the Maine Department of Education (Maine DOE), namely, the [Educator effectiveness](#), [Educator Performance](#), and [Professional Practice models](#), do not include specific language or pedagogical frameworks around technology. In particular, the professional practice models set for educators should include TPACK model components, language and frames for understanding.

The Maine DOE Teacher Performance Evaluation and Professional Growth Model (TPEG) A Handbook and Implementation Guide for School Administrative Units is from 2014-2015. This document should be updated and the specific incorporation of technology integration and TPACK language needs to be considered. In concert with these updated of TPEG, the state should provide more professional development opportunities in technology integration (not device) with focus on TPACK and Ruben Puentedura's SAMR model ([cite](#)), which outlines and defines the levels of technology integration in the classroom. Maine Learning and Technology Initiative (MLTI) should focus more on training than device. The base level of technological training should be made mandatory across the state.

To advance teacher leadership, Maine DOE should incorporate technology in teacher leadership standards and practice ([Maine DOE teacher leadership standards](#)) as well as consider the implications of incorporating technology stance and communication with teacher leaders as part of PPEG. Complementing these standards and evaluations, pre-service teacher programs need to include training in both online and hybrid teaching best practices. As well, courses or internship requirements should have a component that specifically focuses upon the integration of technology in diverse environments.

Perhaps in these ways, Maine state education frames and classrooms can advance and join the 21st century educational reform and movements across the country. By up leveling the integration, discussions, and stance around technology, Maine state classrooms and students can join the global community in work force preparations and conversation.

Implications for Research and Theory

This study illuminated the importance of technology stance and attitude at both the teacher and administrator levels for developing the confidence, voice, and identity of a leader as well as the opportunity to practice leadership, spark innovation, and catalyze change. Data supported theory, which contends that both individual and contextual factors are involved in leadership development. However, technology factors are part of both spheres of influence and

should be considered its own sphere. Mitigating factors to teacher leadership within the technology sphere would include individual stance and attitude, knowledge, utilization, voice and identity, creation, environment, administrative stance and attitude, and provided opportunity or empowerment. In particular, it will be important to study the effects of principal and superintendent technology stance and attitude on student success, teacher growth, school culture, and leadership development.

Additionally, as Swallow and Morrison (2020) contend that the change in physical learning space altered the roles of both teacher and student in the co-construction of knowledge and cooperative activity of learning, future research must examine the expansion of TPACK that remote and hybrid environments wrought on teachers' contextual knowledge to consider effects on instruction, use of immediate environment and active learning. The educational paradigm will be under construction as the pandemic continues to affect teaching and learning, communication and work place structure. Future research will need to explore the effects that years of virtual and hybrid interactions have wrought on our workplace protocols, attitude, productivity, and learning outcomes.

Conclusion

The pandemic exerted pressures on our educational system that highlighted areas of focus for educational reform. From student autonomy to accessibility and equity; from professional development to open dialogue and collaboration; from promotion of initiatives to systemic innovation. Through this research, it is clear that while leadership development begins with individual drive and passion, I have come to fully realize the importance of a network. While I have always believed that technological acuity and integration is the keystone to learning, growth, and success, it is truly the collaborative efforts of a team to bring about change and deep impact. There is great power and influence in developing voice and reach via digital platforms to bring experts, ideas, and innovation to our rural environments. Integrating technology has always been part of the landscape that drives me forward in my work with

educators. Through this work, relationships built and collaborations, mentorship and interview discussion, perhaps it is not the technology itself but the stance and attitude that we embrace as a technologically inclined, constructivist lens embracing community that binds us; the willingness to embrace innovation and take risks, to be creative and try something different. The pandemic provides us an opportunity to view our traditional systems through a new lens born of both necessity and immediacy. Some teacher leaders are able to grow and reach quite amazing heights and with that, their schools and districts equally prosper. This includes the University in its attempts to shift their lens and offer support to our pK12 colleagues. However slow the progress, refocusing our scope and goals in response to a new normal is the first step in forward motion. I hope to follow teacher leader growth and potential systemic changes and state level innovations moving forward.

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APPENDIX A
Interview Protocol from TPACK.org

Structured interview protocol developed by Harris et al. (2012), which the authors used to examine the seven domains of teachers' TPACK.

Structured TPACK Interview Protocol

1. Describe the content and/or process topic(s) for the lesson.
2. Describe the student learning goals/objectives addressed in the lesson. (These will not necessarily be state or national standards. Participants should describe these in their own words.)
3. Describe your students (e.g. grade level, and specific learning needs/preferences). Walk me through the lesson/project as it unfolded in the classroom.
4. What educational technologies (digital and non-digital) did you use and how did you and/or your students use them?
5. Describe any contextual information (e.g. access to a computer lab, materials and resources available; particular departmental/school-wide initiatives) that influenced the design or implementation of the lesson/project.

TPACK-SPECIFIC QUESTIONS:

1. How and why do the particular technologies used in this lesson/project “fit” the content/process goals?
2. How and why do the particular technologies used in this lesson/project “fit” the instructional strategies you used?
3. How and why do the learning goals, instructional strategies, and technologies used all fit together in this lesson/project?

Appendix B

Research Interview Protocol Interview protocol will follow a semi-structured modality.

1. Tell me about the schedule and outlay of your virtual environment.
 1. How were you connecting with students? How often?
 2. How did your expectations change? Why?
 3. How did you decide what was most important for your learners?
 4. Where did you turn for support or resources?
2. Tell me about a specific activity that was successful with students during this time.
 1. What were the learning objectives? Were they the same or modified? Why?
 2. Walk me through the lesson as it unfolded.
 3. Tell me about how you incorporated any technology.
 4. How did the learning goals, instructional strategies, and technologies fit together in this lesson/project?
 5. Why did you select this activity and in what ways did you find it successful?
3. Tell me about your experience using technology.
 1. How did you decide what worked best?
 2. How much support and communication did you experience?
4. Please describe your experiences with your colleagues during the pandemic.
 1. Was there a framework in place for communication?
 2. What happened with faculty or team meetings?
 3. What kind of support framework was in place or developed?
5. Tell me about your interactivity with administration during this time.
 1. How did you receive information or direction?
 2. How often were you given updates or direction?
 3. How do you feel about the way your administration handled the emergency?
 4. Where did they get information or find resources?
6. Did you take any new roles, formal or informal during school closures?
 1. How did this come about?
 2. Are you still in this or these new role(s)?
7. Has the hierarchical structure of information, communication or decision making changed in your environment?
8. What was the effect of the spring, fully remote mode on teachers' relationships with each other? With administration? With students?
9. In what ways, if any, did faculty attitude change as a result of the shift to virtual education? Toward administration? Technology? Pedagogy? School policy? School or district level leadership? Goals?
10. In what ways, if any, did the school community change as a result of the pandemic?
11. Anything else you would like to share about your experience as an educator, professional, and learner over the course of the pandemic?

Appendix C

Pre-interview Survey

The pre-interview survey will collect the following demographic data prior to interview start.

1. Age
2. Gender
3. Years of experience teaching
4. Technology environment
5. EDT program : current student or alumni
6. Start semester and date of first course in EDT program
7. Age of learner
8. Content area focus
9. Professional engagement on social media
10. Participation in any of the following activities during March-June, 2020
 1. Answered questions for colleagues
 2. Created resources to help colleagues
 3. Led learning sessions to help colleagues
 - i. 1:1 or multiple participants
 - ii. Zoom/Google Meet, phone, in person
 4. Joined a committee to focus on immediate issues
 5. Connected colleagues or admin to resources
 6. Collated resources for colleagues or resources
 7. Other

APPENDIX D

Survey Instrument for TPACK Evaluation

Survey instrument using TPACK to assess the 7 domains of knowledge with four subdomains for content (Schmidt et al., 2009).

Technology is a broad concept that can mean a lot of different things. For the purpose of this questionnaire, technology is referring to digital technology/technologies. That is, the digital tools we use such as computers, laptops, iPods, handhelds, interactive whiteboards, software programs, etc. Please answer all of the questions and if you are uncertain of or neutral about your response you may always select "Neither Agree or Disagree"

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
TK (Technology Knowledge)					
1. I know how to solve my own technical problems.					
2. I can learn technology easily.					
3. I keep up with important new technologies.					
4. I frequently play around the technology.					
5. I know about a lot of different technologies.					
6. I have the technical skills I need to use technology.					
CK (Content Knowledge)					
Mathematics					
7. I have sufficient knowledge about mathematics.					
8. I can use a mathematical way of thinking.					
9. I have various ways and strategies of developing my understanding of mathematics.					
Social Studies					
10. I have sufficient knowledge about social studies.					
11. I can use a historical way of thinking.					
12. I have various ways and strategies of developing my understanding of social studies.					
Science					
13. I have sufficient knowledge about science.					
14. I can use a scientific way of thinking.					
15. I have various ways and strategies of developing my understanding of science.					
Literacy					
16. I have sufficient knowledge about literacy.					
17. I can use a literary way of thinking.					
18. I have various ways and strategies of developing my understanding of literacy.					

PK (Pedagogical Knowledge)					
19. I know how to assess student performance in a classroom.					
20. I can adapt my teaching based-upon what students currently understand or do not understand.					
21. I can adapt my teaching style to different learners.					
22. I can assess student learning in multiple ways.					
23. I can use a wide range of teaching approaches in a classroom setting.					
24. I am familiar with common student understandings and misconceptions.					
25. I know how to organize and maintain classroom management.					

PCK (Pedagogical Content Knowledge)					
26. I can select effective teaching approaches to guide student thinking and learning in mathematics.					
27. I can select effective teaching approaches to guide student thinking and learning in literacy.					
28. I can select effective teaching approaches to guide student thinking and learning in science.					
29. I can select effective teaching approaches to guide student thinking and learning in social studies.					

TCK (Technological Content Knowledge)					
30. I know about technologies that I can use for understanding and doing mathematics.					
31. I know about technologies that I can use for understanding and doing literacy.					
32. I know about technologies that I can use for understanding and doing science.					
33. I know about technologies that I can use for understanding and doing social studies.					

TPK (Technological Pedagogical Knowledge)					
34. I can choose technologies that enhance the teaching approaches for a lesson.					
35. I can choose technologies that enhance students' learning for a lesson.					
36. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.					
37. I am thinking critically about how to use technology in my classroom.					
38. I can adapt the use of the technologies that I am learning about to different teaching activities.					
39. I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.					
40. I can use strategies that combine content, technologies and teaching approaches that I learned about in my coursework in my classroom.					
41. I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.					
42. I can choose technologies that enhance the content for a lesson.					

TPACK (Technology Pedagogy and Content Knowledge)					
43. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.					
44. I can teach lessons that appropriately combine literacy, technologies and teaching approaches.					
45. I can teach lessons that appropriately combine science, technologies and teaching approaches.					
46. I can teach lessons that appropriately combine social studies, technologies and teaching approaches.					

APPENDIX E
TPACK Survey for Online K-12 Educators

Survey instrument developed by Archambault and Crippen (2009) that evaluates the seven domains of TPACK. Content questions are general with no subdomains.

Survey Items by Domains

Pedagogical Knowledge

- X (j) My ability to determine a particular strategy best suited to teach a specific concept.
- X (c) My ability to use a variety of teaching strategies to relate various concepts to students.
- X (r) My ability to adjust teaching methodology based on student performance/feedback.

Technological Knowledge

- X (a) My ability to troubleshoot technical problems associated with hardware (e.g., network connections).
- X (g) My ability to address various computer issues related to software (e.g., downloading appropriate plug-ins, installing programs).
- X (q) My ability to assist students with troubleshooting technical problems with their personal computers.

Content Knowledge

- X (b) My ability to create materials that map to specific district/state standards.
- X (d) My ability to decide on the scope of concepts taught within my class.
- O (m) My ability to plan the sequence of concepts taught within my class.

Technological Content Knowledge

- X (o) My ability to use technological representations (i.e. multimedia, visual demonstrations, etc.) to demonstrate specific concepts in my content area).
- O (t) My ability to implement district curriculum in an online environment.
- X (v) My ability to use various courseware programs to deliver instruction (e.g., Blackboard, Centra).

Pedagogical Content Knowledge

- X (f) My ability to distinguish between correct and incorrect problem solving attempts by students.
- X (i) My ability to anticipate likely student misconceptions within a particular topic.
- O (s) My ability to comfortably produce lesson plans with an appreciation for the topic.
- X (u) My ability to assist students in noticing connections between various concepts in a curriculum.

Technological Pedagogical Knowledge

- X (h) My ability to create an online environment which allows students to build new knowledge and skills.
- O (l) My ability to implement different methods of teaching online
- O (n) My ability to moderate online interactivity among students
- M (p) My ability to encourage online interactivity among students

Technological Pedagogical Content Knowledge

- X (e) My ability to use online student assessment to modify instruction
- X (k) My ability to use technology to predict students' skill/understanding of a particular topic
- X (w) My ability to use technology to create effective representations of content that depart from textbook knowledge
- O (x) My ability to meet the overall demands of online teaching

Appendix F
Survey Instrument for Study

DEMOGRAPHICS:

Q1 To which gender do you identify?

Q2 What is your age?

Q3 Please share the total number of years you have been teaching or coaching / integrating (include this academic year F20-Sp21).

Q4 At what grade level are your learners? (check all that apply)

Q5 What is your content focus? (check all that apply)

Q6 What is your role or title?

Q7 What is the technology environment in your classroom (please select one) or multiple environments if you are not in a single classroom (check all that apply)?

Q8 In which Instructional Technology program(s) are you enrolled and / or from which have you graduated? (check all that apply)

Q9 There are 3 semesters each year (spring, summer, fall). How many semesters since and including the semester of your first class in the EDT program have you been a student? Please include Spring, 2021.

Q10 Do you currently use social media for professional work?

Q11 Please rate your current technological ability.

LIKERT SCALE QUESTIONS:

Q12 Please respond to the following statements around technology.

I can learn technology easily. (1)
I frequently play around with technology. (2)
I have the technical skills I need to use technology. (3)
I know how to solve my own technology problems. (4)
I know about numerous different technologies. (5)

Q13 Please respond to the following statements around technology and pedagogy.

I can choose technologies that enhance the teaching approaches for a lesson. (1)
I can choose technologies that enhance students' learning for a lesson. (2)
I can choose technologies that enhance the content for a lesson. (3)
I can adapt the use of the technologies to different teaching activities. (4)
I can use a variety of platforms and tools to deliver online or hybrid instruction. (5)

Q14 Please respond to the following statements around technology, pedagogy, and content

I can use digital assessment to modify instruction. (1)
I can use technology to create effective representations of content that depart from textbook knowledge. (2)
I can teach lessons that appropriately combine content, technologies, and teaching approaches. (3)
I can meet the overall demands of teaching in hybrid and online learning environments. (4)
I can use technology to plan effective instruction around specific topics in the curriculum. (5)

Q15 Please respond to the following statements around your actions and behaviors since school closures (March, 2020 to present).

I let my colleagues know that I was available to support them. (1)
I created resources for colleagues. (2)
I shared my work or opinions with administration without being asked. (3)
I interacted with educational communities outside my school or district. (4)
I researched and explored best practices for remote education on my own time. (5)

Q16 Please respond to the following statements around the actions and behaviors of your community since school closures (March, 2020 to present).

My colleagues turned to me for information or support. (1)
My administration turned to me for information that helped them make decisions. (2)
I was recognized publicly for supporting colleagues or creating resources for colleagues. (3)
I was asked to share my work with colleagues. (4)
I was asked to create artifacts or develop team/school wide workflows for remote learning. (5)

Q17 Please respond to the following statements about your supports, promotion, and environment since school closures (March, 2020 to present).

I am valued by my administration. (1)
I have been sufficiently compensated for my time and efforts. (2)
I am an important member in my school / district community. (3)
I am an important voice in decision making conversations. (4)
I am pleased to stay at this school / district. (5)

OPEN ENDED QUESTIONS:

Q18 Is there anything about your experience during Covid (March 2020 to present) that you would like to share or highlight?

Q19 Is there anything about the Instructional Technology courses or programs that you would like to share?

BIOGRAPHY OF THE AUTHOR

Mia Morrison was born in Philadelphia, Pennsylvania on June 17, 1968. She was raised in Orange, Connecticut and graduated from Choate Rosemary Hall in 1986. She attended Wesleyan University and graduated with a Bachelors in Earth and Environmental Sciences in 1990. She then attended the University of South Florida to complete a Masters and Certificate of Advanced Studies in Hydrogeology. Mia returned to Maine and entered the Instructional Technology graduate program at the University of Maine and received her M.Ed. and Technology Integrationist certificate in 2013. She was named an Apple Distinguished Educator in 2013, Piscataquis County Teacher of the Year in 2015, and was a finalist for the Maine Teacher of the Year for 2016. She is currently the advisor and a lecturer for the Instructional Technology programs at the University of Maine in the College of Education and Human Development. Mia is a candidate for the Doctor of Education degree in Educational Leadership from the University of Maine in May 2022.