A CASE STUDY ON ELEMENTARY SCHOOL TEACHERS' CONCEPTIONS OF THE RELATIONSHIP AMONG PEDAGOGY, SPACE, AND TECHNOLOGY

By

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To my parents who instilled the value of education
To my wife for your love, patience and encouragement
To Owen and Alaina - let's go play outside
ACKNOWLEDGMENTS

I have been looking forward to writing this section of the dissertation since I began my research. Not only does this symbolize the culmination of three years of graduate school, but it’s also an opportunity to recognize the amazing people in my life that have helped me realize the highlight of my professional career.

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By

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Chair: Kara Dawson
Major: Curriculum and Instruction

One of the fastest growing modern trends in K-12 educational technology is the redesigning of learning spaces to support student-centric, active learning instruction (Becker, S., Freeman, A., Hall, C., Cummins, M., Yuhnke, 2016). Teachers have begun to consider how learning spaces affect student learning and how the classroom environment should be considered in equal importance with pedagogy and technology. The physical learning environment (PLE) should be considered a powerful teaching instrument that can either be a dynamic influence on student learning or, if ignored, a barrier to meaningful teaching and learning (Martin, 2002). A typical student will spend over six hours every day in a classroom, therefore it must be a place that supports their social, emotional, and academic needs, as well as having the flexibility to adapt to the instruction.

Major studies in evaluating learning spaces have been conducted in higher education but are scarce in K-12, especially elementary education. The purpose of this study is to explore how elementary school teachers conceptualize the relationship among pedagogy, space, and technology (PST) when designing instruction, and how those conceptions materialize in practice. Using the PST Framework to guide this
exploratory qualitative study, interviews and observations were utilized to understand how three elementary school teachers account for, and implement pedagogy, space and technology into lessons.

Data gleaned through teacher lesson preparation revealed that space encourages pedagogy and pedagogy is amplified by technology. However, the synergy between technology extending the learning space is still developing. When presenting observational data framed by how teacher conceptions of the relationship among pedagogy, space, and technology materialize in practice, the teachers demonstrated a strong understanding of how the classroom environment impacts teaching and learning, however the implementation of technology was inconsistent in their deployment of technology and matching their instructional goals. Overall, this study provides insight into elementary school teachers' conceptions and implementation of the relationship among pedagogy, space and technology. This study adds to research in this field by providing an elementary school perspective of the PST framework and provides suggestions for future research in this area that will contribute to the current body of literature.
CHAPTER 1
INTRODUCTION

Research Context

Cherish children’s spaces. It’s a natural impulse to nurture our young – let that impulse extend to the places where young people learn.
– Bruce Mauand & Elva Rubio, BMD

It is no secret that the landscape of K-12 education is changing. Some children enter kindergarten unable to spell their name or count to ten, but they can access the Web, digital content, and entertainment with ease. The one-size-fits-all approach to teaching and learning that many were exposed to in our own K-12 experiences must be reconsidered, as the world has become a more personalized environment (Scheninger & Murray, 2017). Due to the individual needs of learners, the ways we educate children and the tools we use to do so are changing at a rapid pace. Included in this idea of a personalized education system is the classroom setting. Teachers who look to foster a collaborative, creative, and constructivist learning environment must recognize that one of the major influencers in this movement is the physical learning environment (PLE). PLEs require careful thought in their design to promote student collaboration and an active learning environment. Modern studies on learning spaces have concluded that there is a direct relationship between the physical space and its impact on teaching and learning (Byers, Imms, & Hartnell-Young, 2014; Imms & Byers, 2017). PLEs must be able to adapt to this changing landscape with ease and functionality; the PLE should not be a hindrance to 21st century teaching and learning. To support teacher evaluation of their learning space, the Pedagogy, Space, Teachnology (PST) Framework (Radcliffe, Wilson, Powell, & Tibbetts, 2008) was developed to inform teachers about the intersections in their classroom between pedagogy, space, and technology. This
framework can be applied to any space where people learn and at any stage of a classroom design project. The information gathered from the framework is invaluable to educators who aim to maximize the potential of the learning space and how it successfully embeds technology and encourages pedagogy.

Constructivist classrooms provide easy access for students to work with each other as well as available technological mediums (Barrett, Davies, Zhang, & Barrett, 2016; Mercier, Higgins, & Joyce-Gibbons, 2016; Taylor, Fraser, & Fisher, 1997; Tondeur, De Bruyne, Van Den Driessche, Mckenney, & Zandvliet, 2015). Research in physical space design has provided many examples of how the space can foster constructivist classrooms with the strategic arrangement of the desks, designs that encourage student ownership of the learning environment (Hermans, Tondeur, Braak, & Valcke, 2008; Lee, Morrone, & Siering, 2018; Ng, 2015; Taylor et al., 1997). The PLE should be considered a powerful teaching instrument that can either be a dynamic influence on student learning or, if ignored, a barrier to meaningful teaching and learning (Martin, 2002).

PLEs have evolved over time, however the journey to our current reality has been a long and stagnant process. Images of classrooms with stationary desks facing the front, arranged in tidy rows where students were expected to be passive participants in their learning (Baker, 2012) are imprinted in our minds because this is the learning environment many of us experienced. This was the predominant design of classrooms across the country dating back to the 1830s and the Common School movement. Many classrooms featured steps leading up to a small stage where the teacher stood to deliver information, communicating that the teacher was the keeper and disseminator of
all knowledge. Schools and instruction evolved as the nation moved from the Progressive Era (1930-1945) and Post-World-War II (1945-1960), but classroom design remained standardized (Baker, 2012).

Currently, one of the most popular and rapidly growing trends in K-12 educational technology is the redesigning of learning spaces to support student-centric, active learning instruction (Becker, S., Freeman, A., Hall, C., Cummins, M., Yuhnke, 2016). With an emphasis on active learning and student-centric instruction, PLEs must reflect 21st-century approaches for teaching and learning. Typical students will spend over six hours every day in a classroom, therefore it must be a place that supports their social, emotional, and academic needs, as well as having the flexibility to adapt to the instruction. The synergy between the design of the classroom, the technology available to students, and the pedagogical practices of the teacher are the major contributors to the success of an active learning environment. While all three factors are present in classrooms and acknowledged as contributors to student learning, it is important to know if they are treated as separate entities or designed to be in concert with one another.

Purpose

Given the dearth of existing research on PLE design in elementary schools, the purpose of this qualitative study is to investigate elementary school teachers’ conceptions of how the design of their classroom along with their pedagogical practices and classroom technologies support teaching and learning, as well as how those conceptions materialize in practice. A qualitative research design and data collection methodology will support detailed findings in how elementary school teachers plan for, and implement, space design in their classroom. The following research questions will
guide this study: (1) How do elementary school teachers conceptualize the relationship among pedagogy, space, and technology when designing instruction? (2) How do elementary school teachers’ conceptions of the relationships among pedagogy, space, and technology materialize in their practice?

**Statement of Problem**

I am in my third year as principal at a public school in suburban New Jersey that educates students from preschool through second grade. As building principal, I am responsible for overseeing the social, emotional, and academic growth of all students, as well as having the responsibility to ensure their physical safety. Additionally, as educational leader of the building, I work closely with staff members to support their professional growth and refine pedagogical practice. I am fortunate to lead a building in a district that values visionary leadership and affords me ample opportunities to explore non-traditional learning environments for my students, as well as other progressive educational initiatives.

Teachers at our school have begun to explore alternative seating options, such as soft seating furniture, standup desks, and ball and beanbag chairs to personalize the learning environment and improve student attention and engagement. Teachers are given the autonomy to design their room in any manner they feel is appropriate, and are encouraged to experiment with alternative seating options. However, formal training on the importance of pedagogy, space, and technology has not been offered. As a staff, we have looked to David Thornburg’s (2001) description of learning zones for classroom design. He has depicted four zones that each classroom should feature to account for a balanced approach to teaching and learning modalities such as informational space (campfire), conversational space (watering hole), conceptual space (cave), and
contextual space (life). These learning zones are age and developmentally appropriate for young learners. Many classrooms put these ideas into practice, however sustained professional development on learning spaces for teachers has not been offered.

The research for this study was conducted in classroom settings in elementary grades Kindergarten through Grade 5. Because of ethical concerns regarding my position in the school and the potential conflict that conducting research in my building can create, research will be conducted in a neighboring district that features demographics and size similar to my current professional setting. The setting for my research will take place in an elementary school that has similar class sizes, ubiquitous access to technology, and building administration that supports an active learning environment. Although the setting of my study will not be in my immediate professional practice, the results and potential recommendations can be easily applied and transferred to my school because of the similarities in class size, student demographics, and school funding.

There is an abundance of research on other factors that contribute to designing a classroom. Such physical aspects of the classroom that impact learning include light, sound, air quality, link to nature, complexity, and color. These are interesting topics to consider for future studies on environmental psychology’s impact on student behavior, but they will not be considered in my research. Also excluded from research consideration is school architecture. While this feature is certainly an important consideration, I will not report on it because it is a feature over which I have no control.

**Significance of Study**

There have been two seminal studies that have studied the impact of physical space on teaching and learning: North Carolina State University’s Student-Centered
Activities for Large Enrollment Undergraduate Programs (SCALE-UP) and the Massachusetts Institute of Technology’s Technology Enabled Active Learning (TEAL) project (Lasry, Charles, & Whittaker, 2014). SCALE-UP (Beichner et al., 2007) designed collaborative, hands-on, computer-rich, interactive learning environments for large, introductory college courses with the rationale being that student achievement is maximized when there is close interaction and collaboration between faculty and students. Results of the study are highlighted by greater academic gains, improved attitude, and higher attendance. The TEAL project, like SCALE-UP, was a program designed to successfully implement a technology-rich learning environment with a large-scale course redesign to a college-level physics class. While both are considered influential studies in strengthening empirical evidence to support new learning spaces, the studies were conducted solely in a higher education setting.

I have found a lack of prior research that investigates teacher understanding of the relationship among pedagogy, space and technology. There has been much research published on interactive learning spaces in higher education, as well as architectural design from a design perspective, but limited with a focus on our youngest learners. As an elementary school principal, it is my responsibility to work closely with teachers to support their knowledge, skills, and understanding as it relates to teaching and learning. With the growing educational trend of redesigning learning spaces that allow for more flexibility with design and access to interactive and adaptive technologies (Becker, S., Freeman, A., Hall, C., Cummins, M., Yuhnke, 2016), it would behoove any educational leader to be knowledgeable in this venture to support teachers to design instruction while maximizing the impact of the PLE and technology. The collection of
rich and detailed qualitative data in this study will support elementary school teachers’ understanding of the relationship among pedagogy, space, and technology which will positively impact teaching and learning.

My area of specialization and subsequent research on the topic is aimed to serve a global purpose both for the advancement of the educational technology field as well as a reference for educational leaders who are presented with similar challenges in their professional practice. My goal is to offer colleagues research and findings that can transfer across similar school districts. Because of the growing popularity in the idea of classroom design, I will share my findings with administrative colleagues and their teaching staff through workshops and on-site trainings. My knowledge and understanding of this field, as well as the time spent in the field interviewing and observing teachers, is grounded in research and has helped me establish myself as an expert in the field of classroom design. In my building where I am principal, the findings will allow me to have meaningful conversations with my teaching staff on how best to plan for an active learning PLE and its implementation in practice. Ideally, these conversations will lead to a deeper understanding of the combined effect of pedagogy, space, and technology in teaching and learning.

The goal of a researcher should be to have their work reach a larger audience, contribute to their field, and solve real problems. I am confident that replicated research in how technology, combined with pedagogy and the physical space design of elementary classrooms will support teacher understanding on the importance of classroom design, as well as lead to future research from my qualitative results.
Research Questions

1. How do elementary school teachers conceptualize the relationship among pedagogy, space, and technology when designing instruction?

2. How do elementary school teachers’ conceptions of the relationship among pedagogy, space, and technology materialize in their practice?

Organization of the Study

I will conduct a qualitative, exploratory case study analysis of the pedagogy-space-technology framework’s implementation in elementary school classrooms.

Chapter 1 of this study will present the research context and problem, the research significance to the field of elementary education, and the research questions. Chapter 2 of this study presents a literature review of all relevant areas and theories related to this study, as well as a conceptual framework, which will inform the study. Chapter 3 describes the research methodology used to research the topic. Chapter 4 provides the research findings and data analysis. Chapter 5 states the conclusion and implications of the study.
CHAPTER 2
LITERATURE REVIEW

The purpose of this literature review is to examine existing research on how classroom design has evolved from the early years of the Common School era to today’s 21st Century classrooms. An in-depth look at exiting models and characteristics will lay the foundation for the need to further explore the synergy between pedagogy, classroom space, and technologies. Weinstein Research has demonstrated that when teachers adapt their pedagogy to the learning environment and technological advances to encourage a social, collaborative and active environment, learning improves (Nambiar, Nor, Ismail, & Adam, 2017; Radcliffe, Wilson, Powell, & Tibbetts, 2008). Learning environment is a global term, often used interchangeably with the physical and social structure of the classroom (Byers, Imms, & Hartnell-Young, 2014; Lippman, 2015; Weinstein, 1981). In Blackmore, Bateman, Loughlin, O’Mara, & Aranda’s (2011) literature review connecting built learning spaces and student outcomes, they developed a conceptual framework with four phases of classroom design research (design, implementation and transition, consolidation, and sustainability/re-evaluation). This literature review will focus on the consolidation phase which is “what happens in practice as buildings are used by teachers and students for the purposes of teaching and learning” (p.21). This phase considers changes in pedagogy, space flexibility, planning, assessment for effectiveness, information and communications technology (ICT). All of these components will impact the qualitative study in the subsequent dissertation research. Gaps in both the consolidation phase, and literature on classroom design in general, reveals a paucity of research on space design in elementary classrooms. Compound this scarce research with the added filters of pedagogy and
ICT, and the results are even more sparse. There is an abundance of existing literature on learning space design in higher education and communal space architecture, as well as other design features such as lighting, air quality, color, and sound, but these areas are outside of the scope of my professional responsibilities and were not considered for this literature review.

The development of this paper considered relevant literature using search keyword: physical classroom environment, 1:1 laptop and mobile technology, and 21st century learning spaces. Extensive database searches were conducted using databases provided by the University of Florida such as ERIC Pro Quest, SAGE, Web of Science, Ebscohost, and Google Scholar. Keyword searches used to help filter relevant articles included active learning, classroom design, classroom environment, technology integration, educational environment, and physical environment.

**History of Classroom Design**

While formal educational settings can be traced back to the 5th Century when Sophists predominantly delivered expository lectures to groups of students (Saettler, 2004), the research for this study will begin with the Common School movement of the 1830s. Common Schools, which offered free school for students paid for by taxpayer money, and their founder, Horace Mann, believed classrooms should be standardized with rows of desks facing the lecturer, windows on two sides of the room, and a variety of educational supplies along the sides of the classroom (Baker, 2012). Classrooms were arranged to reinforce order and discipline, factors which were prioritized for good educational practice (Tondeur, De Bruyne, Van Den Driessche, Mckenney, & Zandvliet, 2015). The blackboard was the central focus of the classroom which is where the
teacher disseminated information to students. Figure 2.1 depicts the standardized classrooms of the Common School era.

![Figure 2.1. Horace Mann's plan for one-room schoolhouse, 1938. (Baker, 2012)](image)

Schools and instruction evolved during the Progressive Era (1930-1945) and Post-War boom (1945-1960), but the classroom design remained standardized from the Common School era. Students were kept in rows and sat as passive recipients of knowledge as teachers lectured to them for much of the school day (Baker, 2012). The design of the classroom coincides with the popular learning theory of the time period, behaviorism. Behaviorism, rooted in objectivism, was the dominant learning theory through the mid-1900s. Popularized by B.F. Skinner, he preached that learning occurs in response to a stimulus. The teacher in these early classrooms disseminated information from the front of the classroom, often with steps leading up to a landing where the teacher would position himself. Kohn (1999) referred to these teacher-centric learning environments as the “cells and bells” model because students learn in a standard cell, the bell rings, and then students move to another cell to be subject to the same style of instruction in the same environment.
Physical classroom designs began to morph into more creative learning environments beginning with the Impulsive Period (1960-1980) and extending to modern day, 21st Century Classrooms (Baker, 2012). This transition from standard uniform classroom design to an understanding that there is a connection between school facilities and student learning (Baker, 2012) coincided with learning theorists transition from behaviorism to constructivism. Both cognitive and social constructivist learning theories were influential in this wave of rethinking physical space design.

As classrooms evolve, consideration for their designs must be given to the modern needs of present day learners. Støckert & Stoica, (2017) posit learning spaces must support the needs and expectations of present-day learners (p.190). The Internet, a major feature of 21st century learning environments has provided a level of immediacy of access to information which has supported different pedagogical practices than in prior generations (Cho, 2015). Students are less likely to be passive recipients of information, preferring a more social, collaborative space where information can be easily accessed with a hands-on, inquiry-based approach to learning (Oblinger, 2005; Støckert & Stoica, 2017). The teacher is integral in supporting these environments with a change in pedagogical practices. Teachers structure lessons to promote student socialization with their peers, as well as working collaboratively in environments with digital learning tools (Nambiar et al., 2017). A shift from sage on stage to one that supports inquiry and collaboration; one who supports the learning process as opposed to a teacher-centric approach. The role of the teacher is one who now must show students how to apply their learning and manipulate the learning environment to foster innovation and collaboration (Nambiar et al., 2017), and support student autonomy.
though creating a student-centered atmosphere that encourages student initiative and fosters the building of competencies (Stefanou, Perencevich, DiCintio, & Turner, 2004). In a qualitative, exploratory case study designed to investigate how teachers plan for, and implement, lessons when considering pedagogy, space, and technology, Nambia et al. (2017) concluded that when there is a change in the classroom it will positively impact the teacher-student and student-student dynamics. They found more evidence of collaborative learning and peer support because of the ease of access afforded to them by the room design.

Interaction with peers, collaboration, and discovery learning are all examples of classroom strategies that are rooted in this perspective. “A basic assumption of teaching according to the constructivist learning approach is that knowledge cannot simply be transmitted from teachers to learners: learners must be engaged in constructing their own knowledge” (Dori & Belcher, 2005). Dori and Belcher (2015) found that a learning environment that “fosters social constructivism is instrumental in improving the achievements of students at all academic levels” (p.270). The quantitative study which provided a freshman electromagnetism class with an active learning, technology based learning environment also found that high achieving students blossomed because they were able to teach their peers, and students of all academic abilities achieved at higher rates. The level of student and faculty engagement is a symptom of the effectiveness of the learning experience and represents the quality of learning outcomes (Hunley & Schaller, 2009).

Mayer (2004) suggests there should be a blend between guided instruction and discovery-based instruction where teachers support instruction and provide the proper
amount of guidance so that the knowledge acquired can be utilized effectively when needed. Social constructivism is similar in methodology but favors relativism and experiential learning with lessons designed that promote knowledge acquisition along Len Vygotsky’s zone of proximal development (Schuh & Barab, 2008). Here, knowledge is developed in the interactions among peers. Nambiar et al. (2017) argue that the challenge for new learning spaces is to “provide opportunities for learners to think through problems, have group collaboration and arrive at innovative solutions using technology” (p.31), which also stresses the need for teachers to evaluate how their pedagogical strategies need to be adapted to new spaces. Modern classrooms with ubiquitous access to technology encourage these interactions through collaborative software and Internet-based communication streams. Emmons and Wilkinson (2001) posit, “an ideal classroom is multifunctional, designed to serve both the teacher-centered behaviorist and the student-centered cognitive and constructivist approaches.”

A constructivist classroom allow students to interact with each other, as well as available technological mediums (Barrett, Davies, Zhang, & Barrett, 2015; Mercier, Higgins, & Joyce-Gibbons, 2016; Taylor, Fraser, & Fisher, 1997; Tondeur, De Bruyne, et al., 2015). The design of the physical space should transition from incapable and passive to capable and active. “Learning spaces need to become much more than just tight, static, hierarchical containers of learning” (Byers et al., 2014, p. 8). Examples of physical space design that foster a social constructivist learning environment include strategic arrangement of desks (Barrett, Davies, Zhang, & Barrett, 2016; Tondeur, De Bruyne, et al., 2015; Wannarka & Ruhl, 2008), a design that maximizes student access to ownership of the learning environment (Radcliffe et al., 2008), and flexibility, the
degree to which the classroom allows varied learning methods and activities (Barrett et al., 2016). In a 2013 study on the effects of room design on computer-supported collaborative learning, Mercier, Higgins, and Joyce-Gibbons found that simply changing the orientation of the desks that students sit in and the location of the technology can influence how students interact with each other and the technology. The study, a between-groups design of 96 students in their final year of primary school in England (Grade 5 equivalent domestically), were split into groups and taught in classrooms with two distinct room configurations. The study compared a traditional, forward-facing classroom and a “centered seating configuration” (p.518) and found that the room layout influenced student interaction but had little impact on teacher behavior.

While the research provides examples of designs and zones that should be considered for active, constructivist learning (Thornburg, 1999; Tondeur, Bruyne, et al., 2015), there are still modern classrooms equipped with new digital technologies, that are simply ineffective. There is not a generally agreed upon approach for the creation of teaching spaces that effectively support constructivist learning (Radcliffe et al., 2008). However, the research is consistent in its position that the physical space design must be fluid and match instructional goals (Barrett et al., 2016; Brooks, 2011; Graetz & Goliber, 2002; Tondeur, De Bruyne, et al., 2015). Consider how “singular-focal point technology” (Lippman, 2013), like Smart Boards and data projectors, have essentially replaced chalk/whiteboards and are typically positioned in the same zone of the classroom. Unintentionally, this layout reinforces teacher-centric pedagogy, where there is a clear front of the room where information is disseminated from a single source, not much different than with traditional classroom resources (Byers et al., 2014). Even in
modern classrooms that are branded as “student-centered learning, the physical arrangement of the classroom may be designed with one goal in mind, “attention without distraction” (Whitmore & Laurich, 2010). In sum, a classroom must be purposeful in its design to maximize digital technology’s potential for teaching and learning. Placement without a purpose is diminishing the potential of technology and failing to capitalize on the environment’s effect on student achievement.

**Active Learning Classrooms**

Active learning is a popular term in education but one that does not have a universally agreed upon definition. Petress (2008) offers active learning as the opposite of passive learning which is heavily reliant on the teacher, requires little student personal involvement, and produces passive students who become disinterested, unmotivated, and ineffectual learners. Active learning is commonly described as “any instructional process that engages students in the learning process” (Prince, 2013, p. 223) which “forces them to reflect upon ideas and how they are using those ideas” (Michael, 2006, p. 160). Active learning is grounded in constructivist learning theory but can be designed as individual activities, paired activities, small groups, or larger student projects (Roehl, Reddy, & Shannon, 2013). In Anthony’s (1996) study on active learning in a constructivist learning environment, there was evidence that the creation of an active learning environment allowed students to adapt themselves, the task, and the learning situation, to maximize the learning opportunities. While the research in this paper will not focus on the major constructivist pedagogies of active learning (problem-based, discovery-based, inquiry-based, project-based, and case-based learning), it is prudent to consider these approaches as they are influential in how a teacher may choose to design the classroom. Collaboration in an active learning
classroom is facilitated by modern classroom technologies and a strategic approach to classroom design. Classrooms that offer collaboration centers, or areas, allow students to work cooperatively, think-critically, and improve their communication skills which support state standards for 21st Century Skills and support a learner-centric learning environment.

The TEAL and SCALE-UP projects, as discussed in Chapter 1, were seminal studies that investigated active learning classrooms in higher education. While both are considered influential studies in strengthening empirical evidence to support new learning spaces, they had limitations: both were conducted in higher education in similar courses, and “each entail comprehensive course redesign and new active learning environments, (so) there is no way to know whether or not the results garnered from their studies are due to course redesign, classroom design or both” (Brooks, 2011). The spaces described in these studies have been dubbed a polycentric, or a dynamic and interactive 360˚ space (Byers, 2016; Byers et al., 2014; Imms & Byers, 2017). Polycentric design occurs when there is the absence of a ‘front’ of the room and replaced with multiple focal points (Figure 2.2). Some ideas that have been successful in polycentric designed learning spaces are multiple TVs and mobile interactive technologies around the perimeter of the classroom, and ‘writeable walls’ for student collaboration (Byers et al., 2014). These studies are oft-cited in higher education literature about creating active and interactive learning environments, but they offer little guidance as to how a classroom should be designed for younger learners, with respect to how the PLE is designed with consideration given to a teacher’s pedagogy and the availability of classroom technologies.
On the heels of the TEAL and SCALE-UP project was the Next Generation Learning Spaces (NGLS) project that “explored the interdependence of pedagogy, space, and technology” (Radcliffe et al., 2008, p.3) which was used to develop the Pedagogy-Space-Technology (PST) framework. The PST framework is used by teachers and educational decision makers to evaluate current spaces and create new ones that encourage student engagement and improve learning outcomes. The blend of the three approaches supports a shift from teacher-centric classrooms to more student-centered, collaborative and active learning environments. The NGLS project contributed to the design and evaluation of three distinct learning environments: Collaborative Teaching and Learning Centers spaces (CTLC); Advanced Concept Teaching Spaces (ACTS); and next generation libraries (Radcliffe et al., 2008). Each learning environment identified new opportunities for teaching and learning that fostered collaboration, explored integration of emerging technologies, and ample room for informal learning spaces. These learning spaces that were the product of the NGLS project and PST Framework approach to space evaluation were primarily focused in higher education, however many of the major tenets can be scaled down to support learning space design in the elementary classroom. These tenets include collaborative
teaching and learning spaces, active learning spaces, and peer to peer learning spaces that support reflective, active, feedback, and didactic learning modalities (Radcliffe et al., 2008, p.13).

**Elementary School Classrooms**

The research in learning spaces is extensive for higher education, but less robust in the elementary grades, especially when the search includes technology and pedagogy. For this research paper, elementary school shall be considered grades Kindergarten through Grade 5. Database searches included the filters ‘elementary classroom’ as well as ‘primary classroom’ because international studies only recognize this grade span as primary grades in much of the research. Elementary classrooms tend to share many of the same characteristics such as more children than adults, smaller furniture, work displays on the walls, and manipulatives and classroom supplies strewn throughout the space. Students in the elementary grades spend a large portion of their day in the same classroom and are taught most of their core content (reading, writing, mathematics, science, and social studies) in the setting. Pointon and Kershner, (2000) identify flexibility as an integral component to classroom design so that the room can be rearranged depending on the learning activity. Tondeur, De Bruyne, et al., (2015) studied the physical placement of classroom technology and its influences on educational practices in primary school classrooms. The researchers determined seven common designs (Figure 2.3)- (counter-clockwise from top left) front-facing rows, front-facing pairs, front-facing singles, combination, U-shaped, and square (Tondeur, Bruyne, et al., 2015). The study confirmed that “the classroom layout is closely related to teachers’ practice” (p.550), such as the combination layout is conducive to group activities.
Modern elementary school classrooms must be able to not only meet the needs of their learners, but also contribute to the learning process. Classrooms must provide students with spaces to congregate, collaborate, reflect, and create (Thornburg, 1999). Scheninger and Murray (2017) posit, “if the space doesn’t match the desired learning pedagogy, then it will hinder student learning outcomes” (p.111). Modern classrooms must reflect the notion that learning can occur on demand anytime, anywhere. This idea is supported through the power of Internet connectivity and technology. Educators in the lower elementary grades are now presented with a new challenge, students that have grown up in an age where mobile device technologies have been a presence in their life since birth. Technology in the classroom is no longer optional to support student learning, it is a necessity. In a review of existing research on 1:1 technology in K-12 classrooms, Harper and Milman (2016) found that the influence of 1:1 devices favorably impacted student achievement across several grade levels and subjects (p.138). Immediate access to technology has the ability to individualize instruction and offer new avenues for communication and collaboration (Dunleavy, Dexter, & Heinecke, 2007), improve student engagement and activity at the primary grade level, (Larkin, 2011), and explore new learning avenues (Harper & Milman, 2016).
Technology in the Elementary Classroom

Interactive media technology has been a force present in classrooms since still motion pictures were used during the turn of the 20th century. Technology was slow to develop as new mediums were introduced by the decade (audiovisual, television, microcomputers, multimedia, Internet), however skepticism reigned as evidence did not exist that correlated these media tools to improved knowledge acquisition (Clark, 1983). Often, these devices were used sparingly because they were time consuming, cumbersome, and limited with the level of personalization opportunities for students. These instructional mediums were used as a substitution to traditional instruction, enhancing the learning environment but offering little long-term impact, meaning they leverage technology to replace and/or improve existing tools in the learning task (Hilton, 2016). With the popularity of mobile devices and the abundance of classroom technologies available to students, the Substitution-Augmentation-Modification-Redefine (SAMR) Framework is a guide used by districts to support transformational instruction and learning (Hilton, 2016; Spires, Wiebe, Young, Hollebrands, & Lee, 2012). While many districts explored mobile laptop carts (COWs) or experimented with BYOD programs to allow greater web access to students, there were still limitations in both instructional practices and building infrastructures (Grant, Ross, Wang, & Potter, 2005). The trend now is for districts to provide ubiquitous technology access to all students and teachers, pioneered by the Maine Learning Technology Initiative (MLTI) in 2002 (Garthwait & Weller, 2005). Maine provided all seventh grade students and their teachers an Apple iBook in the hopes of narrowing the digital divide, provide economic competitiveness, and improving 21st century skills (Zucker, 2004). Since MLTI was implemented in 2002 researchers have attempted to investigate the impact 1:1
technology has on students, teachers, schools and communities (Dunleavy et al., 2007). There has been an exponential increase in the number of districts that have adopted some form of 1:1 technology in districts across the country. The needs, implementation, and results vary from district-to-district but it has become apparent the ubiquitous access to technology has become a constant fixture in many K-12 classrooms. Each 1:1 setting had its own unique program that comprises a set of expectations, funding mechanisms, and individual implementation models including variation in hardware, software, networking, teacher training and professional development, as well as program support. With technology as a central focus in classrooms, creative learning spaces can support the affordances of collaboration, creativity, and motivation. The combination of space and technology has the potential for teachers to reshape pedagogical practices and ignite excitement among students for learning.

In addition to an influx of mobile technologies into the classroom, this idea of flexibility has created a lot of headway into present day elementary school classrooms, but the term is often misused. In classroom design research, flexibility is used to describe the maneuverability of the furniture and technology so that the design is agile enough to meet the needs of the learning activities (Oblinger, 2005), as well as the “degree to which the pupils have an appropriate provision of space” (Barrett et al., 2015, p. 122). The idea of flexibility is now confused with alternative seating options, when they are vastly different ideas. Teachers will now describe their class as ‘flexible,’ when they are only offering students different seating options, such as yoga ball chairs, beanbag chairs, or other creative options. These seats serve motivational, comfort, and stimulation purposes but do not offer the classroom more in terms of flexibility. The
Creative alternative seating options are aesthetically captivating upon entering an elementary school classroom, however there is a lack of empirical research that supports their impact on teaching and learning.

**Environmental Psychology**

The environment has a direct impact on learning (Emmons & Wilkinson, 2001). How the physical classroom space is designed sends clear signals to its occupants (students and teachers) where persons can move, what types of activities are valued, and offers psychological cues as to the learning experiences to be delivered (Whitmore & Laurich, 2010). Research has shown that student achievement is accelerated in environments where there is “greater congruence between the actual classroom environment and that preferred by the students” (Taylor et al., 1997, p.294). As students walk into a classroom they immediately begin to formulate opinions on how the classroom space will impact the learning experience. (Graetz & Goliber, 2002). For example, desks in rows suggest lecture, while tables and desks scattered suggest collaboration (Graetz & Goliber, 2002). Many researchers have linked this preconceived notion of learning expectations to the physical arrangement of the classroom to environmental psychology. Environmental psychology is a branch of psychology that is “concerned with providing a systematic account of the relationship between person and environment” (Russell & Ward, 1982). In this definition, environment is defined as the immediate surroundings of the person. Most definitions of environmental psychology focus on the physical environment, but Cassidy (1997) argues that environmental psychology is equal parts physical environment as it is social environment. Cassidy (1997) posits, “in many cases the main effect of a physical setting on behaviour is through the meaning it has acquired from social interaction” (p.3). Consider a church; a
church is just another building, but the social influences are what drive behavior inside its structure. The same considerations can be made to the classroom, and how the social interactions shape behavior. Student appraisals of the learning environment may be shaped by their instructional and social environments (Pekrun, Goetz, Titz, & Perry, 2002).

Environmental psychology is akin to the emotions we feel when we enter a restaurant or retail store (Robert & Rossiter, 1982b), the immediate reactions we feel as we enter the establishment will determine our expectations and behavior for the experience that will be had. These emotions are like those of students as they enter the classroom, their behavior is impacted by the environment. “Behavior toward and within an environment can be classified as either approach or avoidance behavior (Robert & Rossiter, 1982). It is the responsibility of the teacher to identify the potential barriers in the classroom that negatively impact student behavior and modify the design to mitigate distractions (Steg & Vlek, 2009). Teachers set out to create an environment where the students are encouraged to stay and explore, play, socialize, interact with and ultimately succeed. Every teacher, therefore, should think of themselves as a designer, for both instruction and space, “responsible for preparing the environment” to achieve learning and social objectives (Martin, 2002). Building administrators can support teachers understanding of learning space design and help eliminate barriers by using existing research, such as the PST Framework, to support professional growth in this area. Once barriers to effective space design are known, like district requirements or parent expectations, teachers and administrators can begin to implement effective classroom shifts in design that has the potential to positively influence teaching and learning. The
PST Framework can be used as a tool to drive reflection, professional conversations, and instructional decision making when considering the synergy between pedagogy, space, and technology in lesson design.

**Summary**

It is understood that learning can take place in both formal environments such as classrooms and libraries, as well as informal learning environments such as museums, parks, or any other community gathering place. This literature focuses on the evolution of formal learning environments, specifically the elementary classroom, how it has evolved over time, and considerations that must be made to design spaces to meet the needs of the 21st century learner.

Research in the evolution of classroom design can be directly linked to the predominant learning theories during that time period. It is understood that teaching and learning can be dated back to Cro-Magnon cave sketches that represent the earliest record of humans’ desire and need to communicate, to the 5th century BC Sophists when the first recorded mass instruction through prepared lectures and free debates were delivered to a congregation of peers. However, the research in this paper begins with the Common School era of the late 18th century, early 19th century and the dominant learning theory of the time, behaviorism. Classrooms were designed for lectures with a clear front of the classroom where all students were facing the sole source of knowledge the teacher. Learning was a passive process where students were expected to absorb, memorize and recall lecture-based instruction from the teacher. However, as pedagogical practices evolved into a more student-centric, constructivist environment, classrooms morphed to allow for collaboration and conversation.
Constructivist classrooms support active teaching and learning. While there is not a universally agreed upon definition of active learning, the research supports this idea as one that encourages collaboration, communication, and critical thinking. Active learning classrooms are now buoyed by the support of classroom technologies that support these goals and positively contribute to the teaching and learning experience. Classroom technology, now so common that we can say access to devices and the Internet are ubiquitous in elementary school classrooms across the county, when combined with the physical space of the classroom have the potential to transform teaching and learning for a new generation of students.

Teachers are tasked with this challenge of supporting our young learners through the successful synergy of matching pedagogy with technology and space. While there is a dearth of existing research on support for elementary school teachers in this area, there is an abundance of studies done in higher education that the K-12 counterpart can pull tenets from regarding environmental psychology and active learning theory to support their effort. It is my hope that conducting research in the field of elementary education PLEs, building on existing research, that a conscious effort will be made to transform spaces given the pedagogy, space, and technology factors.
CHAPTER 3
METHODOLOGY

This chapter provides a description of the methodology for this study. The purpose, conceptual framework, and context guiding the study are shared along with the research questions. The foundation of the study is followed by a thorough explanation of the methods including sampling, data collection, and data analysis. This chapter concludes with a detailed narrative on the study’s rigor and limitations.

Purpose of Study

Given the scarcity of existing research on PLE design in elementary schools, the purpose of this qualitative study is to investigate elementary school teachers’ conceptions of how the design of their classroom affects their pedagogy, as well as how those conceptions materialize in practice. This study will provide elementary school teachers and administrators with a detailed and descriptive account of how current practitioners consider and implement these factors in their instruction and possible areas for growth. A qualitative research design and data collection methodology will support detailed findings in how elementary school teachers plan for and implement space design in their classroom. The following research questions will guide this study: (1) How do elementary school teachers conceptualize the relationship among pedagogy, space, and technology when designing instruction? (2) How do elementary school teachers’ conceptions of the relationship between pedagogy, space, and technology in classroom design materialize in their practice?

Conceptual Framework

A conceptual framework (Figure 3-1) will be used to critically examine and make transparent the goals, commitments, frames of reference, guiding concepts and
theories, and working assumptions that influence this study (Ravitch & Riggan, 2017). The study will be guided through a constructivist learning lens and supported by the PST framework for evaluating learning spaces. Existing research in the field of learning space design has cited environmental psychology and active learning theory as two major tenets that must be considered when designing learning spaces.

Figure 3-1. Conceptual Framework
Context of Study

The research for this study was conducted in elementary classrooms (K-5) in a suburban central-New Jersey school district. Because of ethical concerns regarding my position and the potential conflict that conducting research in my building can create, the study was conducted in a neighboring district that features similar demographics to my school district. The setting was an innovative district that provides its teachers with freedom to redesign spaces, features similar technologies to those in my building, and offers teachers and students various spaces for tech-based instruction and collaboration. The researched district features five elementary schools (K-5) and two middle schools (6-8). The setting for my research will be one of the elementary schools that has class sizes of approximately 21 students per classroom. The school offers students ubiquitous access to technology in a 1:1, student-to-device design. Devices include tablet (iPads) and laptop (Chromebook) technologies. The observations took place in general education classrooms. The major difference between my school building and the observed school for this research is the ubiquity of technological devices for all students in the observed school district.

Although the setting of this study was not in my immediate professional practice, the findings and conclusion can be transferred to my school district because of the similarities in class size, student demographics, and school funding. Total district spending per pupil is comparable (local funding is $22,294 compared to $21,558 for the hosting district). Figure 3-2 depicts the most recent published demographic data from the host district. Figure 3-3 represents the most recent data from my school building.

Figure 3-2. School demographic information for site of research ("New Jersey School Performance Report," 2016)

Introduction of Participants and Setting

The elementary school in this study, located in suburban New Jersey, educates students in grades Kindergarten through Grade 5. The median household income in this suburban town of 35,429 residents is $99,827 and features an average home value.
$410,300. In New Jersey, school districts are funded by local municipalities, while most schools in other states are funded at the county level. The school is one of five elementary schools and two middle schools that comprise this Kindergarten through Grade 8 district. The participating school has a student enrollment of 514 students (as of the date of the observations) and a student to teacher ratio of 11:1. Student demographic data indicates 78.6% white, 6.2% Hispanic, 3.9% black or African American, and 6.8% Asian.

All classrooms in the participating school have 1:1 student-to-laptop accessibility. The laptops, purchased by the school district, are Chromebooks as the district utilizes the Google Suite for Education platform to support email, student and staff collaboration, and the other applications offered by the product. Chromebooks are stored in the classroom and students have access to them throughout the day. District administration does not impose minimum requirements for technology use in the classroom as each teacher can incorporate technology into lessons where they see fit. There are, however, digital resources which the district has licenses for that are required for students to use in math and reading. These resources will be discussed and detailed throughout the chapter as they played an integral role in the interview and observational data collection. Each classroom also had three iPad tablets for students to utilize, as well.

The classroom space was standard in the 4th and 5th Grade classrooms, 30 feet by 25 feet. The 1st grade classroom was slightly larger at approximately 38 feet by 30 feet and featured higher ceilings making for a different learning environment than the other classrooms. There was a teacher desk, small group instruction desk (kidney-shaped table), mounted projector, carpeted area, classroom library, Chromebook cart, and
whiteboards standard in all observed classrooms. Teachers are given the autonomy to design the classroom in whatever design they choose. The rationale for the designs of their classrooms will be discussed in this chapter.

For this study, three full-time, grade-level elementary school teachers participated in three interviews. An initial semi-structured interview which explored their general teaching practice and their conceptions of the relationship among pedagogy, space, and technology when designing instruction was conducted in their classrooms, as well as two subsequent interviews pre- and post-observation. Each teacher participated in a full-day (7 hours) observation which allowed the researcher to collect data on how the teacher conceptions of the relationship among pedagogy, space, and technology when designing instruction materialized in their professional practice. In consult with the school’s building principal, participants were selected based on predetermined attributes focused on the scope of their teaching responsibilities, demonstrated willingness and interest in designing their classroom, and demonstrated active use of technology in the elementary classroom. Participants are given pseudonyms to protect their identities (Table 3-1).

Table 3-1. Participants in study

<table>
<thead>
<tr>
<th>Name</th>
<th>Teaching Experience (Years)</th>
<th>Current Grade-Level Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teri</td>
<td>15</td>
<td>Grade 5</td>
</tr>
<tr>
<td>Donna</td>
<td>8</td>
<td>Grade 1</td>
</tr>
<tr>
<td>Erin</td>
<td>4</td>
<td>Grade 4</td>
</tr>
</tbody>
</table>

During the interviews and observations, notes were collected in the research journal to describe each participant. These records assisted in understanding the personalities of
the participants and their thoughts and beliefs on lesson design when considering the relationship among pedagogy, space, and technology. The following sections describe the participants individually and the design of their learning space.

**Teri**

The most senior participant, Teri has worked in the school district for 15 years, the past ten years in the elementary school which was the setting for this study. She has also served as an interim building supervisor during her tenure in the district which enables her to have an administrative perspective on teaching and learning. She has taught the upper-elementary grades for most of her professional career as well as all subject areas. She admitted to preferring teaching reading and language arts instruction over other content areas but is becoming more comfortable with mathematics instruction. She cited the “adaptive technology” affordances as a major influencer in her improved comfort with mathematics instruction and lesson design. Her lessons are designed to foster independence and application of learned skills. She noted that her preferred instructional strategy is small group instruction where she is able to reinforce skills after a 10-minute mini-lesson.

During the interview, she addressed many of the questions probing classroom design through the lens of classroom management and strategically arranging desks to ensure students were paired near classmates that encourage positive interactions and collaborations. She also responded to questions about the learning space in terms of efficiency and access to resources. She believes the size of the classroom is a limiting factor to her ability to maximize the effectiveness of the space, as her ideas for a well-designed classroom are not possible given the room’s dimensions and budgetary
contraints. Teri shared her wishes for more collaborative tables with a larger area in the middle of the room where a carpet can be added for whole group lessons. She also desires to have a collaborative, multi-touch interactive board to enhance her instruction.

When asked questions about technology’s role in her classroom instruction, she became more energized and enthused in her responses but did admit bias toward its ubiquity stating, “I’m not pro, pro, pro at technology,” “this is the generation of technology,” and expressed “disappointment” in seeing students read from iPads instead of paperback books. She acknowledged technology’s ability to facilitate a station-rotation lesson design and the ability to assign students lessons on various digital programs such as Freckle and Reflex Math to remediate skills and personalize instruction. She cited the “adaptive” ability of the programs to target instruction and provide students with video tutorials on how to successfully complete mathematics problems.

Figure 3-4. Teri classroom, back. Photo courtesy of author.
Donna has taught Kindergarten and 1st Grade at this elementary school for seven years after teaching for one year in another district. She took many years off to raise her children in-between employment in the two school districts. She teaches an inclusion section of 1st Grade, which means there are special education students integrated into the classroom. There was a special education teacher in the classroom to support the
students with an Individualized Education Program (IEP), however through observation the special education teacher worked with all students throughout the day. Because of the age of the students, she prioritizes routines and movement around the classroom. Instructional rotations for each content are scheduled in 10 to 15-minute intervals.

Pedagogically, she spoke about the importance of students being able to work at their “level” during small group instruction and relies on assessment data to successfully differentiate lessons. The data collected to inform the teacher about readiness levels are retrieved from daily digital formative assessments such as Epic, myOn, Raz-Kids, and Freckle. She believes that the age of her students requires lessons to be exciting and “engaging,” and the approach of the teacher must be “very warm and loving and let them know that it’s a safe place.” She leads the class as if they are a “family.” She defines engaging as “focused on the lesson,” “not fooling around or looking at other places or fidgeting,” and “it’s silent and they’re actually listening, and they just love to learn.”

Figure 3-7. Donna classroom, back. Photo courtesy of author.
Figure 3-8. Donna classroom, side. Photo courtesy of author.

Figure 3-9. Donna classroom, front. Photo courtesy of author.

Erin

Erin has taught 4th Grade during her four-year tenure at the elementary school. Erin appeared very energetic and engaging throughout the interview and observation process. She was awarded a grant this school year which allowed her to purchase new furniture for her classroom. Her classroom was the only classroom observed that did not have traditional desks and chairs. Instead, the classroom featured clover-shaped tables
with storage drawers underneath for school supplies. This classroom also educates
students with IEPs, which requires a second teacher in the room. Erin was very outgoing
and cheerful throughout the data collection process.

She believes students perform at the peak level when they are comfortable and
are provided options on where they choose to learn in the classroom. Erin spoke about
“flexible seating” and allowing student to choose from a variety of furniture and space
options to complete learning tasks. She addressed questions about pedagogy and
technology by stating her appreciation of the interactive capabilities of technology. She
believes she uses technology appropriately to encourage creativity and “higher level
learning,” which she defines as learning tasks that allow students to “think outside the
box.”

Figure 3-10. Donna classroom, back. Photo courtesy of author.
Teacher Conceptions and Implementation of the PST Relationship

This section focuses on how teachers conceptualize the relationship among pedagogy, space, and technology when designing instruction. To better understand the teachers’ thoughts and beliefs on the PST relationship when designing instruction, each
interview transcript was coded and categorized using the themes of pedagogy, space, and technology. Each subsection will present a theme and supporting codes gleaned from the participant interviews and supported through classroom observation data.

Table 3-2. Themes and codes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedagogy</td>
<td>Workshop Model</td>
</tr>
<tr>
<td></td>
<td>Instructional Goals</td>
</tr>
<tr>
<td></td>
<td>Student Engagement</td>
</tr>
<tr>
<td></td>
<td>Cooperative Learning</td>
</tr>
<tr>
<td>Space</td>
<td>Comfortability</td>
</tr>
<tr>
<td></td>
<td>Furniture Options</td>
</tr>
<tr>
<td></td>
<td>Student Driven</td>
</tr>
<tr>
<td></td>
<td>Lack of Space</td>
</tr>
<tr>
<td>Technology</td>
<td>Assessment</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
</tr>
<tr>
<td></td>
<td>Independent Learning</td>
</tr>
<tr>
<td></td>
<td>Adaptive technologies</td>
</tr>
</tbody>
</table>

Research Design

I conducted a qualitative, exploratory study analysis of how elementary school teachers theorize and practice the relationship between pedagogy, space, and technology. This will be achieved through qualitative data collection from various elementary school classrooms. Data from multiple classrooms will be collected and synthesized to provide rich and descriptive findings from multiple classrooms around a singular focus. This approach will allow me to conduct a thorough investigation of a topic that is within the scope of my professional responsibility and potentially support professional growth for teachers and administrators in this area (Baxter & Jack, 2008).
To guide this research and data collection, the Pedagogy-Space-Technology (PST) framework, developed by Radcliffe, Wilson, Powell, and Tibbetts (2008) will be used. While there is not a widely adopted approach for the creation and evaluation of teaching spaces that support constructivist learning, the PST framework uses the findings of prior research in higher education spaces to support its development (Radcliffe et al., 2008). Although this framework is used primarily at the higher education level there are many major themes that translate to the elementary setting. Common themes from Radcliffe (2008) that were used to develop the framework and are appropriate for an active-learning elementary setting are labeled in Table 3.1. Additionally, research supported links between the PST Framework and the elementary school classrooms can be found in the creation of the Linking Pedagogy, Technology, and Space (LPTS) observational metric. The LPTS observational metric has been used in elementary school learning spaces to evaluate student learning experiences in different spatial layouts and how teachers utilize technologies in different spatial settings. The results of the evaluation offer teachers a deeper understanding of the pedagogical possibilities in differentiated spatial arrangements and how this information can translate to improved teaching and learning.

Table 3-3. Characteristics used to develop PST framework (Oblinger, 2005; Radcliffe et al., 2008)

<table>
<thead>
<tr>
<th>Common PST Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design learning spaces around people</td>
</tr>
<tr>
<td>Accommodate information technology</td>
</tr>
<tr>
<td>Support multiple types of learning activities</td>
</tr>
<tr>
<td>Design for comfort, safety, and functionality</td>
</tr>
</tbody>
</table>
The PST framework is a series of questions that offer insight into the requirements for PLEs in terms of how pedagogy, space, and technology impact the design process. Questions are listed in Appendix 1. This framework will be utilized and applied to existing learning spaces in the school setting to understand what teachers consider and how they combine pedagogy, space, and technology in practice. The framework is used by researchers, practitioners, and scholars to design, improve, and evaluate classroom spaces (Støckert & Stoica, 2017; Wilson & Randall, 2012). Støckert and Stoica (2017) site the PST framework as a leading framework to be utilized by educators and learning spaces designers throughout the lifecycle of a learning space since it is a “model for continuous improvement and evaluation” (p.191). The intentional sequencing of the questions demonstrates how the three independent elements influence each other. Technology extends the classroom space, while the space embeds classroom technologies. Pedagogy is encouraged by space and enhanced by technology. While pedagogy appears at the top of the diagram it is not meant to suggest a hierarchy, however it is the recommended part of the framework to start the cyclical process (Radcliffe et al., 2008). The framework can be applied to address any learning setting, which will allow me to adapt it to address the teaching and learning needs of an elementary school classroom.

Figure 3-13. Pedagogy Space Technology Framework (Radcliffe et al., 2008)
An observation protocol was developed and piloted that collects data on classroom technologies, teaching methodologies, classroom arrangement, and learning activities. The observation protocol was adapted from the Linking Pedagogy, Technology, and Space (LPTS) observational metric which is currently used in 11 international universities to provide teachers with feedback on duration and frequency of instructional strategies, classroom design, and technology usage (Byers, 2016a). The LPTS metric is designed to provide teachers with frequency table graphics that demonstrate how much time was spent in pedagogy styles. This data is quantitative. My adaptation of the observation metric will use its ‘look-fors’ but not focus solely on frequency and duration. I am interested in an exploratory case study of elementary school teachers’ beliefs and practices related to the PST Framework. I feel this framework provides this research with the proper support for data collection.

**Sampling Procedures**

As this is a qualitative study and generalization is not a goal of the research, nonprobability sampling has been selected (Merriam & Tisdell, 2016). This research design acknowledges that there is an unequal chance of participant selection, but this is by design (Dooley, 2001). The research questions dictate the attributes which are crucial to this study (Table 3-4). Purposive sampling has been selected as the sampling procedure to provide the most rich and descriptive data to support the research questions. “Purposeful sampling is based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned” (Merriam & Tisdell, 2016, p.95). A subset of purposeful sampling is convenience sampling which will dually be utilized because all participants will work in the same school building.
Collaboration with the building principal of the elementary school will take place to determine teachers in the building that meet predetermined participation attributes. The researcher provided each prospective teacher with a narrative about the study and the requirements (interviews, observation) for participation (Appendix 3). The target number for participation in this research is 3 volunteers that meet predetermined criteria (Table 3-4).

Table 3-4. Sampling attributes

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary school teacher – grades K-5</td>
<td>Scope of research design is focused in the elementary school setting. Although I am principal of a PK-2 building, it is prudent to expand the scope to K-5 because this age grouping is more popular in New Jersey elementary schools. Typically, in New Jersey, elementary schools educate grades K-5.</td>
</tr>
<tr>
<td>Access to classroom technology</td>
<td>As part of the PST Framework, access to classroom technology is required. Only classrooms with ample and differentiated access to technology will be considered, such as Promethean Boards, Chromebooks, and tablet technologies.</td>
</tr>
<tr>
<td>Classroom teacher</td>
<td>It is recognized that related arts are integral to the education of the whole child. However, this study will only consider teachers that are responsible for core content instruction (math, reading, writing, science, and social studies).</td>
</tr>
<tr>
<td>Active use of technology in the elementary classroom</td>
<td>Teachers participating in this study must have demonstrated a commitment to technology integration. Because technology is an essential component to the PST Framework, technology must be a routine component to teachers' lessons. Level of comfort with technology will be determined by the building principal and communicated to the observer. Principal will make this determination through his own evaluations and conversations with his teaching staff.</td>
</tr>
</tbody>
</table>
Data Collection Procedures

The goal for participation will be three teachers selected through purposive sampling methods. Between interviews, the researcher will observe each participant’s classroom. Teachers will meet twice with the researcher, once for a pre-observation interview and again for a post-observation interview. Data collection began in March 2019 and continued through June 2019, once Institutional Review Board (IRB) permission had been given. Interview questions (Appendix 1) and observation framework (Appendix 2) are elements of existing frameworks, however final refinement of the questions occurred through expert review and pilot testing. Pilot testing of instruments was conducted in my school setting to test interview questions and observation protocols, gain practice in interviewing and observations, establish consistency and pacing with instrumentations, and make modifications as needed.

Interviews

Interview protocol was designed using semi-structured interviews (Patton, 1990). Interview questions were scripted and asked exactly as written, however a semi-structured approach allows me to asking probing questions to allow participants to expand and clarify answers. Scripted interviews were appropriate for this study because they reduce interviewer judgment, bias and variation. All interviews were conducted face-to-face, on-site of the classroom observation. Each interview was audio-recorded using mobile technology applications. The initial interviews were transcribed by hand, while all subsequent interviews were transcribed by a web-based transcription service.

Observations

Each participant’s classroom was observed following pre-observation interview. Patton (1990) argues the purpose of observational data is to describe the setting, the activities
that took place, the people who participated, and “the meanings of what was observed from the perspective of those observed” (p.202). The purpose of the observation was to collect data of the teachers’ implementation of the information shared during pre-observation interview. The observer assumed an overt role as the teachers were aware of both the observer and the purpose for being present in the classroom. Each observation was a single observation which was conducted over the course of one school day, which is approximately six hours of instructional time. One school day was chosen because it allowed me to observe full lessons, transitions between activities, and any possible adjustments to the PLE. The observer collected data on classroom design, adjustments to space depending on learning activities, accessibility of technologies and their effect on the space design.

A journal was kept to record anecdotal data throughout the interview and observation data collection periods. Data collected included nonverbal observations during the interview, as well as feelings, reactions, and reflections (Patton, 1990). Journal was also used to record field notes from the observation. Field notes were descriptive and contained the observer’s own feelings, reactions, and reflections. These supplemental data points were included during data analysis.

Table 3-5. Data collection methods and procedures

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Strategy</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview</td>
<td>Standardized, open-ended (Patton, 1990)</td>
<td>Researcher will conduct pre- and post- interviews using standardized, open-ended strategy with purposive sample of participants (N=3). Interviews will be audio recorded and undergo verbatim transcription. Audio data will be transcribed by a web-based transcription service. Accuracy will be ensured through member checking protocol. Researcher journal will be kept to record nonverbal observations during the interview, as well as feelings, reactions, and reflections (Patton, 1990)</td>
</tr>
</tbody>
</table>
Table 3-5. Continued

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Strategy</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>Overt observation (Patton, 1990)</td>
<td>Observations for each participant will occur during the research timeline and take place over the course of three hours. Observations will take place in both the classroom and design center spaces. Observation framework adapted from LPTS metric, but designed to collected data qualitatively. Observer will be visible to the class but not partake in the lesson or engage with the students. Field notes (Merriam &amp; Tisdell, 2016; Patton, 1990) will be used to gather the data during the observations. Field notes will be descriptive as well as contain the observer’s own feelings, reactions, and reflections. Field notes will be collected in the researcher journal.</td>
</tr>
</tbody>
</table>

**Data analysis procedures**

Ensuring the accuracy of the interview transcripts was paramount to guarantee a reliable approach to qualitative research and contribute to the trustworthiness of the findings. All interview transcripts were reviewed a minimum of two times while listening to the audio recordings prior to coding and thematic analysis.

After reviewing each transcript for accuracy and observation data collection sheets, the data were open-coded and analyzed using thematic analysis with the goal of rich, thick descriptions (Creswell, 2013). After open-coding of the transcripts and observation data collection sheets, themes emerged for categorizing codes across the data.

The guidelines of phases for thematic analysis as described by Braun and Clarke (2006) will be used to analyze the descriptive data. These six phases of thematic analysis include: (1) becoming familiar with the data, (2) generating initial codes, (3)
searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report.

Phase one, familiarity with the data occurred during transcription and reading the data. Immersion in the data is imperative and required repeated readings of the data to understand the breadth and depth of the content (Braun & Clarke, 2006). During this immersion, notes were kept for ideas that have been formulated for making codes. Each interview was recording and transcribed using Rev software. I listened to the recordings while reading the transcripts to ensure accuracy. Any errors were corrected, and identifiers were striken from the transcripts at this time. The combination of interview and observation data were used to formulate codes. A descriptive coding strategy was used during the first cycle of coding.

During this phase the initial transcript and observation that was coded was sent to a peer in my Ed.D. cohort to undergo peer-debriefing. Peer debriefing is an approach used in qualitative research to enhance credibility and guard against researcher-bias (Hail, Hurst, & Camp, 2011). My peer, a colleague from my cohort who also works in K12 education, and I met via a scheduled Zoom session. I presented my coding scheme and rationale. This approach allowed me to talk through my initial codes and rationale for decisions. Through our meeting, it was determined that I was overgeneralizing codes and that I needed to collapse some while being more descriptive. We discussed potential biases and assumptions as well as vague descriptions in my coding. Additionally, having the opportunity to explain the data and rationale to my peer allowed for a deeper understanding and a more objective perspective of the data that was presented (Hail et al., 2011). It was helpful that my peer was familiar with the
vernacular that is associated with ‘teacher-speak,’ therefore we were able to discuss commonalities and differences seamlessly.

Following the peer debriefing, I updated my codebook to reflect the changes that were made. The remaining transcripts and observation data were coded and followed open coding strategy. All transcripts and observation data were manually coded. Qualitative coding software NVivo was used to facilitate the coding process, however I reviewed and verified each code so that every interview and observation datum is represented equally. Ensuing rounds of coding utilized a pattern coding structure. In this stage, codes were contracted and expanded and put into clusters for potential themes. A careful review of the codes revealed redundancy in codes. For example, there were lines of the transcripts coded as ‘working in isolation’ and another instance of data coded as ‘independent practice.’ These codes were consolidated to a single code of ‘independent practice.’ Pattern coding generated categories and lead to the emerging of themes.

Once coding schemes had been determined through various rounds of review by the observer, the codes were used to develop potential themes. The development of overarching themes underwent careful analysis, like the process of coding. After exhaustive immersion within the data, themes emerged that clearly captured the essence of the responses and actions of the participants. While each step is a thorough process, I ensured that the development of themes was only finalized once codes were determined.

As themes developed, patterns emerged which were reported to support the research questions. This exhaustive process was not meant to be a checklist of tasks,
rather it was a constant flow of revisiting the phases to ensure a rich description of the data is presented in a coherent way so that the readers can understand the essence of the study.

**Trustworthiness**

In an effort to establish trustworthiness, combat subjectivity, and account for potential ethical issues, I adhered to established qualitative inquiry standards for trustworthiness (Creswell, 2013; Merriam & Tisdell, 2016; Patton, 1990) for data collection and analysis. Procedures used for trustworthiness are presented below.

Interview question development and observation protocols followed the guidelines described by Patton (1990). Prior to finalization of interview questions and observation template, the protocols underwent pilot testing with teacher volunteers in grades which would be used in the research study. These volunteers were tenured teachers in the same grade levels which would be used in this study. They participated in think-aloud interview sessions and allowed me to observe their lessons using the designed observation protocols. Feedback from the volunteers during these pilot sessions allowed the interview questions and protocols to be refined and more aligned to the research questions and focus of the study.

All interviews with participants were audio recorded and transcribed using transcription software. Trustworthiness of the transcript was accounted for through listening to each interview while reviewing the transcripts. Following this review for accuracy, the transcripts underwent a thorough member checking process. Member checking eliminates the possibility of misinterpreting participant responses and perspective while also accounting for research bias and misunderstanding (Merriam & Tisdell, 2016). Each interviewee was emailed a copy of their interview transcript from
their general and post-interview session. Member checking provided the interviewees with an opportunity to validate or clarify their responses and ensure the essence of their responses was recorded accurately. I did not receive revisions from any of the participants therefore the transcripts were analyzed as is.

Extensive measures were taken to ensure the trustworthiness of this study, such as reflexivity, member checking, and peer debriefing. Since the researcher was the sole data collector, the potential for biases is present, which can influence a qualitative study. To lessen the potential for personal bias, I applied Creswell's (2013) strategy of reflexivity in my journal by describing my role within the study, affiliation with the research setting, and being aware of my biases throughout the data collection, analysis, and reporting. I triangulated the interview transcription, observational data, and field notes to ensure consistency. In addition, peer debriefing was utilized to reinforce initial codes. A peer familiar with K-12 education and qualitative research was provided with a full copy of an interview transcript and observation protocol data sheet. Peer debriefing was conducted through a video conferencing session upon completion of the initial coding of the data for the first participant. Rationale for coding schemes were discussed and the exercise resulted in codes being restructured and reorganized. Data is openly and honestly reported in this study, whether these findings present positively or negatively.

Additional measures of trustworthiness were recognized through the use of established criteria for qualitative data collection (Creswell, 2013; Merriam & Tisdell, 2016; Patton, 1990). Volunteers for participation were selected as per a predetermined
set of attributes that were confirmed through consultation with the school’s building principal.

Interview questions were adapted from the PST framework (Radcliffe et al., 2008) that address the research questions and focus on elementary education learning spaces. Interview protocol, sequencing and wording were supported through guidance stated in Creswell (2013) and Patton (1990). Observation protocols were supported through protocols shared by Patton (1990) using an adaptation of an existing observation metric, LPTS observation metric (Byers, 2016a).

By using multiple methods (interviews and observation) to collect data around a singular focus, triangulation is another source of credibility for my findings. Creswell (2013) posits triangulation “is a powerful strategy for increasing the credibility or internal validity of your research” (p.245). Triangulation is established by using observations and interviews, as well as multiple interviews with the participants. Multiple perspectives towards a singular focus provides robust data and an opportunity to understand the phenomenon through several lenses.

Trustworthiness was accounted for through the collection of an audit trail. An audit trail, kept in the researcher’s journal, provides transparency for all aspects of the study. The notes collected for the audit trail include observation field notes, codebook, procedures, notes on the structure of categories, schedules, and personal notes.

Finally, to address potential researcher bias, reflexivity was used (Creswell, 2013). A statement of positionality was put forth, which included my professional role and past experiences with respect to elementary education. Researchers must explain
their biases and assumptions so that the “reader can understand how the research arrived at a particular interpretation of the data” (p.212).

**Role of the Researcher**

As the sole researcher in this study, my responsibilities were to ensure the integrity and ethical collection of data to support the research questions. I am a white male who has spent 16 years working in upper-middle class public schools in suburban communities in New Jersey. I was a high school special education teacher for eight years and have been in school administration for the previous eight years. In my professional role as elementary school principal, one component of my responsibilities is to work with educators on all aspects of their pedagogy, including technology integration and classroom design. Classroom observations and engaging in professional discourse are regular responsibilities of mine to ensure teaching and learning are achieving at high levels. I recognize that classroom observations for evaluative purposes differ from observation for data collection, however there is a high level of familiarity with classroom observations using a framework.

**Ethical Considerations**

Major ethical concerns were averted by conducting research in a neighboring school district as opposed to the school where I am the building principal. The trustworthiness of the research depends largely on the ethical commitment of the observer and trustworthiness of the data (Merriam & Tisdell, 2016). Conducting a qualitative study in my own district, which would include non-evaluative interviews and observations, could result in untrustworthy data. Teachers may feel uneasy about my presence in the classroom, conducting observations and evaluating the synergy between their pedagogy, classroom space, and technology. I do not have any prior
personal or professional relationship with any of the participants in this study. Full transparency of data, whether positive or negative, was reported accurately.

Other Considerations

Any other ethical consideration was accounted for through consultation and approval with the Institutional Review Board (IRB). Observations were conducted live, without recording. Student data was not kept, nor was any type of student identification structure needed, which eliminated the need for parental consent in this study. Teacher anonymity was preserved through use of identification markers.

Considerations

It was difficult to determine causality because of the myriad factors involved in a classroom. Student behavior, motivation, teacher-student relationships, and academic ability (among others) are all contributing factors to the classroom dynamic and teacher pedagogical approaches to a lesson(s). Given the complex web of people, places, and events that compose a classroom, it is not possible for me to parse out all potentially influential factors and focus solely on the features of the pedagogy-space-technology factors.

Another limitation to this study is the budgetary constraint placed on the school and teachers. The school and teachers have limited funds for furniture and technology which could impact the results of the study. There is the potential that through teacher interviews, they recognize what an ideal learning environment is for a particular lesson or pedagogical style of instruction, but are limited because the available furniture, space, and technology are not conducive to their vision.

I am aware of other factors that contribute to designing a classroom. Environmental psychology includes other physical aspects of the classroom that impact
learning such as light, sound, air quality, link to nature, complexity, and color. These are interesting topics to consider for future studies on environmental psychology’s impact on student behavior, but they will not be considered in my research. Also excluded from research consideration is school architecture. While this information is exciting, I will not report on it because I have no control over school architecture.
CHAPTER 4
FINDINGS

The purpose of this study was to explore how elementary school teachers conceptualize the relationship among pedagogy, space, and technology when designing instruction, and how those conceptions materialize in practice. Using the PST Framework to guide this study, interviews and observations were utilized to understand how elementary school teachers account for, and implement pedagogy, space and technology into lessons. To facilitate this understanding, an exploratory qualitative analysis was performed to answer the research questions. This analysis includes multiple interviews and onsite observations for the three participants in the study. This chapter introduces the elementary school and participants that took part in this study and presents a rich description of their experiences designing instruction.

Pedagogy

During the initial interviews, the teachers appeared most comfortable discussing their teaching style and approach to designing instruction. This seemed to be more natural and conversational than a discussion on the physical learning space and technology. The teachers were comfortable engaging in conversation about the art of teaching and how they plan lessons. They were confident in their responses and gave robust descriptions of their instructional planning processes.

Workshop Model

Although the participants did not use the term “workshop model,” their planning and execution of lessons followed this common instructional strategy. The workshop model is an instructional strategy that prioritizes student ownership over their learning. There is a strong emphasis on differentiated learning and maximizing work time, so
students have ample opportunities to practice new skills and apply them in projects and products. The design may vary from classroom to classroom, depending on the content, age, and abilities of the learners, but the general structure is uniform throughout. Typically, the lesson begins with a ten-to-15 minute mini-lesson in which the teacher leads a whole group lesson on a skill or topic. Once the mini-lesson has concluded, the class is divided into small groups and assigned to stations throughout the room. Each station asks students to complete a learning task that reinforces the mini-lesson. Stations can be independent practice (worksheets), technology (accessing digital tools), projects or games, and teacher-led small group instruction. The small group instruction table with the teacher allows the teacher to monitor and observe student understanding. This is where the teacher can target instruction to enrich or remediate learning. During the onsite observations, there was a whole group mini-lesson where students sat at their assigned desks in Erin and Teri’s classroom, and on the carpet in Donna’s 1st Grade classroom. Donna shared the importance she places on the mini-lesson:

"The children are engaged. We do a lot of turn and talk on the carpet. A lot of questions answering, um, open ended questions and try to like really get their understanding as a whole group."

The mini-lessons typically ranged from 10 to fifteen minutes in length. Upon conclusion of the mini-lesson, the teachers put station rotation groups on the projection screen to inform students of the stations they would be learning in for that subject area. It was evident that these routines were in place since the beginning of the school year because students were autonomous and behaviorally appropriate moving through the room and accessing learning materials. Students were aware of where to locate resources and technology equipment and navigated the classroom with no support from the teacher. The workshop model of instruction was present in all classrooms for all
content areas observed. Despite the differences in ages among the three classes, all
three rooms followed the same rotational structure: whole group mini lesson, technology
station, writing station (reading), game station (math), and small group instruction.

Within this rotational design, teachers commented on the sanctity of small group
instruction and how integral it is as a component of teaching and learning, which
requires the teacher to be flexible and easily adapt to the students’ needs. Teachers
report that the instructional grouping is informed by informal observations of student
work and supported by assessment data from the digital programs used in other
rotations. The teacher is seated at a U-shaped table, which is often referred to as
“kidney-shaped” tables in interviews and works with a group of four to six students on a
specific skill, of which everyone shares a similar level of understanding. Each small
group is working at a different level, whether that be approaching, meeting, or
exceeding grade level standards. Donna offered the following feedback about small
group instruction in mathematics:

There’s a different group for addition and subtraction because they’re two
separate skills. So I think it's important too that the small group learning is
crucial at a first grade classroom.

Teri favors small group instruction because she is able to focus on her “struggling
students while assigning the rest of the class assignments that allow them to work
independently on the Chromebooks.”

The workshop design for instruction was prominently on display throughout the
observations and the teachers all reported positive outcomes during our post-
observation interview. They commented about their ability to meet with every child
during the day and provide them with meaningful instruction at their level.
Instructional Goals

Unlike the demonstrated consistency in utilizing the workshop model by the participants, they were divided when asked about what type of learning they are trying to foster in the classroom. All teachers spoke with conviction about their instructional goals, and all commented that they feel they are successful in their approaches. Erin spoke about learning through investigation through student partnerships. She spoke about designing projects that utilize available technologies in the classroom and partnering students, so they have someone to work through the project with. She noted that science and social studies are two subjects that lend themselves better to investigative learning. During the observation, students were engaged in a science project that asked them to design a robotic hand. Students watched a video of the project as a whole group and were given the materials to begin designing and building their hand. This activity was designed to be independent but because of the clover-shaped tables, the students were able to communicate freely with tablemates and share ideas on their design. Aside from the instructional video that informed students about mechanical hands and their design, this activity was absent of technology.

Teri responded to questions about instructional goals in terms of fostering student independence. She wants the students to see her as a “resource.” Teri states:

I don’t want to be the teller. I want them to be able to work independently and find the answers that they’re looking for. Most importantly, I want them to be able to come up with questions to help them find answers that they’re looking for.

Teri further explains that the most effective way to foster this learning is through small group instruction where she can meet with every student, answer their questions, and allow them to find the answers that they are looking for.
Student Engagement

It is acknowledged that student engagement is a vague term in educational research and one that does not have a universally accepted definition. However, the topic was discussed when asked questions about successful lessons. Donna, who works alongside the youngest learners of all the participants, answered questions about successful lessons in terms of student engagement and excitement. While all participants brought up student engagement at various points throughout the interviews, Donna spoke most poignantly about this being her goal for lesson instruction. When asked to define engagement, she responded with ideas of active listening, a love for learning, and demonstrating on-task behaviors. When asked specifically about her beliefs for which type of teaching is most successful in her classroom, she immediately responded with high levels of engagement and meeting their emotional needs. This was the first response from participants that addressed social-emotional learning. Donna noted that her classroom was like a family and she promotes kindness and compassion.

When evaluating lesson effectiveness, Donna discussed times when students were so engrossed in lessons and projects that they did not want to move on to another topic or recess until they were finished with the assigned task. Lesson evaluation is also monitored through formative observation measures such as exit tickets, question and answering sessions on the carpet. In math, Donna also noted that she will allow students to take on a teacher-like role and ask questions to their classmates to check for understanding. This instructional strategy is conducted as a whole group and typically done on the carpeted area.
Cooperative Learning

All participants discussed, and executed, plans for cooperative student learning during lessons. The active learning approach of cooperative learning, sometimes stated as student collaboration, was demonstrated through stations during the workshop model for instruction. In Erin’s class, cooperative learning was displayed through students critiquing each others’ presentations and offering constructive feedback on improvements, as well as shared documents to record information on Greek mythological figures. In Donna’s classroom, the younger learners participated in cooperative learning through side-by-side completion of a science project and a game center during math rotations. The side-by-side science project was designed as an independent project, but the teacher encouraged the students to talk to their classmates as they work and discuss the design of their translucent window. Teri also designed cooperative learning activities through mathematic games that required students to work in pairs to complete learning tasks. Cooperative learning was important to the teachers because they equated cooperative learning as an opportunity to move around the room and further engage students in learning. The students worked well and were on task during these designed activities.

Space

Comfortability

All participants acknowledged comfortability as a factor when considering the space of the classroom. While each classroom had slightly different dimensions, furniture options, class size, and physical student size, every teacher acknowledged student comfort as an important element to a learning space. Comfort was described
and observed as both the ease and freedom to move about the room as well as the general feelings of the students in the classroom. Erin stated:

I think the room supports that by giving the students flexibility to, to perform in a space and an environment that they’re most comfortable. And I think that when you’re most comfortable, you’re the most successful. I think I always attribute it back to my own life and I feel like you know, a lot of times I feel like, in the past teachers would have just you know, stayed in school and do their work. I work best at home and in my pajamas.

Teri added that she has certain areas of room set for certain reasons, comfort being one of them, “where students can have their physical needs met and be in a comfortable space, so they can relax and do their work.”

All classrooms had areas of the room that were designed to encourage comfortability such as carpet squares, beach chairs, and pillow cushion seats. It was evident during observations that the teachers deliberately designed these spaces for this purpose. Students were observed lounging in these areas and having on-task conversations while visiting these designated spaces. While all rooms had these spaces available, not all students visited them and took advantage of their affordances. In one classroom, most of the students chose to work and collaborate at their work stations, on hard surfaces. Donna stated:

An effective workspace is a space where the students are comfortable. Um, they want to be there, and they have the freedom to move around and access the things that they need easily so that they can complete their tasks.

Participants also broadly defined comfort in terms of safety and assurance of a safe learning environment, where students feel comfortable to share and take risks. One participant believes that her room of diverse learners at all academic ability levels must feel comfortable in their abilities and understand that all students learn differently.
She believes the room must be designed to foster this type of environment and spends a great deal of time on establishing this understanding.

Two participants cited student movement as important elements of their design, wanting students to navigate the classroom uninhibited. One participant broke down how she limits the minutes of sitting during a lesson, and how students are encouraged to move around the classroom. In all classrooms, students moved throughout the room between activities and were permitted to move freely during rotational instruction when not working in small groups with the teacher. The free movement around the classroom appeared seamless and distraction-free. Students moved around purposefully and on-task with learning objectives. The movement also allowed students to engage in appropriate social interactions.

**Lack of Space**

Two of the three participants noted the lack of physical space and class size as a hurdle to designing the classroom how they imagine it to be set up. When asked about what a well-designed learning space looks like, one respondent stated, “well, typically in a room larger than this” and another laughing statement, “in a lot more space than what we have.” When pressed about what more space would allow them to do, teachers stated that they would have more space in the middle of the room for whole group instruction and that the furniture could be strategically placed around the perimeter of the room to facilitate. The teachers noted that added space would allow for student to move around the room more freely. They stated that the number of tables and desks, bags, and class size make moving through the classroom cumbersome. The teachers feel with the number of students in the class and all of the furniture they feel “cramped” and that it is difficult for the students to access their materials because of lack of
storage. Classroom observations support these sentiments as students were observed having to walk sideways between desks and tables and wait for classmates to pass through narrow openings before they could travel the same path. In one of the classrooms with multiple teachers in the room due to student IEP needs, the second teacher desk in the room took up considerable space and limited movement options in the classroom. It is also noted that both of the teachers that cited lack of space as a limitation to their ability to design an optimal comfortable learning space worked with students that were older, physically bigger, and had more personal items (books, notebooks, and bags). Donna, who worked with the youngest students in the study and had the largest classroom dimensions of all the observed rooms, stated multiple times in the interview that she was lucky to have a such a large space which afforded her many options for design and layout of the furniture. The larger classroom featured more work stations than the other classrooms, which were all utilized throughout the classroom observation. During interviews, Donna acknowledged the size of her classroom and noted that not all teachers are fortunate to have a corner classroom which affords them more square footage.

**Furniture Options**

All classrooms featured a teacher desk (multiple teacher desks for classrooms with a second teacher in the room), kidney-shaped table for small group instruction, student desks, classroom library in a corner of the room. The most popular area of the room for the participants was the carpet area where whole group instruction takes place. In Donna and Teri’s classroom, this area was in the back of the room near the classroom library, in Erin’s classroom it was in the front of the room near the overhead projector. Teri stated, “at the carpet, being able to sit in a circle, so that they, they’re
looking at each other. Some students are laying down, but they’re still facing each other.” Throughout the classroom observations, the carpeted areas were used as a gathering space to conduct whole class instruction or for students to work side-by-side during rotational instruction. Students used the area to socialize, work in groups or independently, lie down and work, or spread out with instructional games. Also offered in the classrooms were carpet squares that students were able to pick up from a designated area of the room and bring to any part of the room they chose during assigned times. The carpet squares were utilized during rotational instruction and were observed being used by students when partnering to complete a collaborative activity, often sitting side-by-side on the carpet square with a partner. Teachers commented on how affordable the squares are because they can be had for relatively low cost at local flooring stores and they provide a nice alternative to traditional seating options.

Along with carpets, the other most popular piece of furniture that was utilized throughout the school day and spoken about by all participants were small group tables (kidney-shaped tables) where teachers conducted small group instructional groups. When asked about the area of the classroom that works the best for supporting instruction, one participant responded:

Well, the tables (indicating kidney-shaped table on side of the classroom) definitely support that because it’s like a thinking ground for my students. I see how they, when, when it’s time for them to go off in groups or work you know, independently, I see how they flock to the table, because it’s just ideal for them to be looking at each other as their working, laptops open, being able to have eye to eye contact. Um, you know, so that, that is ideal.

The teachers would position themselves at the curve of the table, across from a small group of students (typically a group of five or six) and be within an arm reach to support students and direct their attention. The students are on task and active participants in
this setting. The students were engaged with the teacher and the learning tasks, and not distracted by the classmates moving about the room. One teacher noted that small group instruction tables present a problem with storage because students always must visit their personal storage bins for materials. Learning materials must be brought to the table rather than it being easily available to them.

One participant, Erin, had more elaborate furniture options than the other two classrooms. She applied for and won a grant for collaborative tables she dubbed “clover tables.” The purpose for choosing this furniture was:

So, last year we, my previous co-teacher and I, we got these really awesome, they’re like clover style tables. And they work wonderfully for you know, facilitating discussion amongst the students. They also work really well with students with needs because working in a clover sides table or in a table in general, students are more inclined, I feel like, to help other students. I see that a lot.

The tables were the dominant piece of furniture in Erin’s classroom and took up a lot of square footage which encumbered movement around the room. The students were observed working cooperatively at the tables, sitting side-by-side each other and sharing their Chromebook screens. Students also chose this area for independent work and independent reading.

The other two observed classrooms had traditional desks but clustered them together to make communal tables, like the clover tables in Erin’s classroom. Teri stated that her rationale for clustering her furniture was to free up space in the classroom to allow for more areas in the room where students work in groups. The classroom observation in Erin’s class substantiated this point, however the students used their clustered tables as an area for collaborative work and shared learning along with other area throughout the classroom.
**Student Driven**

When asked directly about the motivation for the design of the classroom, all three participants cited student collaboration as a motivating factor. They felt it was very important for students to learn in a space where they can make eye-contact with each other and learn from each other. Erin prefers a U-shaped design to support this collaborative classroom:

…and we felt that by setting it up in that U shape, you can visibly see people. And I feel like we like to teach that a lot of times it’s not just about you know, talking at a person, it’s about body language. So when every student is facing one another, it’s easier to conduct a, a conversation. Um, so that’s kind of why we worked it out in that way.

Another participant, Donna, clusters her desks in groups of four or six so that students are working alongside classmates of mixed academic abilities. She is quoted as saying that this purposeful design in lieu of “old traditional styles like rows and aisles”, “there’s more conversation during their group work.”

Teri utilizes a turn-and-talk strategy during instruction so the students’ proximity to each other facilitates this goal. However, Teri also recognizes the behavioral and classroom management impact on student grouping and is mindful of noise and the students’ ability to work cooperatively with each other. She said, “they sit according to what I see in them as far as their behaviors and who talks too much to the other one.” Teri also stated in the interview that if there are students that she “can trust, that they are allowed to work and collaborate in the hallway.” During the observation, there were no observable off-task behaviors while students were seated at their clustered desks. Side conversations and teacher re-direction occurred sparingly when the students were working in rotational groups and seated on the carpet. Donna strategically sets her two
reading tables on opposite sides of the room in her first-grade classroom so that the volume does not distract simultaneous reading groups.

Student choice in where to work was noted in all three participant interviews and observations. Student choice seating is defined in this research paper when teachers allow students to choose the space in the classroom and the appropriate furniture for learning. Predominantly, student choice seating occurred during learning rotations when the teacher is working with a small group at a small group table and the other students are assigned learning tasks to completed independently or cooperatively. One participant cited the movement and freedom to choose where to learn stymies boredom. All participants offered student choice seating when students area working with technology, reading independently, and playing instructional games. Assigned seats were observed during whole group, teacher-led instruction, at desks and/or on the carpet.

One participant, Erin, discussed the idea of “flexible seating” during our interview and defines it as:

Flexible seating to me, truly means that they have choice of where to sit, that’s the first thing. Um, they have the equipment of different items to sit in. So, you know, it’s not just a chair, but you have a bouncy ball and a swivel chair, um, standing desks if they want to stand. I know, sometimes I work better standing. (laughs). Um, so they have that as well. But I think choice is the biggest thing for me, for flexible seating.

Students were observed navigating the room independently and choosing areas and furniture of their liking. Students in this class adjusted tables for appropriate spacing throughout the lessons. There was one period during the observation in which all students were working on the floor, some using carpet squares. However, most of the
independent and cooperative learning took place on the clover tables with open and free dialog between classmates.

Other findings

Throughout the in-class observations, it was recorded that the classroom design and furniture layout did not change during the day. Tables and desks stayed consistent from student arrival through dismissal. Teachers stated during interviews that they did not plan to adjust the layout during the lesson. Furniture in all classrooms was not on casters, which would make furniture adjustments cumbersome.

Technology

The observed classrooms in this elementary school were all afforded with ubiquitous access to Chromebook laptops. Chromebooks, in this setting, are laptops with Internet connectivity but lack a hard drive. Students have unique and secure login credentials which give them access to district-approved Internet sites and applications. To facilitate navigating the various learning programs and applications, the district purchased a license for Clever, which is a single login platform that brings the students to all of the available programs. This eliminates the need for students to remember numerous username and password logins and facilitates the sign-in process. Students were observed to not have any issues with accessing technology and digital programs. Technology played a feature role in all classrooms, to varying degrees, with all students having equal time and access. Each classroom was also equipped with three iPads, however they were only used in two of the three classrooms. In Erin’s 4th Grade classroom, the iPad was used as a presentation tool where students rehearsed presenting slides to classmates in small groups. In Teri’s 1st Grade classroom, the iPads were used as a rotation activity and allowed students to work cooperatively playing
Osmo games. Osmo is an interactive technology using iPads that allow students to manipulate letter and number tiles to answer game-like questions. Class sets of iPads are available from the media center, but all participants responded that they do not take advantage of this often. Teachers cited the difficulty in downloading apps and the scarcity of devices as the main reasons why they are not integrated more regularly into lessons.

The following sections are the major codes that developed through interviews and observations of the participants as they related to technology in the classroom. As stated above, technology was used throughout every lesson and observation conducted on site and was planned for in the teachers’ preparation for the day’s lessons.

**Assessment**

All participants spoke at length about the digital tools available to students to assess and monitor their progress through a learning continuum. There are numerous digital tools available to students and teachers to track progress in reading and mathematics. The digital programs that were most mentioned and utilized in the classroom were Reflex and Freckle (math) and myOn, Raz-Kids, and iReady (reading). Donna spoke highly of the programs and data collection capabilities:

Freckle also gives me great data with their fact practice or I can assign them different areas that they need, addition, subtraction, story problems, and fact families. And they can do that work, and then I can see the data on how they performed.

She also noted that the students enjoy their time on the reading programs and do not know that they are being assessed while reading books on their reading level.

Teri spoke at length about the adaptability features of some of the digital tools that allow students to work on a task at their present readiness level. The programs can
monitor student progress and tier instruction to the individual student. Students sitting
next to each other on the same program may be getting different experiences based on
the amount of correct and incorrect answers they provide. Teri notes how this
information is helpful when designing lessons and remediation or enrichment activities
for her students. She also commented on the ability of the programs to assign select
groups of students extension activities to challenge them beyond the normal curriculum.
She noted one student who is currently working at an “8th Grade level” in mathematics.
During the observation, he was assigned an alternate activity involving volume on the
digital program Freckle to complete independently. All other students were assigned a
different task. When asked about monitoring the data, the teacher reported that she
reviews progress at the end of the class period and uses the information for targeted
instruction during the next day’s flex period. Erin noted that she receives weekly reports
on student growth and gives access to the reports to the students so that they know
how they are doing and are benefitting from the program.

Observations in all classrooms demonstrated class-wide use of digital
assessment tools in all content areas. Digital assessments was mostly assigned as a
station during instructional rotations in both reading and mathematics. All students had
an opportunity to access digital assessments, as assigned by the teacher. Students
accessed the programs autonomously and completed all assignments willingly.
Students were permitted to use the Chromebooks anywhere in the classroom, most
chose to work at their desks.

**Frequency**

Teachers reported in their interviews and demonstrated during observational
rounds that students use the Chromebooks every day. One participant estimates that
40% of the school day is dedicated to student-on-device time. Donna noted that she finds the Chromebook use successful because while she is working with a reading group, other students are reading a book on iReady for 20 minutes every day. Observation records indicate student usage during all content areas taught. The only technology that was used that was presented as a whole-group exercise was a science video on opaque and transparent in Donna’s class. The video clip was presented on the overhead projector and students sat at their seats and watched the instructional video. The video was used as an instructional tool as well as a demonstration for a hands-on activity. While students used Chromebooks throughout the lessons, they were primarily used as a 1:1 learning tool with little collaborative uses. Students were permitted to use the entire classroom as a learning space with the Chromebooks, however most students chose to work at their desk or table.

Tablets were used as a regular part of instruction in Donna’s 1st Grade class, serving as a learning station during math rotations. Erin’s class used one iPad while students were rehearsing a presentation they would be delivering to the class at a later time. The tablet’s purpose in this activity was to serve as a display for presentation slides. Tablets were not used in Teri’s classroom, which was expected as she discussed in her interview that they were seldomly used by her students.

**Independent Learning**

Throughout the observations all technology use in the classroom was designed to be a one-to-one experience where students interacted solely with assigned digital program. Students were observed sharing screens to show classmates what they were working on, but the classwork was not designed to be collaborative. When technology was assigned as a center activity, the students retrieved a Chromebook from the cart.
and logged in to access a digital program. The only collaborative feature that was used was in Erin’s class. The class was learning about Greek mythology and she assigned a research packet to the entire class via Google Classroom. The research packet was to be completed independently, but all submitted work would be facilitated through the collaborative Google platform. The teacher can review student work, leave comments, and make suggestions on submitted assignments for each student. While this assignment was observed on its first day, the manner in which students accessed information, the lack of questions, and the way they initiated research tasks indicates that this infusion of technology was a regular part of the teacher’s instruction.

Adaptive Technology

During teacher interviews, participant responses to interview questions about technology use in the classroom elicited strong reactions to the personalization capabilities of the digital programs. One participant said of the adaptive capabilities, “it provides a little bit more privacy between the teacher and the student.” The participants all discussed how the Chromebooks allow for students to work “on their level,” which speaks to the individual nature of the programs that are assigned.

During the observations each classroom allocated time during literacy and math instruction for students to login and access digital tools provided by the district. With unique login credentials, each student had a different learning experience depending on their success using the program. The teachers responded during the interview that the program tracks each student’s activity and that the programs can personalize the digital learning experience. During the observation in Teri’s classroom, she had one student working ahead of his classmates in mathematics as his digital learning experience assigned him higher level. While students were working independently on fluency facts
on Reflex math, one student was working on geometric shapes and finding angle measures. Similar assignments were delivered digitally in the other classes during literacy instruction. When students accessed digital reading programs, like myOn, they were immediately provided with leveled texts in a variety of genres to encourage high-interest participation.

**Chapter Summary**

The results of this study were presented in this chapter organized by themes. Participants in this study have demonstrated creative and sound pedagogical practices, a commitment to infusing technology into daily instruction, and an interest in exploring how the classroom environment supports teaching and learning. During this chapter, participant’s responses to questions about pedagogy, space, and technology, and follow-up observations have been reviewed and reported accurately. While all participants described and demonstrated an awareness of the three factors of the PST framework, differences in their execution and planning presented themselves. Throughout this chapter, insight into the teachers’ planning and execution of the relationship among pedagogy, space, and technology had been explored.

**Teri**

Teri, a 5th Grade teacher and the most tenured participant in this study, considers the design of room to encourage collaboration and student gatherings. She wants to design areas of the room that are comfortable and inviting for students to gather in. She believes the classroom should provide enough space for the students to move around the classroom freely and have easy access to learning materials. Of note, Teri stated that she considers comfortability and student grouping more when designing literacy instruction and more technology and independent learning than when designing math
instruction. Teri stated that the areas of the room that work the best are the carpeted area and collaborative table. She said that the students flock to these areas because they invite student discussion as the setting allows for face-to-face conversations and eye contact. Teri referred to these areas as “thinking grounds” for her students. Student groupings, typically done in pods of four-to-five desks clustered together, can vary depending on the lesson and goals as students may be strategically placed depending on academic ability, friendships, or behavior. Classroom management was mentioned first when asked to describe the motivation for her room design. By focusing on management, she ensures productive and on-task conversations, question-and-answer dialog, and partner work. Ideally, Teri feels a well-designed space should be larger than the one she currently teaches in and believes it should have technology more readily available. Classroom technologies, such as tablets and Chromebooks, in an ideal setting, would already be out and students would travel to a station to work on the devices (as opposed to navigating the room with their Chrombook). She also noted that the noise level in a small space is problematic and causes student distractions, especially when working with students in a small group.

Teri believes successful lessons begin with high levels of student engagement and application of learned skills through purposefully designed learning tasks. Teri defines engagement as active listening and participation throughout the lesson. These tasks can be projects, demonstrate understanding in technology-based tasks, or independent practice assessments. Typical lessons are created using a workshop model design that include whole class direct instruction, small group instruction, and learning stations. Teri stated that her stations include a technology station, a game
station, and a research station. She believes successful lessons are when these stations run smoothly, which means on-task behavior and demonstrated understanding of the lesson objectives through observation and formative assessments. Teri states that she fosters a learning environment that encourages student independence and autonomy. She wants students to find answers to their own questions through student discussions and online research. The teacher’s role, in her room, is that of a resource for learning, not the lone source of information. The best way to accomplish this goal is through small group instruction which allows for more student interaction and meaningful interaction with the teacher. The small group also allows for greater opportunities for lesson differentiation and personalization.

Teri stated in her interview that technology is used every day through adaptive programs that track student progress and offer personalized experiences every time a student logs in. This is helpful when working with struggling students because Teri can access a digital program, identify the standard which is presenting a problem, and prescribe remediation activities for the students to complete. Technology is used in multiple ways such as links to games, a website to support a lesson, or problem-solving worksheets. Teri mentioned that technology facilitates the teacher’s ability to create stations and activities. Finally, Teri discussed how much her students love using technology in the classroom and use their Chromebooks whenever possible. The students are permitted to use their devices throughout the room, even in the hallway if the students so choose.

**Donna**

Donna, a 1st Grade teacher with the largest classroom, worked with the youngest learners in the study. Her classroom also hosted a second teacher, as dictated by
student IEPs (Individual Education Plan). Donna prioritizes student grouping when designing her classroom so that cooperative learning activities are effective. She believes in frequent movement for students throughout the room and noted that students should never be sitting idle for longer than 20-minutes. She believes a well-designed space should offer students multiple options for learning, such as collaborative spaces for paired learning and comfortable seating options for reading and independent work. Donna clusters her desks and groups students heterogeneously to encourage conversations. Donna believes the most effective spaces in the classroom are the small-group tables on each side of the room because this is where students can work closely with each other as well as the teacher and away from any distractions. Outside of some concerns about crowded spaces near the cubbies for morning and dismissal routines, Donna is very satisfied with the classroom design and the many options available for the students.

Donna’s goals for her lessons are high levels of student engagement, excitement, and motivation for learning, especially reading - which she says is the favorite part of the students’ day. Donna designs multiple opportunities during lessons for turn-and-talk sessions and open-ended questions that aim to elicit deep understanding of taught material. She meets with students everyday during small group instruction and designs her instruction using a workshop model. Typically, there are three different rotations during reading and math workshops that are set throughout the classroom. The small group instruction center allows Donna to remediate or enrich appropriately. Donna notes frequent assessment, through digital tools and observational notes, allow for small group instruction to be appropriate for the students’ academic
ability level. Donna’s room has multiple small group tables throughout the room to conduct these small-group lessons, as well as opportunities for students to gather and work side-by-side and socialize.

Donna was the only participant that stated that she used her iPads as a center during instruction. The interactive, game-like program Osmo is well-received by her students and is an effective resource for building words and manipulating geometric shapes to create familiar images. Chromebooks are also planned for instruction everyday as students log in to various digital assessment programs purchased by the school district. Donna stated that the students are very fond of the literacy programs because they get to choose high interest books on their reading level. The Chromebook programs allow Donna to assign students with learning tasks that are on their level and provide her with relevant data that help inform student grouping.

**Erin**

Erin, a 4th Grade teacher, designed a classroom featuring different furniture and seating options than the other participants. The classroom had clover-shaped tables with higher elevated chairs, in place of traditional desks seen in the other classrooms. Erin considers student needs when designing her classroom, ensuring all students are comfortable and have equal access to resources. Erin also clearly articulated how instructional content is considered when designing her room. Specifically, science and social studies were subjects that she designs many projects and hands-on activities which require partner work and collaboration. Erin believes the U-shaped design of her tables around a large communal space in the middle with a carpet facilitate communication and class discussions. Erin stated she also struggles with the size of the classroom and the number of students in the room. She said she often feels cramped
due to lack of space. Her classroom supports instruction by affording students the flexibility to “perform in a space” in which they are most comfortable. She believes comfortability directly relates to student success.

Pedagogically, Erin plans lessons that encourage higher-level thinking and creative learning. She believes that students are able to learn independently through digital resources so it is her responsibility to challenge them to think about and apply their learning. She believes strongly in direct and guided instruction for core subjects like math, reading, and writing, whereas science and social studies lend themselves more to learning through investigation. She evaluates learning through assessments and informal check-ins which are ongoing and occur throughout the school day.

Erin believes the greatest advantage of the technology in the room is how it is able to reach all learners, despite varying learning abilities and styles. She posited, “sometimes a digital resource can teach better than we can.” She mentioned applications that are used to supplement her instruction, such as Pear Deck, Achieve3000, MyOn, Khan Academy, and YouTube, which allow for students to engage with each other using technology. However, these cited programs were not present during the classroom observation. Erin estimated that approximately 40% of instructional time is spent on technological devices and programs.
CHAPTER 5
DISCUSSION AND IMPLICATIONS

This chapter discusses the findings of teacher conceptions and implementation of lessons that consider pedagogy, space, and technology. The findings are explored in relation to the research questions that guided this study, as well as the literature that provided its foundation. The chapter concludes with a discussion on implications, limitations, and recommendations based on the findings.

Summary of Study

The purpose of this study was to explore elementary school teachers’ conceptions of the relationship among pedagogy, space, and technology when designing instruction, and how these conceptions materialized in practice. Specifically, this study sought to understand how teachers plan for, and execute lessons while considering the variables of pedagogy, space, and technology in an elementary school and how these plans fit in the PST Framework.

The findings are presented in terms of how they fit into the PST Framework and the connections that formed between and among teacher pedagogy, learning space, and classroom technologies. The intersection between these components are analyzed and discussed in terms of how closely related the teachers’ conceptions of the relationship among pedagogy, space, and technology were implemented in their lessons. The intersections between pedagogy, space, and technology describe the relationship between the components and how each one can maximize the effectiveness of the other. Additionally, the conceptual framework for this study, as well as existing literature on learning space design and integration of learning technology, provided an outline for the presentation of the findings. The conceptual framework
provides the findings with a research supported foundation to analyze the results and potentially springboard additional studies on this topic.

To understand the experiences of teachers’ conceptions and implementation of the relationship among pedagogy, space, and technology in lessons, the following research questions were addressed:

- How do elementary school teachers conceptualize the relationship among pedagogy, space, and technology when designing instruction?
- How do elementary school teachers’ conceptions of the relationships among pedagogy, space, and technology materialize in their practice?

The following section discusses the findings related to each of the research questions and the literature which provide a foundation for this study.

**How Do Elementary School Teachers Conceptualize the Relationship Among Pedagogy, Space, and Technology When Designing Instruction?**

The Pedagogy Space Technology Framework flow chart was used when evaluating the qualitative data from multiple elementary school teacher interviews to understand how they conceptualize the relationship among pedagogy, space, and technology when designing instruction. Figure 5-1 demonstrates how each component for planning an instructional lesson influences each other. The findings for teacher conceptions of the relationship among pedagogy, space, and technology, follow this design and are presented in terms of the connections between the factors.

![Pedagogy Space Technology Framework](image)

Figure 5-1. Pedagogy Space Technology Framework (Radcliffe et al., 2008)
Space and Pedagogy

Across all three participant interviews, a universal response from the teachers indicated a strong desire to design their learning space to encourage collaborative, partner-based lessons. Through purposeful clustering of the desks and tables, strategic student groupings, and purposeful placement of ancillary furniture such as carpets and alternative seating options, teachers indicated a strong understanding of how space encourages pedagogy. Despite complaints about the physical size of the classroom from two of the three teachers, each participant described how the desks are clustered to encourage meaningful discussion between students and groupwork participation.

Teachers explicitly indicated a desire for the students to feel comfortable and safe in the classroom which supports an implicit understanding of the central ideas of environmental psychology. Russell and Ward (1982) support this position in that there is a strong relationship between people and their environment. Student behavior is shaped based on their surrounding instructional and social environment (Pekrun et al., 2002), which is demonstrated in the classroom with the clustered desks, carpeted areas for gatherings, and open classroom libraries.

There was a strong belief demonstrated and articulated by the participants that students should not sit idle and be passive recipients of knowledge. The teachers prepare lessons that encourage creativity, collaboration, and problem-solving. They design lessons, especially in science and social studies, that ask students to create projects and present to the class. During math and ELA, lessons are designed using a workshop model where students navigate the classroom independently to centers where they are tasked with different activities that require them to apply the learned skill from the day’s mini-lesson (ten to 15 minute whole group instruction prior to center
rotations). The classroom supports these learners and designing lesson goals that also include student movement around the room, strategic arrangement of furniture, and student ownership of the learning space. Teachers vocalized how students move around the room and travel to different learning centers, sometimes working independently and other times working in small groups with teachers. As supported by Taylor et al. (1997) there is a purposeful congruence in design of the classroom between the learning environment and the physical space, which students prefer to learn in. The teachers commented on developing a learning space that is both safe and comfortable, while allowing students the autonomy to move around the room and adjust the space as the deem necessary. Especially in literacy instruction, the teachers used the term “cozy” often which is supported by their addition of soft furniture options and personal carpet squares that offer students this purposeful environment of coziness.

**Technology and Pedagogy**

All classrooms were fitted with 1:1, student-to-technology, access. There were Chromebook carts in each classroom which afforded students the opportunity to access the Internet and digital tools. The ubiquitous access to technology, as supported by Dunleavy et al. (2007), can allow teachers to design lessons that afford learners new avenues for learning and collaborating, both synchronously and asynchronously. All teachers spoke about how they incorporate technology into their lessons daily and that the students enjoy working with their devices. The programs used in the classroom are purchased by the district and provide the teachers with various supplemental resources to support lessons and facilitate data collection. The teachers spoke about their favorite programs and how the data collected is used to determine student groupings. The teachers spoke at length about the different math and literacy programs that are utilized
daily that allow students to login and complete lessons and activities that are personalized to their ability level. The programs are adaptive, spoken specifically as such by Teri, and track student progress so that when students log in they are challenged appropriately; their reading programs are appropriately linked to student reading levels and math programs track fluency to increase rigor after each successful response. During interviews, the participants spoke about the voluminous data that is collected from these programs and how they assist teachers with creating lessons that are tailored specifically to the students’ immediate needs in that content area.

Assessments have been a staple in classrooms well before ubiquitous technology made its introduction, however the amount of data readily available to teachers and the corresponding adaptive capabilities of the programs have reshaped how teachers plan instruction. The programs allow teachers to print student achievement reports by standards or skills. Mining assessment data can be a cumbersome undertaking, however the immediate user-friendly reports allow teachers to design instruction that is specific and on-target with immediate student needs and allows for quick remediation of skills that are lacking. The support for students is typically done during small group instruction center and can be remediation, enrichment, or on-grade-level teaching.

When asked how often this data is analyzed the teachers reported looking at the data multiple times a week - both independently and during data meetings with colleagues. Teachers reported using technology in science by playing media clips from a science specific website. The teachers reported that these videos were highly engaging for their students and provided teachers with hands on projects that accompanied their lessons.
Technology was also prominently planned for during workshop model lessons as each participant included a technology center in each content area. The technology center is designed to be an independent practice opportunity for students to choose a digital tool from a menu provided by the teacher. The programs that were discussed during the interview were all independent assessment applications, with the exception of Donna’s iPad station and whole-class science lessons that were disseminated through a multi-media video clip.

**Technology and Space**

Analysis of participant responses does not indicate the same level of understanding of the relationship between technology and space as was indicated in the other relationships. Figure 5-1 depicts the considerations for a success link between space and technology. Learning spaces should act as the channel that enables the convergence between technology and pedagogy (Oblinger, 2005). While participants placed importance on each factor independently, their responses demonstrated little indication that there was a purposeful synapse between them. Classroom technology can extend the learning space by providing students learning opportunities that go beyond classroom walls. The technology that was planned for was designed as independent learning stations. The current use of the technology, as planned for by the teachers, is as a component of the classroom to conduct assessments and engage in personalized learning experiences. It was not designed to be collaborative hub where students can gather and work cooperatively on research simulation projects or research tasks. When discussing the learning space, participants did not indicate that learning could be extended outside of the school and how technology can be the vehicle to augment and redefine the learning experience. Responses to learning space questions
were focused only on the physical structure of the classroom and not the potential for anything outside of the classroom walls. Teachers did indicate a room in the building, an annex off the media center, that features collaborative technology screens with interconnected capabilities between devices and a large display screen where they can reserve time for students to visit, but most said it is not often that they take their students there.

**Other Considerations**

There are myriad factors that must be considered by elementary teachers when designing their space and the lessons to be taught. Unlike other industries and professions, there are many larger social forces in the ecology of schooling that must be considered by teachers. Factors that can contribute to a room design, a teacher’s pedagogical practice, and the technology offered in a classroom, include student test scores, teacher evaluations, pressures from administration and parents, and technology purchased by the district that does not necessarily support creativity or collaboration. While these factors were not explicitly mentioned during interviews or collected during observations, I know from experience as a teacher and administrator that outside forces that cannot be accounted for can influence the pedagogy, space, and technology decisions of classroom teachers.

**How Do Elementary School Teachers’ Conceptions of the Relationships Among Pedagogy, Space, and Technology Materialize in Their Practice?**

Observational data was collected and analyzed for each participant. Interviews prior to the observations informed the researcher of instructional goals for the day’s lessons. Observations were conducted over the course of one school day, approximately seven hours of instructional time, and spanned all major content areas.
Interview data guided the observation and provided the researcher with a lead into the lessons that were planned that day and the instructional goals set by the teacher. This section will summarize the findings of the observational data, supported by research, and present how aligned teacher plans were with their instructional practice.

**Zones for Learning**

All teachers designed their classroom in similar fashions, which was articulated during interviews and confirmed during observations. The design of the classroom was purposeful to address different learning activities presented throughout the lessons. There was a designated area for whole group instruction where lessons were teacher-led, and students congregated to listen and participate in the mini-lesson (term used to describe the 10 to fifteen-minute whole group instruction component of workshop model). This area was a defined large, open, carpeted space near the teacher’s instructional easel. Another designated area that was consistent across all classrooms was a space where students could gather freely, play games, read, and work together. This area had non-traditional furniture options and elicited a feeling of comfortability and student ownership. Along the perimeter of each classroom were collaborative tables for small group instruction and guided conversations with teachers. These areas are where targeted instruction takes place using a small group instruction approach with four-to-six students working directly with the teacher. This structure was consistent throughout the observed classrooms for ELA and math instruction. The final component to the room design was a technology base that housed Chromebook laptops for all students. Students were given the autonomy to use the device wherever they felt most comfortable. While some students worked on the carpet, most worked independently at their desks.
These zones demonstrate a keen awareness of a constructivist learning environment. The room is designed to encourage conversation and social support, while lessons focus on problem solving and conceptual development. Students are encouraged to work cooperatively in activities that require exploration, articulation, and reflection. The adaptive technology in the room allows for appropriate scaffolding of materials, while the workshop model of instruction allows ample teacher-led support and modeling during small and whole group instruction. Constructivism was overtly present when teachers were describing their lesson and rationale for room design and pedagogical practices, as well as in practice with the design of their classroom and implementation of the lessons. Through purposeful arrangement of desks, carefully designed lessons that encourage collaboration, and allowing student ownership of the learning environment, the teachers fostered a constructivist learning that is supported by existing research (Hermans, Tondeur, Braak, & Valcke, 2008; Lee, Morrone, & Siering, 2018; Ng, 2015; Taylor et al., 1997).

The purposeful design of the classroom to have distinct areas for student gatherings with different learning expectations attached to them aligns with Thornburg’s (1996) vision of optimal learning zones in each classroom. He positioned that each room should have four zones that encourage independent thinking, direct instruction, collaboration, and exploration. Some of these ideas morphed together in the design of the observed classrooms, such as clustered desks used for independent practice on laptops and collaborative group work, but the planning for, and execution of specific learning zones was evident.
Active Learning Spaces

The Next Generation Learning Spaces (NGLS) (Byers et al., 2014), Technology Enables Active Learning (TEAL) Environments, and SCALE-UP projects (Dori & Belcher, 2005) presented research on active learning spaces in high school and higher education classrooms. Active learning classrooms integrate emerging technologies, provide sufficient room for informal learning spaces, areas for student collaboration, and flexible design for adaptability to learning goals (Byers et al., 2014). Active learning classrooms are in stark contrast to the traditional design of desks in rows, facing the teacher who disseminates all information from the front of the room. The participants in this study indicated an awareness of that stale model and purposefully design their room to enable as much maneuverability as possible, create multiple opportunities for student interactions throughout the room, and lead instruction from multiple points in the room. There was not a true front of the room in any of the classrooms that were observed. Teachers articulated the motivation for a space that allowed students to move freely, have easy access to materials, be comfortable and safe, and work collaboratively. The design coincided with teacher desires for a space that centered on high levels of student engagement. Individual desks were clustered together to form tables in Donna and Teri’s classrooms, while Erin had clover-shaped tables in the room in lieu of desks. There were communal learning spaces around the perimeter of the classroom and limited restrictions on accessing any learning tool in the classroom. The classroom appeared to be a shared ownership space between teacher and student, which coincides with Byers et al. (2014) research on active learning spaces. During instruction, students moved to different parts of the room to engage with learning tasks.
The teachers did not designate where learning had to take place, therefore the rooms were constantly active and fluid.

The component of active classrooms that was absent in all classrooms was the notion that the room adapts to the content being taught. Research supports classrooms that are flexible enough to adapt to instructional goals. For example, if the lesson is designed for student collaboration, the furniture and the room should morph to a collaborative environment where tables, chairs, and technology work to support this goal. In contrast, should the lesson be designed for independent practice or partner work, the room can quickly adjust to support this instruction. This is especially important in an elementary classroom where students are typically contained in one classroom throughout the day and receive all the content in one learning space. Teachers did not present this idea as an option, nor did they seem aware of this possibility. When asked directly if the room transforms at all during the school day, responses universally were negative. Their lessons did not indicate that maneuverability and flexibility of the room to match pedagogy has ever been an option. It is worth noting that the furniture in the room did not have casters so affording students and teachers the ability to manipulate the room throughout the day would likely prove to be cumbersome and time consuming.

**Role of Technology**

Teachers were inconsistent in their deployment of technology and matching their instructional goals. Teachers communicated during the initial interview how the Chromebooks facilitate collaboration and group work, in addition to independent formative assessment practice. They discussed how the classroom technologies and digital programs are engaging for the students and how much they enjoy the programs. Teachers loosely defined student engagement in their terms as students being on task
and demonstrating enjoyment and enthusiasm for learning. In ELA and math, the devices were only used during center activities and instructed for independent use only.

Students logged in, accessed their learning program, and worked through a learning module without interaction with peers. Collaboration or sharing laptop screens was not present during time with laptops. Despite being able to use the Chromebooks wherever they chose, tech use was primarily conducted at their desks. Only in Donna’s class where iPads were used was technology used as a group activity. Students worked in pairs at an iPad to complete word building activities. This activity appeared to engage students as evidenced by their excitement and cooperation in completing learning tasks.

Donna and Erin used multi-media videos to support science instruction which succeeded in content delivery and student engagement. The videos offered students detailed information about science-themed topics and guided them through a hands-on activity to recreate stained glass and robotics hands using classroom materials. During this time, students were moving around the room, working together, discussing their models, and supporting each other in understanding the material. The students demonstrated high levels of on-task behavior when using Chromebooks, which matches half of the teachers’ definition, but there was little evidence to support their high levels of enthusiasm when working independently on math and literacy programs.

The International Society for Technology in Education (ISTE) provides teachers in grades K-12 with a comprehensive scope and sequence to “identify prerequisite skills and recognize students’ proficiency and progression across grade levels” (International Society for Technology in Education, 2000). The most recent iterations of these standards goes beyond technology as a tool for learning, and now has clear
expectations that students will use technology to take charge of their learning. With collaboration being a goal all teachers shared for technology use in lessons, ISTE standards for this skill for Grades 4-5 require students to be at the developing stages of:

- synchronous collaboration using tools like video conferencing
- use virtual world and gaming tools to work collaboratively toward common goals
- use social media tools to connect, collaborate, and share

While these are a sample of the communication and collaboration standards, they highlight skills that were absent from the lessons. The resources and tools were available to teachers, as was the academic freedom to design lessons that modify and redefine learning using technology, but the lessons were barren of these applications. In these lessons, the students were consumers of the technology in the classroom, not producers. The adaptive technology was deployed as a tutor and tool for learning (Bull, 2009), a familiar challenge for schools. These findings align with the research of Cuban (2001) and Conlon and Simpson (2003) who argue that teaching and learning have not significantly changed as a result of increased classroom technologies. Some of the reasons for the lack of impact technology has had on teaching and learning, such as heavy demands that are made of teachers generally, lack of skill in the use of instructional technologies, and lack of motivating examples of use in curriculum (Conlon & Simpson, 2003). These barriers, once identified, can be used to build meaningful professional development to support teacher growth in this area.

Research Implications

The results from this study provide insight into the elementary school teacher lesson planning preparation process and lesson implementation with consideration for pedagogy, space, and technology. The data highlighted participants’ consideration for
how pedagogy, the physical learning space, and technology are connected and how their application in lesson delivery. The following sections describe the study’s findings, impacts, and suggestions relating to the elementary school setting and concludes with its contribution to the current literature on the topic of study.

Professional Practice

As principal of an elementary school that offers students and teachers similar learning environments and educational resources and technologies, this study presents valuable information to support teachers’ purposeful implementation of space and technology into their pedagogical practice. Currently, there is a trend in elementary school education to rethink spaces and offer students flexible seating options. There are many vendors, workshops, and social media posts that highlight colorful classrooms with creative seating options that are inviting to students. While there may be value in a room that is aesthetically pleasing to students, especially from an environmental psychology standpoint, the teacher must be able to successfully link the classroom to their pedagogy and available technologies. A strong understanding of the PST Framework and how each instructional factor must be linked to each other to optimize learning conditions must be present or else the classroom does not operate at full effectiveness.

As an educational leader, the research allows me to better understand what elementary school teachers consider when designing lessons and offer suggestions and feedback for how they can improve their professional practice. This can be done through formal professional development sessions, teacher workshops, or simply collegial conversations with staff about the connections between pedagogy, space, and technology. The PST Framework flowchart can drive professional development
conversations and action. The flowchart provides teachers and administrators with a clear visual for the connectedness of pedagogy, space, and technology. The flowchart can frame conversations and allow teachers to focus attention on a synergy they want to create in their classroom. As an educational leader responsible for delivering high quality professional development I would first look to understand teacher goals for lessons and the motivation for the design of their space and their use of technology. This would be followed by nonevaluative observations where I could see their conceptions materialize in practice. This nonevaluative observation can be supported by the LPTS observational metric (Byers, 2016a). Finally, the observation would be followed up with a post-conference to discuss my findings and support growth in this area. Similarly, with a strong understanding of the existing research to support this study, I feel confident in working with administrative colleagues to support their understanding of the PST Framework and how they can support staff in their own buildings. It is very easy to get caught up in an educational fad and spend limited financial resources in chasing the new status quo, however, equipped with a researched-backed understanding of how to integrate technology within the learning space to maximize teaching and learning potential, administrators can feel empowered to make sound decisions when considering redesigning learning spaces.

Professional Context

There was a large gap in literature on evaluating learning spaces in elementary schools. Elementary school principals must be able to demonstrate sound decision making that is supported by research when supporting teaching and learning in their building. Added research in the field of evaluating learning spaces and ensuring proper synergy among pedagogy, space, and technology is imperative when supporting
teachers and making financial decisions on classroom resources. Understanding how to maximize teaching and learning by strategically preparing the classroom and technology allows school leaders to have meaningful conversations with their staff to improve their practice.

Additionally, given then the narrow scope of technology integration into the lessons, a deeper look into integration strategies needs to occur. There was a noticeable difference in how teachers planned for technology integration and its impact on learning. The teachers described the technology as a collaborative tool for learning and appreciated the adaptive capabilities of the software programs used in the classroom. In reality, the technology was used more as a tutor for learning rather than a transformative tool to enhance pedagogy. It would prove prudent for educational leaders to consider these findings and support teacher understanding and professional growth in technology integration into lessons. Sustained, expertly guided, and job-embedded professional development in this area would be an appropriate next step to maximize the benefits of instructional technology in the classroom. Ideally the comfortable role of technology serving as a tool and tutor for learning can be transformed into a medium that redefines teaching and learning.

**Limitations**

This study aimed to explore elementary school teachers’ conceptions of the relationship among pedagogy, space, and technology when designing instruction, and how these conceptions materialized in practice. Through the examination of this study, various limitations were identified. In this section, the timing of the data collection in the school year, the research setting, sample size, the learners, and architectural design were all limiting factors.
Timing of Data Collection

Data collection for this research study was conducted during the spring semester, which greatly impacted the results of the classroom observations and how teachers design their lessons. Especially in an elementary school, the initial months of September and October are spent instilling routines and building up to independent learning for the students. Typically, teachers during this time have a great focus on classroom management and establishing trust with their students and their ability to use technology appropriately, especially the younger learners. Had the research been conducted during this semester the responses and observations of lesson planning and execution could present differently than the data collected during this window of time.

Research Setting

The research was conducted in an elementary school with traditional classrooms but with access to resources not standard among all public schools. The classrooms were fully equipped with 1:1 device-to-student ratio, desks and/or tables for every student, full complement of digital tools purchased by the school district, and class sizes between 18-20 students. It is understood that these conditions are not typical in elementary schools across the state and region. The school is fortunate to have these affordances for their students and teachers to enhance learning and make the environment as physically comfortable and well equipped as possible. School districts that have different circumstances for their children could produce different results if the study was replicated.

The setting also focused solely on general education classrooms. While special education students and teachers were also included in the classroom, the focus was on general education classrooms because of the size of the room and the number of
students that populate the class. Teachers in a general education classroom design lessons that are designed to address learning standards, while special education teachers’ lessons are designed to address both learning standards and individual goals for each student. The technology and resources available in special education classrooms are so varied depending on the needs of the learners that it would be difficult to generalize their responses to allow transferability to other elementary school contexts.

**Sample Size**

To enable a successful completion and detailed analysis of this study under certain time restrictions, only three participants were chosen for this study. While the three participants selected produced enough data to form detailed conclusions and results, a wider net of participants could strengthen the findings. A greater participant pool would allow for greater opportunities to understand teacher conceptions of the relationship among pedagogy, space, and technology and offer varying perspectives of their understanding and implementation. Interviews and classroom observations are time consuming data collection methods, however more participants could benefit the validity of the data and ensuing results.

**Learners**

Most studies that have been conducted using the PST Framework have been conducted when evaluating learning spaces at the higher education level. However, the purpose of this study was to use the PST Framework to evaluate elementary school teachers and their learning spaces. While this fits into the context of my professional practice, it has a relatively narrow scope. The age of the learners, their level of independence, and limitations on assignments that can be done via technology only
allow for the research to go as far as the students’ abilities. A narrower focus on the upper elementary grades, such as grades four through six, can strengthen this research study because the students are expected to be more independent thinkers and are allowed more freedoms with technology. Classrooms with more mature learners may stretch the collaborative abilities of the available technologies and design projects and assignments that encourage more group work. These possibilities could alter the way the classroom looks and operates, as compared to the observational data collected in this study.

Another limitation associated with this study was the lack of input from the students. It would have been valuable information to have spoken with students in each classroom to gain their perspective of the design of the space, what they want in a classroom, and understand which aspects of the space and classroom technologies work best for them.

**Architectural Design**

One of the major advantages of the PST Framework is its ability to not only evaluate current learning spaces, but also help to design new ones (Radcliffe et al., 2008). The spaces in this study were already established and teachers were limited in the furniture and technology offerings due to budgetary constraints. Teachers are provided with school purchased furniture and technology devices. Teachers have little-to-no control over the space or furnishing therefore there is little maneuverability in adapting the room and technology to fully match pedagogical practices.

**Recommendations for Future Research in the Field**

The current study focused on exploring how elementary school teachers consider the relationship among pedagogy, space, and technology when designing instruction.
The research addressed several gaps in current literature - notably the age of the learners and myriad content areas taught in a self-contained classroom environment. Based on the findings and limitations associated with this study, other areas of potential research can be considered.

One potential target for future research in the context of evaluating learning spaces at the elementary school level is a narrower focus on one grade level, ideally in the upper elementary grades. A kindergarten through fifth grade focus, as was presented in this research allows for a broad, general view of how teachers prepare lessons considering pedagogy, space, and technology but the varying factors in student abilities is limiting. A strong focus on one grade level, which would include all teachers at that grade level in that school would allow for consistency in data analysis. In this study, analysis of independent learning expectations and technology use had to be tempered for the younger students because the autonomy for learning is less than what would be expected of a 4th and 5th Grader. Replicating this study with a team of only 4th or 5th Grade teachers has the potential for a deeper understanding of how they prepare lessons when considering the relationship among pedagogy, space, and technology.

In addition to a narrow focus on one grade level, incorporating a focus group interview can benefit this study. Ultimately, the goal of this research is to improve teaching and learning. When teachers can sit together and discuss motivations for design or considerations for technology deployment, they learn from each other. A focus group design may trigger ideas and creativity in a participant that was dormant prior to this experience. Allowing colleagues to join in the observation process and offer feedback to each other, as well as the researcher, can produce a more robust
understanding of teacher preparation and execution of lessons when considering pedagogy, space, and technology.

**Summary of Findings and Implications**

The current study used the PST Framework (Radcliffe et al., 2008) to explore how elementary school teachers conceptualize the relationship among pedagogy, space, and technology when designing instruction and how these conceptions materialize in practice. Elementary school teachers who met predetermined criteria for participation were interviewed and observed using an adaption of the PST Framework for evaluating learning spaces. Findings in the study identified that participants demonstrated the knowledge that learning space encourages pedagogy and that technology enhances pedagogy, however there was little indication of an awareness of the relationship between space and technology. Observational data supported these conceptions, though the execution of technology supported pedagogy was limited and failed to truly enhance teaching and learning. While technology was ever present in all classrooms, its use was primarily as a tool for learning, not a redefining element of learning.

Implications of the study’s findings described how their may be discrepancies between teacher conceptions of the relationship between pedagogy and technology and its implementation as well as the disconnect between technology and space. This study presents how school administrators should support teachers in their understanding of these relationships and their potential for positive results in teaching and learning.

Several limitations were identified that were part of the research design and others that were beyond control of the study. Sample size was a limiting factor
associated with the design as was the mixed grades of the classrooms in the study, the timing of the study, and the fixed architecture of the classrooms.

As noted in the literature, there is a direct relationship between the physical space and its impact on teaching and learning (Byers et al., 2014; Imms & Byers, 2017). The learning space should be considered a powerful teaching instrument that can either positively impact teaching and learning or, if ignored, become a barrier to meaningful instruction (Martin, 2002). This study supports existing research that the learning space alone is not enough to influence teaching and learning; there must be a purposeful synergy between pedagogy, space, and technology. Elementary school teachers in this study demonstrated a stronger understanding of the relationship between pedagogy and space, as well as pedagogy and technology, than the relationship between space and technology. Future studies in elementary school teachers’ understanding of the relationship among pedagogy, space, and technology when planning lessons should consider the limitations presented in this study and focus on one grade and expand the number of participants to allow for a deeper understanding of teacher conceptions of pedagogy space and technology when designing instruction. Even more, educational leaders should take these findings and consider professional development in the purposeful design of the physical learning environment and the ability to maximize its impacts on teaching and learning, especially the relationship between space and technology. Affording teachers the opportunity to learn how to ensure technology extends the learning space, such as maximizing educational technology’s capability to transform learning beyond the walls of the classroom, can have a positive impact on instructional lessons and further encourage a constructivist learning environment.
APPENDIX A
INTERVIEW PROTOCOL

(Demographic data to be obtained prior to scheduled interview with teacher)

Time of interview:

Date:

Place:

Educator marker #:

Opening description

• You were identified by your building principal as a teacher who demonstrates exemplary pedagogical practice, effectively infuses classroom technologies into lessons, and considers the learning space as key influencer to effective teaching learning. I am excited for this opportunity to learn from you. The purpose of the initial interview is to learn how elementary school teachers consider the learning space, classroom technologies, and their personal teaching style when designing instruction. There will be a second interview before the observation where we will discuss the day’s lessons and agenda. This interview will help me learn about what types of instruction I will see that day. A final interview will be conducted after the observed lessons and allow for additional questions and feedback about the lesson and describe the outcomes of the day. The focus of this study is only on your considerations toward the relationship among pedagogy, the learning space and technology when designing instruction. Please consider these interview questions in general terms and not tied specifically to a particular content or time of the school year. When asked about lessons and/or classroom spaces, think of a typical lesson or setting and reflect upon that image you have created.

• All responses will be kept confidential and the answers from all teachers I interview will be combined for this report. “Nothing you say will ever be identified with you personally. As we go through the interview, if you have any questions about why I’m asking something, please feel free to ask. Or if there’s anything you don’t want to answer, just say so” (Patton, 1990, p.328).

• Any questions before we begin?

Interview questions adapted from PST Framework (Radcliffe et al., 2008).
Interview #1 – General

**General:**

3. Tell me about what you think about when you design your classroom space.
4. Describe the furniture and technology that is currently available to you in your classroom.
5. Describe how your classroom is arranged
6. What is your motivation for this design?
7. Generally speaking, what does a successful lesson look like to you?
8. What does a well-designed learning space look like to you?
9. What are important elements of a learning space?

**Pedagogy:**

10. During a typical lesson, what type(s) of learning are trying to foster? Why?
11. During a typical lesson, what type(s) of teaching do you find to be the most successful in your classroom?
12. Generally speaking, how do you know if a lesson was successful?

**Space:**

13. Which aspects of the space design work well in your classroom?
14. Which aspects do not work well?
15. What aspects of the design and the furniture support your desired outcomes for instruction?

**Technology**

16. What technologies are available to your students?
17. What technologies are most effective at enhancing instructional practice?
18. What technologies do you find most successful with your students and why?
19. Describe how technology is used to complement the space design and instructional goals.
Interview #2

Conducted on site and before the classroom observation.

20. Describe the learning activities that I will observe today
21. What are your instructional goals?
22. Describe the design of the classroom for the lessons and any modifications you plan to make as the lessons evolve.
23. What role will technology play in today’s lesson?

Interview #3

Conducted via phone or video conferencing, at the end of classroom observation.

24. Describe today’s lessons and the overall success in accomplishing your instructional goals.
25. Which aspects of the space design and furniture worked, and which did not?
26. If you could adjust the space, how would you design it for the observed lessons?
27. What technologies were most effective at enhancing today’s lessons? Why?
APPENDIX B
INFORMED CONSENT

Date:

Classroom Grade Level:

Educator marker #:

- Researcher will schedule convenient time with teacher when students will be present for instruction. Observations will be conducted over the course of one (1) school day, be limited to one classroom setting, and span multiple content areas.
- Data will be collected using a template and codes in written form.

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APPENDIX C
INFORMED CONSENT

Informed Consent Form
Please read this form which describes the study in some detail before you decide to participate

Protocol Title – The elementary school classroom – How the learning space, technology, and pedagogy affect lesson design and instructional practice.

General Information About This Study
I am a doctoral student at the University of Florida conducting research for a degree in educational technology. As a component of my dissertation, I am conducting a qualitative study on how elementary school teachers’ conceptions of the relationship among pedagogy, the physical learning environment, and classroom technologies when designing instruction materialize in their practice. Your participation will allow me to better understand the breadth and depth elementary school teachers consider these factors and the impact it has on daily instruction.

What Can You Expect If You Participate in This Study?
Participants will be asked to partake in three (3) interviews and a classroom observation (1). Interviews will be scheduled at a day and time convenient for the interviewee and last no more than 45 minutes. The observation will span the course of one school day. The interview will be semi-structured which means questions will be scripted, however the interviewer has the flexibility to asking probing or follow-up questions. I will ask a series of questions that ask the interviewee to reflect on their feelings and attitudes about how the physical learning space, classroom technologies, and pedagogical practices impact instruction. You will not have to answer any question you do not wish to answer. I will provide you with a copy of the interview transcription so that you have an opportunity to clarify any response that is inaccurate or unclear.

Confidentiality
All participants will remain anonymous throughout the course of the study and written report. I will be the only person with access to information regarding the identity of the participants. Each participant will be given an identifying number that only I will know. With your permission, I would like to digitally record our interview. Any information that would identify you will be removed from the recording. Once I have transcribed the interview, the audio file will be erased. Observation data will be collected on a standard template that will be shared with you but will be customized depending on the responses collected during our initial interview. Observation data will be confidential and not shared with anyone. The observation is non-evaluative and only used to record data that pertains to the scope of this study. Student data is not included in this research and thus will not be recorded.

Your Participation
You are under no obligation to participate in the interview or observation. You are free to withdraw your consent at any time without consequence. If you decide to withdraw, any data
collected up to that point will be erased and will not be considered during data analysis or included in the final manuscript.

**Risks, Benefits, and Compensation**

There are no anticipated risks, compensation, or other direct benefits to you as the participant in this qualitative study. There are no real, potential, or perceived conflicts of interest on the part of the researcher or the school district involved in this study, and there is no possibility that the research results will be commercialized.

**More Information About This Study**

If you have any questions about this research protocol or the scholarly aspects of this research, please contact me, Paul Baker, at --- --- ---- or my faculty advisor, Dr. Kara Dawson, at dawson@coe.ufl.edu. If you have additional questions about your rights as a research subject, please call the University of Florida Institutional Review Board (IRB) office at (352) 273-9600.

I have read this form and voluntarily agree to participate in the interview. I have been given a copy of this form.

_________________________________________________________  ________________  ________________
Signature of the Participant                                Date

_________________________________________________________  ________________  ________________
Signature of the Student Investigator                      Date
LIST OF REFERENCES


Technology in Education, 48(2), 129–142.


http://doi.org/10.2307/2184941


http://doi.org/10.1207/s15326985ep3902


BIOGRAPHICAL SKETCH

Paul Baker earned a bachelor’s degree in International Business from The College of New Jersey (2003). Shortly after, he completed a teacher certification program at Georgian Court University (2004) where he earned his Teacher of the Handicapped certification to teach special education from Grades K-12. He began his career in education as a high school special education math teacher. While teaching, Paul earned his master’s degree from Rutgers, The State University of New Jersey (2010) in Educational Leadership. Paul has utilized his degree in school leadership to hold positions as supervisor of curriculum, instruction, and special services, assistant principal, and building principal in various public schools in New Jersey. He earned a Doctor of Education degree in curriculum and instruction with a concentration in educational technology from the University of Florida (2019). Due to his experience in school leadership, his research interests include integration of instructional technology into the classroom and the physical design of learning spaces.