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How Does the High School Redesigned Learning Space Influence Collaboration, Communication, Creativity, and Critical Thinking

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by

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APPROVAL FOR SUCCESSFUL DEFENSE

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DEDICATION

My research study and dissertation would not have been possible without the unwavering support and encouragement of my wife, Amy. She recognized that this was important work and knew just how to challenge me to stay focused on the goal of completing the dissertation. Her ability and commitment to help me focus, her time and effort in proofreading, and her words of encouragement throughout what seemed to be an endless process was invaluable. I simply would not have completed this goal were it not for her love and confidence in me. I am forever grateful and fortunate to be with such a loving wife and partner.

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My parents, Kirsten and Peder, continue to serve as excellent parents as well as powerful educator role models for me. I recall as a child, seeing my father sitting at the dining room table working on his own graduate studies while also being a successful teacher. He set the example for me that continuing one's learning is the key to future success.

Along the way, family members including Rita, Barbara, Gary, and Wright, continually provided encouragement and served as cheerleaders along this long journey.

ABSTRACT

This study examined the affect that redesigned learning spaces might have on student engagement levels, specifically the extent to which redesigned learning spaces facilitate the 21st Century Learning and Innovation Skills known as communication, collaboration, critical thinking, and creativity. Using David Ross's work with the Partnership for 21st Century Skills, the study observes the efforts of a suburban high school that has redesigned traditional classrooms into progressive and innovative learning spaces. This qualitative study utilized seventeen, face-to-face interviews with teachers who are teaching in redesigned classrooms to collect their impressions of how such learning spaces influenced engagement. The face-to-face interviews were recorded and transcribed for analysis by the researcher. Upon completion of the interviews, the data was analyzed using a cross-case analysis of the data. Literature suggests that the physical environment may play a role in engagement levels, but the majority of the studies have been conducted in common, larger education spaces, not classrooms. Additional studies have been conducted in redesigned classrooms, but with a significantly younger population and older, college-aged population. This study suggests that redesigned learning spaces in the high school does indeed impact engagement levels in a positive manner. Features such as writable whiteboard tables and moveable tables and chairs provide exceptional support for impacting engagement. In addition, subjects such as mathematics realized unanimous feedback from teachers regarding the positive impact that such redesigned classrooms have had on high school student engagement. Overall, the study suggests that collaboration and communication skills are enhanced at greater levels than critical thinking and creativity.

Keywords: Redesigned learning spaces, flexible furniture, 21st century learning and innovation skills, collaboration, communication, critical thinking, creativity, high school, curriculum.

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CHAPTER 1

INTRODUCTION

Background of the Problem

In 1938, educational philosopher John Dewey opined the primary purpose of a school system was to teach students how to live a pragmatic and useful life by preparing students to function in their current environment (Dewey, 1938). More recently, educational theorists such as David Tyack stated that the purpose of school was to meet the social and economic needs of society (Tyack, 1998). Kathleen Bennett deMarrais and Margaret LeCompte (1995) have quantified four distinct functions of schooling, one of which emphasizes the importance of providing students with experiences and curriculum that will prepare them for their yet-to-be-determined careers. Through these educational philosophers, it can be inferred that the purpose of high school is to provide students with the skills and techniques needed to tackle the challenges they will encounter in their careers; careers which may not exist today.

The world of work today is very different from what it looked like two decades ago and continues to evolve quickly. In fact, the World Economic Forum report on the "Future of Jobs" (2016) states that the number one driver of change in global industries is the changing nature of work; specifically, the evolution of flexible work environments. The report indicates that the changing work environment has already been felt in industry, and the report highlights that technology has allowed organizations to enable workplace innovations such as remote working, co-working spaces, and teleconferencing (World Economic Forum, 2016).

While the workplace is evolving, schools have been slow to modernize practices to keep up with the skills adolescents will need to be successful in the future workforce (Loveless, 2017).

The 2017 Brown Center Report on American Education, conducted by the Brookings Institute, revealed that America's educational system may not be preparing students adequately for the world of work because schools do not sufficiently introduce students to the experiences that future workers will need to succeed in the workplace. Results from international testing such as the Program for International Student Assessment (PISA), the Trends in International Mathematics and Science Study (TIMSS), as well as comparisons between educational priorities of American vs. foreign high schools conducted by the Brown Center of Education Policy, suggest that the United States trails behind over a dozen other industrialized countries in workforce preparedness (Loveless, 2017). This quantifiable data provide evidence that American students are losing their ability to compete in the global marketplace (Kiefer, 2012).

Table 1

United States PISA Scores (2015) in Relation to Other Countries

	Reading	Math	Science
United States Ranking	23 (Tied)	39 (Tied)	25
Number of countries ranked statistically lower than the U.S.	14	26	18
Number of countries ranked statistically higher than the U.S.	42	28	39

Note: Reprinted from "The 2017Brown Center report on American education: How well are American students learning?", by Loveless, T. 2017, *Brown Center on Education Policy, Brookings Institution.*

Places where people work, like factories or offices, have evolved drastically in the last century. The physical workplace has generally shifted from an authoritarian workplace arrangement where supervisors ordered workers to perform individual tasks, to a physical

environment that embraces the concept of teamwork between supervisors and workers (Cuff, 2016).

Today, companies tend to focus less on the development of products, and more on inspiring employees to embrace the company's vision and culture. Companies have become more focused on brand, vision, and mission, and the work that is performed has become more distributed and collaborative (Tompkin, Mihailoff, Muchnick, Hsiao, & Diaz, 2015). Workers have a real need to collaborate and communicate with one another in order to achieve company goals (Tompkin et al., 2015).

The modern workplace may conform to the needs of its mission, employees, and global economy, but are schools, whose objective it is to prepare students for the world of work, adjusting instructional spaces to meet the needs of the modern learner and prepare them for their future career? Typical high school classrooms still place a focus on the teacher, with students at individual desks becoming the recipients of knowledge (Gensler, Rosenstein, Tompkin, & Cubbison, 2016). However, research on how students learn describes effective learning as a process that occurs as a result of experiences that involve a change in beliefs, behaviors, and attitude as a result of those experiences (Webster, 2015). It is suggested by Gensler et al. that the design of instructional spaces reflect the broad and diverse experiences and activities that learners need to be engaged in to prepare them for their future endeavors and work experiences. (Gensler et al., 2016).

Educational leaders may be shifting curriculum and striving to move instructional practice towards a more student-centered experience, but unless the physical layout and design of the space facilitate such methodologies, it can be difficult to translate instructional practices into desired student outcomes (French, 2017). The recent focus on challenge-based learning, project-

based curriculum, and 21st Century Skills centers on the need for students to become proficient in the "4 C's" as outlined by the Partnership for 21st Century Learning and Innovation Skills: collaborate, communicate, critically think, and create. Developing a "one-size-fits-all" learning model will not promote 21st Century skills, but the design of spaces that allow students to shift between collaboration, focused work, presentation, and research will allow more students to be engaged and support their self-directed learning (Gensler et al., 2016).

Learning spaces that match the instructional needs of the students are crucial for the academic community to flourish, while the absence of purposefully designed learning spaces can result in the fragmentation of the intellectual health of those enrolled in school (Savin-Baden, 2017). Yet, what is the motivating factor for schools to renovate instructional learning spaces? Companies have the ability to rationalize changes they make to their physical environment by citing that improved work practices will lead to increased revenue or improved product development and efficiencies. Schools do not have the ability to link renovated instructional spaces to revenue. However, justification may be realized if a link can be established between student engagement, specifically through student collaboration, communication, critical thinking, and creativity. Does student engagement increase in an instructional space that is appropriately designed to reflect the instructional needs of the student and mimic the future world of work? Perhaps educators are missing an opportunity to leverage instructional spaces that will promote the desired behaviors, just as companies have shifted their workspace design to foster what is important to the mission of the company (Bricker & Saint-Louis, 2015). A study of existing, redesigned spaces that are meant to promote collaboration, communication, critical thinking, and creativity must be studied to determine if educators should move forward with designing spaces that address the needs of the student and future employee in the workforce.

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The Statement of the Problem

A historical review of school design reveals that the physical design of classrooms have not evolved to the extent that the physical design of workplaces has evolved throughout the last century (Barrett, Zhang, Davies, & Barrett, 2015). Researchers are concerned that America's educational standing in the world is slipping compared to other countries with more progressive approaches to education, and that United States schools are not addressing the need to prepare students for the future world of work (Casner-Lotto & Barrington, 2006). The problem is that there is a dearth of research suggesting a connection between how the physical layout and design of a classroom may influence the way students learn and acquire the 21st Century Learning and Innovation Skills needed to succeed in the students' varied future work endeavors (Merrill, 2018).

The wider acceptance of incorporating 21st Century Learning and Innovation Skills throughout classrooms in the United States is causing educators to believe that the traditional, rectangular, white-painted, cinder block classroom, lined with straight rows and columns of desks, may limit the ability to promote the tenets of 21st Century Learning. In addition, if workplaces are adjusting their office layouts to promote a company's culture through increased levels of collaboration, communication, critical thinking, and creativity, then perhaps schools should be designing learning spaces that promote similar outcomes for students. The belief that physical space influences student learning to enhance the acquisition of 21st Century Learning and Innovation Skills suggests that research is needed to support or refute the notion that space may influence learning (Merrill, 2018).

Purpose of the Study

The purpose of this study is to investigate and examine the affect that redesigned learning spaces may have on student engagement levels—specifically the extent to which redesigned learning spaces facilitate the level of communication, collaboration, critical thinking, and creativity that takes place in the learning space. This study observes the efforts of a suburban high school that has redesigned traditional classrooms into progressive and innovative learning spaces, in an effort to foster 21st Century Learning and Innovation Skills within their respective curricular area. It is important to study the influence from the perspective of multiple high school teachers to provide a broader base for the knowledge and research study.

The literature does not reveal meaningful statistics or information regarding the affect that redesigned learning spaces may have on promoting student engagement among high school students. Research highlights the connection that larger learning spaces such as libraries, learning commons, makerspaces, and open spaces have on student climate, culture, and motivation among students (Byrne, 2016). However, there is a gap in the research, as little work has been done to examine the impact that redesigned, classroom learning spaces may have to enhance an educator's ability to promote 21st Century Learning and Innovation Skills, specifically at the high school level (Byrne, 2016).

This study contributes to the body of research regarding redesigned, classroom learning spaces for both educators as well as designers and school architects. In addition to contributing to the research, such outcomes may influence school designers, as well as educational leaders who may advocate for redesigned spaces but need research to provide strong data to those who would allocate funding for such learning space redesigns.

Theoretical Framework

The work of David Ross and the Partnership for 21st Century Learning provides the framework for effective learning that serves as the theoretical lens used to analyze the affect that redesigned learning spaces may or may not have on student engagement levels. David Ross is the leading educator behind the Partnership for 21st Century Learning that established the 21st Century Learning and Innovation Skills, which are necessary to ensure that students will thrive in a constantly evolving world where learning never ceases (Ross, 2017).

Through his work at the Partnership for 21st Century Learning, Ross built a framework of skill-based outcomes through a collaborative partnership between educational leaders, governmental officials, and businesses, representing over five million members of the global workforce. This framework, known as the 21st Century Learning and Innovations Skills, is what students must master to prepare themselves for an increasingly complex life and work environment (Ross, 2017). The 21st Century Learning and Innovation Skills, known as the 4 C's, include Creativity, Critical Thinking, Communication, and Collaboration (P21 Framework for 21st Century Learning, 2016).

Acquiring knowledge of content and specific information is an important aspect of developing 21st Century Skills, as is mastering technology and mass media literacy, life, and career skills. However, the Framework for 21st Century Learning and Innovation Skills that emphasizes communication, collaboration, critical thinking, and creativity is at the center of what is needed for students to succeed in the world of work (Plucker, Kennedy, & Diley, 2015). Such learning and innovation skills are recognized as the skills that distinguish students who are prepared to function in high, 21st-century work environments, versus those students who are not as prepared (P21 Framework for 21st Century Learning, 2016).

The World Economic Forum, in it's 2016 "Future of Jobs Report," ranked the top ten skills workers will need in 2020. Complex problem solving, critical thinking, and creativity topped the list and coordinating with others (collaboration) rounded out the top five needed skills (World Economic Forum, 2016).

Communication is considered a gateway skill to the overall framework of the 4 C's. Language is powerful as it relates to the ability to connect with other humans. The ability to use words, in conjunction with behavior, to achieve the desired goal and the ability to engage in formal and informal language is a skill that enhances a person's ability to succeed socially and professionally (O'Neal & Ringler, 2010). Methods of teaching students how to communicate include modeling activities such as journal writing, questioning, debating, interviewing, and reflection practices (Jacobsen-Lundeberg, 2016).

Collaboration is a vital educational outcome that requires students to share, listen, and negotiate with teammates to establish a consensus using negotiations, compromising strategies, and conflict resolution. Interpersonal communication, conflict resolution, and task management are the most significant elements of collaboration. However, having students simply work in groups is not enough to develop collaborative skills (P21 Framework for 21st Century Learning, 2016). Teachers must directly model and teach what collaborative skills look like by modeling how to negotiate, compromise, and resolve conflicts (Jacobsen-Lundeberg, 2016).

Critical thinking is a complex skill that requires individuals to engage in a multifaceted issue that does not have all the information that an individual may deem necessary, and expects the student or team to problem-solve for a solution. Critical thinking strategies, of which there are several, tend to include an ability to analyze a situation, draw conclusions based on information acquired, construct a strategy to solve the problem and evaluate the strategy or

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solution that was developed (P21 Framework for 21st Century Learning, 2016). Teachers should engage with students in critical thinking skills and work along with students to facilitate their thought process as they are directed through the framework for critical thinking (P21 Framework for 21st Century Learning, 2016).

Creativity requires individuals to approach challenges in unconventional ways, developing new ideas to solve a problem. This skill requires individuals to take risks in a confident and calculated manner, have a growth-mindset, participate in divergent thinking, while also gaining significant knowledge regarding the issue or task at hand (P21 Framework for 21st Century Learning, 2016). Brainstorming, problem-finding, researching, and role-playing are all strategies that can be employed to enhance creativity in the classroom. For students learning how to critically think, beginning with exercises in divergent thinking is a positive starting point for students (P21 Framework for 21st Century Learning, 2016).

Research Questions and Hypothesis

Research Question 1: What are the characteristics of a space that would address the needs of the Learning and Innovation Skills within the Framework of 21st Century Learning, specifically: collaboration, communication, critical thinking, and creativity?

Research Question 2: How does an instructional space, designed by a teacher, influence the teacher's perspective on instructional practice?

Research Question 3: Can a redesigned classroom learning space influence student engagement?

Research Design

A qualitative research methodology was used to analyze the relationship between the redesigned high school classroom and perceptions of student engagement. In addition, features of the redesigned classroom were analyzed to determine if there were trends or aspects of the space that appear to trigger higher levels of engagement than other features in the classroom. Feedback obtained by interviews with high school teachers who have redesigned learning spaces to develop 21st Century Learning and Innovation Skills, provided the input necessary to determine the link between redesigned classroom spaces and engagement levels among high school students.

Significance of the Study

There is an increasing emphasis on enhancing a student's ability to acquire 21st Century Learning and Innovation Skills prior to entering the workforce. In addition, there is an ongoing trend that corporate offices and work areas are increasingly flexible, open, mobile, and collaborative in nature (World Economic Forum, 2016). Global businesses are seeking current and future employees who are able to communicate, collaborate, critically think, and create in a free, more open environment. In addition, education systems generally educate students using 20th-century methods that limit companies from hiring workers with the skills that are needed to succeed in the future global workplace (World Economic Forum, 2016). Pairing the needs of corporate America with the newest pedagogical trends in education is causing educators to examine and evaluate if classrooms may be better designed to motivate and engage students to meet the needs of employers.

It may seem reasonable to think that renovating a learning space would cause students to have a more positive outlook on the educational experience than they may have in a traditional classroom, but does a redesigned space actually increase the level of student engagement? Are there social-emotional connections or implications that might be different for students with special needs? What role do educational leaders play in influencing such physical spaces and what kind of professional development and support may teachers come to expect if they find themselves teaching in a redesigned classroom?

 This study provides educational leaders and teachers with data that will qualitatively measure how redesigned learning spaces may effectively and positively affect student engagement, using the framework of the 21st Century Learning and Innovation Skills known at the "4 C's". The results of the study may inform and influence decision making among parents, educators, policy-makers, and, most importantly, may influence student outcomes.

Parents connect their own prior school experiences with that of their children. The results of this study may be used to educate parents on why the classrooms their children learn in should not look like the classroom they once occupied decades ago. The study provides a context for why physical layout changes may or may not be pedagogically important, while the physical layout for a workplace has benefited outcomes for progressive corporations that think carefully about the physical layout of their workspace.

The study provides educators with evidence to reinforce why the learning space may or may not be related to the acquisition of skills deemed necessary by future employers. Educators have previously focused on lighting, wall color, air quality, and seats to define a healthy or productive learning space. This study provides educators with an opportunity to consider how flexible furniture, writing surfaces, technology, and other features play a role in increasing the

quality of collaboration, critical thinking, creativity, and communication skills that are acquired by the students.

The study provides policy-makers, including professionals who are responsible for implementing policies with information to make informed decisions about classroom design. Board of education, construction officials, and governmental entities may decide to modify policies and practices that regulate educational building codes such as the square footage mandated per student in a classroom. Building renovation, as well as new construction designs, may be influenced by the potential need to create flexible learning environments. Wall, acoustical design, writing surfaces, and technological innovations will all need to be considered when designing new learning spaces.

Finally, the students are the most important, significant recipient of the effects of the study. If there is a connection between the redesigned learning space and the acquisition of 21st Century Learning and Innovation Skills, then the pupils will be better prepared for the world of work that they will enter into in the near future. Increasing the skill acquisition of the 4 C's will lead to a more engaged student who will recognize that their learning space has played a critical role in the skill acquisition for their future success in the workforce.

Assumptions

There are certain assumptions made throughout this study that must be recognized.

Assumption 1: Teachers using a redesigned learning space are in that space with their students because there is a perceived need by the teacher or administrator that the curricular needs of the course emphasize the acquisition of 21st Century Learning and Innovation Skills.

Assumption 2: The high school teachers are able to be objective when asked to be reflective about their teaching and their students' learning when interviewed.

Assumption 3: The teachers who have taught in both traditional and redesigned learning spaces will be objective enough about both learning environments so as not to express a bias about teaching in a redesigned space.

Delimitations and Limitations

This qualitative study has several limitations that are important to note. The study is restricted to a suburban high school that has multiple redesigned learning spaces to embrace and promote 21st Century Learning and Innovation Skills. Schools that can afford to redesign classrooms tend to be more affluent schools and may not serve as diverse a student population as other, less affluent schools.

In addition, there are other factors that are involved in 21st Century skills. This study is limiting itself to the four major components: collaboration, communication, critical thinking, and creativity. Future researchers may want to analyze the importance that redesigned classroom spaces may have on other aspects of the Partnership for 21st Century Skills' framework.

The third important limitation is the lack of control over teacher quality and performance variables. Specifically, one limiting variable that cannot be controlled for is the quality of the teacher and the teacher's ability to inspire and motivate students.

This study takes place in a Long Island School District that has redesigned multiple learning spaces specifically to promote student engagement and to foster the adoption of 21st Century Learning and Innovation Skills. There may be certain design features more prevalent in the Northeast than in other areas of the country, so a future study to examine similar factors throughout the country would prove beneficial for future research.

Definition of Terms

21st Century Learning and Innovation Skills: Known also as the 4 C's: Collaboration, Communication, Critical Thinking, and Creativity. These skills are necessary for students to be prepared to enter the complex life and work environment of the 21st Century. (P21 Framework for 21st Century Learning, 2016).

Collaboration Skills: One of the 4 C's that comprise the 21st Century Learning and Innovation Skills. It is the ability to share work responsibility and value the individual contributions of every team member. Being able to contribute and advocate for a position, while also demonstrating flexibility and a willingness to be helpful in making compromises when interacting with others (Plucker, Kennedy, & Dilley, 2015).

Collaborative Spaces: A space specifically designed to foster the exchange of information, with the ultimate goal of forging networks of ideas, concepts, and solutions to problems (Webster, 2015).

Communication Skills: One of the 4 C's that comprise the 21st Century Learning and Innovation Skills. It is the ability to effectively articulate thoughts and ideas to a diverse audience using oral, written, and nonverbal communications skills through a variety of media, including print, audio, and visual displays (Dilley, Fishlock, & Plucker, 2015).

Critical Thinking and Problem-Solving Skills: One of the 4 C's that comprise the 21st Century Learning and Innovation Skills. It is the ability to reflect, analyze, and evaluate facts,

data, research, and prior knowledge to solve complex, open-ended problems (Dilley, Kaufman, Kennedy, & Plucker, 2015).

Creativity and Innovation Skills: One of the 4 C's that comprise the 21st Century Learning and Innovation Skills. It is the interaction between ability, process, and environment where an individual or team of individuals working together produce concepts, ideas, or products that are unique or novel and do not necessarily conform to what would be typically considered a solution (Plucker, Kaufman, & Beghetto, 2015).

Creative Office: Modern workspace that rejects the pre-millennium office space where workers were sectioned into cubicles of space to perform individual tasks, limiting communication and collaboration. Creative office space is a term coined by Silicon Valley technology companies that have famously established progressive office designs that blend an open-floor-model layout with collaborative and shared spaces that include modern furniture and technology with leisure amenities to motivate and inspire the worker (Cuff, 2016).

Learning Space: Refers to the area, room, or facility where a student is engaged in learning. A classroom is a typical learning space, but a learning space is an environment that describes the physical space that facilitates learning in more detail and does not have to be confined to an area within a school building (Savin-Baden, 2007).

Personalized Learning: An instructional philosophy where learning is connected to each individual's development, background, interests, and experiences. It is an approach that broadly

and equitably supports educators' efforts to empower learners as individuals (Digital Promise, 2016).

Redesigned or Flexible Learning Space: A traditional classroom that has been refurbished to address the needs of a modern learner and current instructional trends. The person designing the instructional space is typically concerned about the interior configuration, furniture, lighting, and technology used to support the pedagogical needs of the instruction (Merrill, 2018).

21st Century Learning Environment: A process-supporting system or skill-based supporting system that organizes a situation positioning people to learn in an optimal manner, which will address the acquisition of 21st Century Learning and Innovation Skills. The environment may be in a place or space, but may also take place online (Nissim, Weissblueth, Scott-Webber, & Amar, 2016).

CHAPTER 2

LITERATURE REVIEW

Introduction

Synthesizing the body of knowledge that has been collected with regard to how the

physical characteristics of a classroom influence how students communicate, collaborate,

critically think, and create is vital to developing the methodology, executing the study, and

drawing conclusions upon completion of the study. The theoretical framework surrounding this

study centers on the work by David Ross and the Partnership for 21st Century Skills' Learning

and Innovation Skills, known as the 4 C's. Conceptually, it is imperative to develop an

understanding of why collaboration, communication, critical thinking, and creativity are vital

skills for today's learner to acquire (P21 Framework for 21st Century Learning, 2016). In an

effort to better understand the conceptual framework of the study, the literature review critically

unravels the research on 21st Century Learning and Innovation Skills, the shift in instructional

methodology, the evolutionary trends of physical classrooms, and the affect the physical

classroom has on learning.

Theoretical Framework - 21st Century Learning Skills and the 4'C's

The literature review begins with a critical overview of 21st Century Learning and

Innovation Skills, which serves as the theoretical framework for the study. What are the

requisite skills that will be required for members of the 21st-century workforce to be successful

and do the young people of today exhibit the range of skills and the ability to apply 21st Century

Learning and Innovation Skills in the workplace? That is a question that a consortium of The

Conference Board, Partnership for 21st Century Learning, Corporate Voices for Working

Families, and the Society for Human Resource Management asked in an extensive survey of over four hundred United States businesses (Casner-Lotto & Barrington, 2006).

The four hundred and thirty-one employers represented a cross-section of vice presidents, directors, managers, and other human resource officials from across all regions and fields, representing a workforce of over two million workers. The officials completed in-depth surveys that allowed the consortium to establish a list of the most important skills that employers are seeking in the future workforce. Reading, writing, and arithmetic skills are no longer listed as the most important outcomes of an education. Instead, the study yielded that the following were considered "very important" in determining the future success of recent graduates (Casner-Lotto & Barrington, 2006):

- Professionalism/work ethic – Does the potential employee demonstrate personal accountability and effective work habits such as punctuality, working effectively with others, and time/workload management?

- Oral and written communication – Does the potential employee articulate thoughts and ideas clearly and effectively in both oral and written modalities? Public speaking must be clear and effective in communicating ideas to an audience.

- Teamwork/collaboration – Does the potential employee possess the ability to form strong relationships and negotiate and manage conflict that will allow the person to work with various groups of people?

- Critical thinking/problem-solving – Does the potential employee have the ability to reason and think analytically by using facts and data to solve problems?

The results from the consortium of The Conference Board, Partnership for 21st Century

Learning, Corporate Voices for Working Families, and the Society for Human Resource

Management, indicated that over fifty percent of college entrants are deficient in the

aforementioned areas in the report. Specific deficiencies were found in oral and written

communications, work ethic, and critical thinking and problem-solving skills. The following are

highlights from the report – specifically for graduating high school students (Casner-Lotto &

Barrington, 2006):

- Professionalism/work ethic: 70.3 percent of employers reported high school
  graduates as deficient.

- Written communications: 80.9 percent of employers reported high school
  graduates as deficient.

- Critical thinking/problem-solving: 69.6 percent of employers reported high
  school graduates as deficient.

The consortium of The Conference Board, Partnership for 21st Century Learning,

Corporate Voices for Working Families, and the Society for Human Resource Management

report calls attention to the serious implications that such deficiencies will have on the American

workforce. CEO's are aware of the choices that will need to be made by businesses, which may

include hiring more skilled foreign workers, if the United States is to remain competitive in the

global economy (Friedman, 2005). As a result, the consortium calls for the business and

education communities to team together to enhance the educational experiences for students by

providing new educational opportunities in a new way, promoting real-world experiences as

outlined in the Framework for 21st Century Learning (P21 Framework for 21st Century

Learning, 2016).

Stakeholders should consider developing cross-sector approaches to aid in developing more hands-on and practical experiences for students throughout the curriculum. Changing the way students learn by motivating and engaging them in authentic, real-world experiences could address the future needs of employers as indicated by the consortium (Casner-Lotto & Barrington, 2006).

The framework for 21st Century Learning and Innovation Skills was created not only from feedback from businesses but after exhaustive input from educators, who were able to synthesize the important needs for the world of work with how educators could help satisfy those needs. A significant portion of the framework established by the Partnership for 21st Century Skills centers on the imperative that educators have placed upon themselves to promote the skill development of students centered on the 4 C's: Communication, Collaboration, Critical Thinking, and Creativity. The acquisition of specific content area knowledge is an important part of developing 21st Century Skills, as is mastering the use of technology and establishing mass media literacy, life, and career skills. However, at the center of teaching and learning are the 21st Century Learning and Innovation skills that are recognized as the tools students need to succeed in the 21st-century work world (Plucker, Kennedy, & Dilley, 2015).

21st Century Learning Skill: Collaboration

The ability for students to learn how to work together on a common goal is a vital skill that will enhance the prospects for employment once students leave school and enter the workforce. Included in collaboration skills is not only the ability to communicate with others, but the acquisition of conflict resolution skills, and the ability to forge consensus and negotiate. Instruction in collaborative practices includes peer evaluation, group formation, and role assignments (Plucker, Kennedy, & Dilley, 2015).

Developing collaboration skills requires more than simply working in a face-to-face environment with fellow students or colleagues. Collaboration is becoming an increasingly high level and sophisticated skill set that sometimes requires individuals to interact with people they have never physically met, but instead is required to work closely within a virtual environment that requires a high level of collaborative technologies. Unfortunately, collaboration in schools remains highly traditional and is reflective of outdated models of interacting with students (Dede, 2010.

The Partnership for 21st Skills suggests that assessing students for collaboration skills should be done by providing a mix of collaborative and individualized learning experiences throughout all aspects of student learning. Students should be assessed based on overall student outcomes as well as an evaluation on their team-building/collaboration skills. Evaluating student collaboration skills can come from an observer witnessing students interacting with one another, but better evidence typically is measured via technology that can capture and track student work contributions and interactions in a common working document. Google drive is often a powerful technology used to track student input, contributions, and collaboration throughout a collaborative group activity (Plucker, Kennedy, & Dilley, 2015).

21st Century Learning Skill: Communication

Communication skills or competencies include not only interpersonal communication, but mass communication, computer or technology-facilitated communication, written communication and other non-verbal methods of conveying thoughts, ideas, and opinions to others (Putnam, Roberts, & Porter, 1987). The importance of being able to convey succinct, relevant, and useful information to others in a verbal, written, or another format is becoming increasingly important in a technological world.

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Mastering the use of digital media is a critical aspect of literacy that students must master in order to effectively convey thoughts, ideas, and opinions in our technological world. The internet and technology, in general, have expanded the methods people use to communicate in the 21st Century. Being a digital media literate citizen is vital since this medium for communicating is a more relevant way to convey information than many other methods of communicating. Therefore, being able to evaluate, synthesize, and develop the strongest solutions based on that information will allow skilled, communicative groups and individuals the ability to synthesize information and convey that information to others in a relevant and effective manner (Coiro, Knobel, Lankshear, & Leu, 2014).

Businesses want employees who have the ability to provide an "elevator pitch" whereby a person has only a short, defined period of time to pitch an idea to another person. This is a unique skill that must be developed, but has positive implications for those in the business world and is gaining popularity among business leaders who need quick-thinking, intelligent workers (Dilley, Fishlock, & Plucker, 2015). Within the classroom, it is recommended that educators determine what type or modality of communication needs to be emphasized within the particular classroom environment and how the learning space can be leveraged to facilitate that type of communication. In addition, the assessment of such activities should be conducted using examples of student work that reflects a student's communication skills. Teaching communication skills should be integrated throughout the curriculum to reflect the importance of such skills (Dilley, Fishlock, & Plucker, 2015).

21st Century Learning Skill: Critical Thinking

Reasoning, judgment, and logic are important cognitive skills for students to acquire and lead to the strategies that humans use to solve problems in an organized and systematic fashion

(Wagner, 2008). In fact, John Dewey (YEAR) argued that thinking without reflection is reckless and flawed, and, in order to develop better solutions, one must be self-reflective. The definition of problem-solving or critical thinking has evolved since Dewey, and focuses on skills that include reflection, but also incorporate analytical skills, evaluative practices, and deliberate thought processes.

Educators strive to assess students for their critical thinking skills primarily through the development of authentic, yet sometimes simulated, real-world problems. Teachers are encouraged to model critical thinking skills, but modeling such skills is more effective when the teacher models the critical thinking subs-skills (reflection, analysis, evaluation) throughout their instruction. Critical thinking is different than decision making whereas critical thinking is a process of analyzing, synthesizing, conceptualizing, applying and evaluating information from sources to form a decision based on that critical thinking process.

Providing students with performance tasks whereby students are expected to respond critically to a situation has faced criticism as a partially flawed instrument, but does seem to be a stronger indicator of a student's ability to think critically than other assessment measures (Dilley, Kaufman, Kennedy, & Plucker, 2015).

21st Century Learning Skill: Creativity

The industrial or manufacturing-based economy of the past is quickly evolving into an economy that relies more heavily on a knowledge-based economy that is fueled by individuals or collaborative groups who are able to solve problems in an innovative fashion that is efficient, economical, pleases the consumer, and spares resources. Educators, however, struggle to define what creativity means and how one measures and assesses student creativity.

The rapid growth of scientific knowledge in the last century and the desire to solve the countless problems that have challenged scientists and engineers have placed tremendous interest in the understanding of what it means to be skilled in creativity. Most recently, scholars have suggested that a creative product must not be obvious, new, or unique (Plucker, Kaufman, & Beghetto, 2015).

How can educators develop more creative students? There is no such person as a "creative person." Instead, Beghetto's study recognizes that all students have creative competencies that can be developed, nurtured, and achieved (Beghetto, 2009). In fact, it is the interaction between the person looking to develop creative skills and the environment that is a key factor in developing creative competencies. Student's openness to new experiences, self-confidence, motivation, knowledge-base, resiliency, and willingness to take calculated risks are all factors that must be cultivated to promote creative problem-solving skills among students (Plucker, Kaufman, & Beghetto, 2015).

Creativity is a skill often encouraged in young children and is linked more within arts education than in mathematics and sciences. However, research has shown that teacher conceptions of creativity are often inadequate, and teachers tend to avoid or miss opportunities for imaginative processing (Newton & Newton, 2009). The Polish philosopher Wladyslaw Tatarkiewicz states that creativity is inevitable; it comes naturally to children because their lives depend on being creative. However, as children grow older and more pragmatic, educators need to concentrate on how creativity can be nurtured in students and appreciate being taught a skill by teachers (Grohman & Szmidt, 2012).

The Shift in Instructional Methodology

The relationship between teachers and students plays an important role in the outcomes exhibited by students. In addition, a teacher-centered classroom environment fosters more passive student learning while instruction in a learner-centered or student-centered classroom environment tends to promote student engagement. Learner-centered education causes the student to become a constructivist learner because the teacher acts more as a facilitator of the educational process. Typically, learner-centered models of instruction include inquiry-based instruction or critical thinking, problem-based learning where the teacher acts as the facilitator to the learning (Cornelius-White, 2007).

Throughout his work on systems thinking as it relates to educational institutions, Peter Senge (2012) states that most educators are aware that the industrial age method of schooling is no longer considered an adequate method of educating students for tomorrow's world of work. Instead of intensifying current practices by increasing the rigor of schoolwork and simply setting higher expectations on standardized exams, the concept of the student and the teacher interactions should be examined and refined to promote the skills that are needed for tomorrow's work environment. Teachers have tremendous influence when they serve students as mentors who establish learning opportunities that promote student engagement (Senge, 2012).

Research has demonstrated that the affect that teachers have in a learner-centered environment exhibits above-average associations with positive student outcomes. Specifically, learner-centered environments promoted positive teacher-student relationships as well as fostered positive student-student relationships when compared to other educational innovations. Also, achievement in areas such as critical thinking, mathematics, verbal achievement, and social connections were all viewed as positive in the meta-analysis performed by Cornelius-White

(Cornelius-White, 2007). Additionally, many of the positive results of learner-centered environments are also reflective of what 21st-century skills are seeking in their employees.

Addressing the higher levels of Bloom's Taxonomy (analysis, synthesis, and evaluation) needs to become more common practice in American schools (Hopson, Simms, & Knezek, 2002). By engaging students in higher levels of the taxonomy, students are also exercising their skills in thinking critically and problem-solving. Hopson, Simms, and Knezek (2002) suggest that learners in the information age must, "learn not only how to access information, but, more importantly, how to manage, analyze, critique, cross-reference, and transform [information] into usable knowledge" (p. 109). Doing so requires more traditional learning environments that are not learner-centered to restructure their classrooms so that technology can be used to provide students with active learning opportunities, authentic tasks, problem solving, and higher order thinking skills that would help educators address the needs of the 21st-century learner.

Hobson, Simms, and Knezek illustrate some of the key differences in learning that takes place in traditional versus new learning environments:

Table 2

Traditional Learning vs. New Learning Environments

Traditional Learning Environments:	New Learning Environments:
Teacher-centered learning	Student-centered learning
Single sense stimulation	Multi-sensory stimulation
Single path progression in learning	Multiple path progression in learning
Single media	Multimedia
Isolated work	Collaborative work
Teacher information delivery	Student-centered learning
Passive learning	Information exchange

Factual, knowledge-based, literal thinking	Activity / exploratory / inquiry learning
Reactive response	Proactive / planned action
Isolated, artificial context	Authentic, real-world context

Note: Reprinted from "Using a technology-enriched environment to improve higher-order thinking skills", Hopson, M.H., Simms, R. L., & Knezek, G. A. 2002, *Journal of Research on Technology in Education, 34,* page 110.

Although not in response to the 21st-century learning skills consortium, the National Educational Technology Standards for Students, published by the International Society for Technology in Education (2007) developed standards that "students should know and be able to do to learn effectively and live productively in an increasingly digital world". The standards include an emphasis in areas such as critical thinking, problem solving, and decision-making. ISTE (2007) states, "Students must use critical thinking skills to plan and conduct research, manage projects, solve problem and make informed decisions using appropriate digital tools and resources". All of which are skills reflected in the 21st Century Learning and Innovation Skills.

In a 2003 study by the Center for Research in Educational Policy, students were separated into two different groups of similar students. One group of students would be in a traditional learning environment and have five or more computers in the classroom while the other group would be in a new learning environment where each of the students had access to a laptop that they could also take home. In addition, the teachers working in the new learning environment had also been exposed to a professional development program designed to help teachers develop a framework for problem-based lessons that incorporated real-world resources and experiences into the unit. Doing so engaged students in critically examining community and global issues while improving student research and technology skills (Lowther, Ross & Morrison 2003).

The results of the study showed that teaching and learning were noticeably different in the new learning environment. Results showed a noticeable difference in the new learning environment where students experienced higher levels of engagement than in the traditional classroom. Finally, assessments of student writing samples on a prompted essay also favored students in the new learning environment over the control students in the traditional classroom (Lowther, Ross & Morrison 2003).

Evolution of Classroom Space

Educating young people is one of the most central purposes of a democratic society. Dewey claimed that a government which relies on the election of citizens to govern could not be successful without an educated population (Dewey & Boydston, 1983). The buildings that are designed and constructed to form the foundation of a democratic society must reflect the values and needs of society. Throughout American history, it is assumed that school design has been an influential factor in assisting how teachers educate and how students learn (Baker, 2012).

Horace Mann, long considered one of the preeminent educational reformers in American history, laid the foundation for the United States' understanding that the education of the country's young people should be free and available to all students. As one of the first members of the Massachusetts State Board of Education and a member of the United States House of Representatives from 1848 to 1853, Mann felt public education must promote civic virtue and character, in addition to promoting a student's academic prowess. Mann was keenly aware of how critical educated teachers were to student success and strove to equip teachers and schools with the supplies and facilities needed to improve learning (Baker, 2012).

Mann found that the American system of schools was built on inequity. A lack of state supervision caused the condition of schools, curriculum structure, and instructional practices to

vary greatly from state-to-state and town-to-town. Mann visited over one thousand schools over

a six-year period and spent much of that time addressing the physical inadequacies of the schools

he observed. Schools often lacked proper levels of light, heat, ventilation, and comfortable

furniture that was needed to educate students. The hours that students spent on hard benches, the

poor condition or lack of blackboards and books were just some of the issues that Horace Mann

would address as he advocated for a free, non-religious, common educational experience known

as, "The Common School" (Mondale & Patton, 2006).

Henry Barnard, the first United States Commissioner of Education from 1867-1870, was

carefully focused on how public schools could be reorganized and restructured to improve

student outcomes. He was an educational reformer who was highly critical of where schools

were constructed, as schools were often built in areas where students were exposed to busy

streets and bad neighborhoods. Furthermore, he was also critical of the aesthetic components of

many public schools. He felt that schools were often designed without considering the

importance of the external and internal appearance of the school and questioned how the

appearance of a structure could influence student learning (Baker, 2012).

The late 19th and early 20th century was the highpoint for the industrial model of

classroom design. School design became standardized to meet the need of educating larger

numbers of students in a consistent manner. The standard classroom would often have a teacher

placed in the front of the classroom with students seated on benches or chairs that were often

bolted to the classroom floor. Doing so allowed more students to receive direct instruction. John

Joseph Donovan, an early 20th-century school architect and author of "School Architecture:

Principles and Practices" called for schools to be designed for efficiency and educational

adequacy (Donovan, 1921). The utilitarian approach to school design continued through the

years following the Second World War as communities were faced with an increase in students moving into suburban housing developments (Baker, 2012).

The connection between instructional practices and the physical layout of a school and classrooms began to emerge in the middle and late 20th century. The 1960's and 1970's age of a youth-oriented culture and associated political movements caused educators and school designers to rethink how teachers should instruct students. Educators focused on differences in student interests, motivations, backgrounds, and abilities. Therefore, instructional methodologies became more progressive and differentiated in nature. Schools embracing "open classrooms" were more like a workshop and often replaced student desks with larger tables for group work and experimentation. Learning centers emerged where students would work alongside teachers and sometimes there would be several teachers in large, open rooms with moveable dividers to focus students in small group activities when needed (Cuban, 2004).

In the late 20th century, the open classroom model shifted back to the more utilitarian model of classroom design after the Vietnam War, as the national crisis at the time caused the nation's leaders to address the perceived "slipping of academic standards." The open classroom concept was an easy target and the trend in classroom design was to shift back to a more conservative, industrialized approach where the teacher provided the knowledge to children in a more conservative, teacher-directed facility (Cuban, 2004).

Throughout the early 21st century, questions about American students' ability to excel in the global marketplace has placed schools and teachers in the crosshairs of educational policy-makers. The labor market is recognizing that a critical gap exists between what our students are learning and achieving and the skills needed to succeed in current and future careers. New models of teaching and learning, including the use of technology, has outpaced the modifications

needed within the physical structures where students learn (Kiefer, 2012). Redesigning classrooms and schools to reflect more progressive models of working environments found in modern technology companies is becoming more prevalent in progressive school districts. Increasingly, educators and architects are finding new ways to create student-centered learning environments that promote the needs of a 21st-century learning space (Monahan, 2002).

Although school design trends have been influenced by the needs of society, new technologies, advancements in neuroscience research, and subsequent development of pedagogy plays a tangential role in the development of schools (Baker, 2012). Students continue to utilize technology to obtain information, thus shifting reliance on teachers from a deliverer of information and knowledge to a facilitator of learning. The teaching and learning dynamic has shifted to a more interactive, problem-solving experience that is meant to enhance student learning, known as 21st Century Learning and Innovation Skills, where the physical design and aesthetics of the learning space may influence that experience (Walker, 2014). In fact, the concept of 21st century learning environments suggests that learning spaces may be physical places, but also suggests that learning environments may be on-line, because the environment must not simply be limited to the physical places, but the modality that allows the learning process to be supported (Nissim, Weissblueth, Scott-Webber, & Amar, 2016).

In addition to reflecting societal trends and the needs of students, learning spaces must also reflect the needs of the instructor. These needs are often reflected in the societal behaviors of learners but may differ depending upon the pedagogical expertise of the teacher. Learning spaces must be valued and redefined from time to time in order to keep up with the needs of the learner and the aspirations of the academic community (Savin-Baden, 2007).

School buildings that were designed and constructed decades ago are still used today, even though instructional methodologies have evolved and are quite different from the pedagogical needs of the past, leaving academics to reason that the physical plant and layout must adapt as well. The same concept for buildings extends to individual classrooms and learning spaces. Keeping current with pedagogical practice, learning science, and societal needs must be the driver for redefining learning spaces as such endeavors can become expensive and, if not redesigned with evidence to indicate the likelihood of success for student learning, can be wasteful (Walker, 2014).

The Learning Space & Learning

Assumptions have been made regarding how the physical space of a school influences the learning that takes place inside. The HEAD Project (Holistic Evidence and Design), funded by the Engineering and Physical Science Research Council in England, provides evidence that well designed primary schools boost academic performance in reading, writing, and mathematics (Barrett, Zhang, Davies, & Barrett, 2015). The study described three major physical characteristics used to develop the conclusions in the study: naturalness of light, temperature, and air quality; stimulation of color; and individualism defined by ownership of the teacher and student along with the flexibility of the classroom design (Barrett, Zhang, Davies, & Barrett, 2015). The flexibility of the classroom design, not the whole-school architectural design, was the influencing factor on student learning in the primary grades studied (Barrett, Zhang, Davies, & Barrett, 2015).

Research studies, such as the HEAD Project, have focused on the architectural features of classroom spaces, but little evidence is available to suggest the flexibility of the classroom space plays a role in the acquisition of 21st Century Learning Skills. However, considerable research

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has been conducted between physical spaces and the pedagogical influence caused by such spaces (Walker, 2014).

The research conducted in the area of space and pedagogical influences centers around ascertaining feedback on experiences within new spaces or conducting satisfaction surveys from students and staff members (Jankowska & Atlay, 2008). A study implemented at the postsecondary level at the Bridges Centre for Excellence in Teaching and Learning at the University of Bedfordshire in 2008 reported that a creative space focused on the aesthetic features, layout flexibility, writable surfaces, and technological aspects of a space may result in heightened student engagement and enthusiasm (Jankowska & Atlay, 2008). A second study conducted by researchers at The University of Queensland (2011), explored the role of social spaces on student engagement. Interviews were conducted with over one-hundred college students who utilized that space. Findings indicated that the space enhanced student engagement due to its inherent ability to foster active learning, as well as student-to-student interaction, and that classroom design is a factor in the students' perception of the space (Matthews, Andrews, & Adams, 2011).

Linking pedagogy to space does not result in a defined formula for all educational institutions. Instead, creating powerful and robust learning environments that support 21st-century learning must be differentiated based on the clientele, the needs of the community, and the diverse abilities and experiences of the teachers and students. Because these factors are often in a state of flux, there is a need for the space to be flexible and dynamic in nature (Kiefer, 2012).

The link between the learning space and pedagogy is further refined in an Israeli study that investigated the effect of innovative learning environments on pre-service teachers'

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motivations and 21st-century skills (Nissim, Weissblueth, Scott-Webber, & Amar, 2016). For a learning environment to achieve its goals of supporting 21st-century innovation and learning skills, the space should offer an assortment of "changing situations." These environments must be flexible to adapt to the fluid needs of the student-teacher interactions. The environment should be rich in technology, but primarily must be designed to create opportunities for collaboration, critical thinking, communication, and creativity (Nissim, Weissblueth, Scott-Webber, & Amar, 2016).

Redesigned classroom space must be more than renovated spaces that support new technologies and promote student-centered collaboration. There is evidence to show that modern learning spaces must address the need for learning to not just take place in the classroom, but allow students to network with connected students, experts, and environments outside of the classroom, thus fostering a greater sense of relevance and community (Kiefer, 2012).

If classroom learning environments are designed to address the flexible and evolving pedagogical needs, then what type of environment should be designed for the specific learning need? Reconfigurable buildings, rooms, hallways, common areas, offices, furniture, technology, lighting, acoustics, and ventilation must all be addressed. This concept of flexibility is widespread and broad and must be further specified and defined (Monahan, 2002).

Intentional or not, the form, functionality, and finish of a space reflects the culture, behavior, and priorities of the people who occupy that space. This suggests that a learning space designer is simultaneously a cultural translator and a builder. That said, learning space design has its own grammar that can be tweaked to bolster desirable habits (Doorley & Witthoft, 2012). Just as people are willing to pay a premium at restaurants and hotels for the experience of being in a particularly inspiring environment, students may benefit educationally when immersed in an

redesigned classroom meant to enhance engagement. Ultimately, the research indicates that thoughtfully designed environments can be used to inspire students (Doorley & Witthoft, 2012).

Summary

The research indicates that businesses are in dire need of hiring employees who exhibit the skills necessary to succeed in the future world of work. Skills needed include life and career skills, media literacy skills, and content knowledge expertise as well as learning and innovation skills. Educators are increasingly focusing on the learning and innovation skills as the need for collaboration, creativity, critical thinking, and communication have not been central to traditional teaching and learning modalities.

Implementing a curriculum that develops greater learning and innovation skills requires educational leaders, policy-makers, as well as teachers to play a more significant role in the implementation of such a change-initiative. In this case, innovation is the incorporation of 21st Century Learning and Innovation Skills into the curriculum and how a redesigned learning space can influence the level of student engagement.

Learning Space research suggests that space does influence human activity, but the acquisition of skills in such a space may constrain or promote learning depending upon the experience that is provided by the instructor.   Research shows evidence that the physical layout of the classroom can influence a student's learning and motivation.

Classroom design has been slow to evolve as compared to its workplace counterparts. Savin-Baden (2007) indicates that the only way for an educational space to evolve at scale is if the learning spaces are valued enough and reflect the need of the learner and aspirations of the overall academic community. Thus, if redesigned classrooms are to be implemented for the

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purpose of acquiring 21st Century Learning and Innovation Skills, then the skills themselves must be perceived as necessary to the student, educator, leader, and community at large.

The global business community, via the Global Economic Forum, has responded that the highest rated driver of change in the workforce is the fluidity of the work environment, specifically the flexibility of those work environments that promote co-working, innovative thinking, and collaboration (World Economic Forum, 2016). The current impact of work environment as a driver of change, along with the same report indicating that four out of the five top skills needed for future workers are the 4 C's, suggests that there is a need to discover how learning space in the educational environment might enhance the ability for students to acquire the learning and innovations skills needed in the future global workforce (World Economic Forum, 2016). If learning and innovation skills such as collaboration, creativity, critical thinking, and communication are going to be enhanced, the 21st Century Skills Framework will need to be intertwined throughout research on leadership, educational spaces, and curriculum.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study is to investigate and examine the affect, if any, that redesigned learning spaces may have on student engagement. Specifically, the work centers on the extent to which a traditional classroom space, that has been redesigned to provide flexibility for various learning activities, influences the level of communication, collaboration, critical thinking, and creativity that takes place in a redesigned learning space. Most educational research highlights the connection that larger, common-area learning spaces like libraries, makerspaces, and open areas have on school climate/culture and student motivation levels. Instead, this study focuses on individual classroom learning spaces and the affect that redesigned classroom spaces might have on influencing student engagement when students are working in that space. The research questions that guided this study are as follows:

1. What are the characteristics of a space that would address the needs of the Learning and Innovation Skills within the Framework of 21st Century Learning and Innovation Skills, specifically: collaboration, communication, critical thinking, and creativity?

2. How does an instructional space, designed by a teacher, influence the teacher's perspective on instructional practice?

3. Can a redesigned classroom learning space influence student engagement?

This chapter will lead the reader through a discussion of the research design and methods that guided the study. Next, the reader will be provided with a description of the research subjects used in the study as well as a review of the procedures implemented in the study.

Finally, data collection procedures and analytical methods used to analyze the data will be presented to the reader.

Overview of the Research Design

This study is designed to investigate any potential influence that a redesigned learning space may or may not have on enhancing student engagement, using the Partnership for 21st Century Learning and Innovation framework. Qualitative data, using cross-case analysis methods from semi-structured interviews, were employed to understand and develop themes between the perceptions that teachers have regarding student engagement when working in redesigned classrooms as compared to student engagement levels when those same teachers previously taught in traditional classrooms.

A qualitative methodology is used as a method of gaining a significant in-depth of understanding regarding this particular societal problem (Creswell & Creswell, 2017). Qualitative research methods seek to: conduct research via prolonged and/or intense contact with subjects, gain holistic information of the context of the study, capture information on perceptions of the subjects through deep discussion of the topic, and develop themes and patterns to better explain how people interpret their experiences with their environment (Miles, Huberman, & Saldana, 2014).

The purpose of comparing and contrasting different perceptions of student engagement in a traditional classroom and redesigned learning space is to determine if there are themes that might address how and/or why teachers might have different impressions of student engagement in their redesigned learning spaces versus student engagement when the teacher taught in a traditional classroom environment. The cross-case analysis focuses on establishing themes and understandings in an effort to understand the experiences of the subjects, thereby establishing a

deeper understanding of the issues facing the research sample (Miles, Huberman, & Saldana, 2014).

To complete the study, semi-structured interviews were used as a tool for collecting data. Collecting data through open-ended questions allow the researcher to make interpretations based on the responses and develop meaning from the data. The qualitative style of research inquiry encourages a more inductive framework as the researcher concentrates on observational feedback to reflect the importance and complexity of the research (Creswell & Creswell, 2017). Because the meaning behind the experiences is subjective and varied, the researcher focuses on common meanings or categories in an effort to discover commonalities between the varied teacher experiences (Creswell & Creswell, 2017).

Research Setting and Context

A high school on the western end of Long Island was selected to be the setting for the research. According to the New York Education Department school report card, the high school involved in the research is comprised of approximately one thousand students and has a diverse student body, primarily comprised of 62% White, 24% Hispanic, 12% Asian, and 2% Black students. The average high school class is 22 students, and just over twenty percent of the students qualify for free or reduced price lunch (NY State Education Department, 2017).

The district's mission statement revolves around the need to inspire students to engage in lifelong learning while focusing on character development contributing in a positive way to our global society. In addition, as one of its strategic objectives, the district highlights the importance of 21st Century Learning and Innovation Skills as per the following objective: "The District will continue to value technology as a tool to foster 21st-century skills. The District will aspire to implement technology K-12 as a means to engage students in content curriculum"

(Public School Outreach, 2018). The annual budget for the 2018 - 2019 school year is $98

million, yet its annual budget increases continue to be lower than the year over year county

average for annual increases (Public Schools Outreach, 2018).

The teaching staff of the high school includes a principal, three assistant principals, and

approximately 90 teachers. 97% of the teachers have more than three years of experiences and

68% of the teachers have a master's degree with thirty or more additional credits (NY State

Education Department, 2017).

The district has been a member of the Digital Promise League of Innovative Schools

program for four years and was selected to the League because of its innovative programs in the

area of independent learning, electronic badging, authentic student work portfolios, and

redesigning learning spaces to promote student engagement (League of Innovative Schools,

2018).

The League of Innovative Schools is a national network of 102 school districts serving

more than 3.3 million students, whose experiences reflect the diversity and challenges of public

education throughout the nation. The Vision of the League "aims to galvanize networks to

design, validate, champion, and scale effective, innovative learning opportunities to advance

equity and excellence for every student" (League of Innovative Schools, 2018).

The school's ongoing commitment to redesign learning spaces is the primary reason for

being selected for this study. The district's newsletter, sent to each homeowner and business in

the district states, "Each of our schools boast innovative learning environments with movable

furniture and whiteboard desks that take 21st Century learning to a new level for our students"

(Public Schools Outreach, 2018).

Methodological Approach

The methodological approach to this research is that of a constructivist, philosophical worldview and employs a cross-case analysis research methodology. A constructivist approach, as suggested by Michael Crotty, makes several assumptions that are followed in this study. The first assumption is that the subjects of the research tend to construct meaning as they engage with the interviewer and tend to share more valuable information through open-ended questions to express their views (Crotty, 2015).

Second, the constructivist worldview of qualitative research seeks to understand the context of the subjects by visiting them in the setting or context of the study to gather information first-hand (Crotty, 2015).

Finally, the process of qualitative research allows the researcher to generate meaning and impact from the information that is gathered through the interactions between humans in the study (Crotty, 2015).

This qualitative study utilizes the constructivist approach of view by having the researcher immerse himself in the context of the environment. The researcher conducted seventeen open-ended, face-to-face interviews with suburban high school teachers from one school. Each of the subjects interviewed were teachers assigned to redesigned learning spaces but had prior experience teaching in a traditional classroom. The interviews took place within the educational space, when logistically possible, so the teacher and observer could better relay the context of the responses to the open-ended questions.

Information and commonalities from all responses were used to determine if there is a link between redesigned classroom spaces and the teacher's perception of student engagement among high school students. Interviews provided the researcher with rich, thick descriptions that

then led to opportunities where the researcher delved deeper to solicit clarifying statements and additional information that lent itself well to the cross-case analysis model (Bloomberg & Volpe, 2016).

Research Sample

The League of Innovative Schools is a national network of 102 public school districts whose vision is to galvanize networks to design, champion, and scale effective, innovative learning opportunities to advance equity and excellence for every student. The researcher's membership in the League of Innovative Schools has allowed the researcher to be exposed to a variety of high schools that have embarked on initiatives to redesign various learning spaces. As a member of the League of Innovative Schools, the researcher was able to select a school district whose effort to redesign its classroom spaces addresses the research questions and the purpose of the study. The researcher approached the superintendent of the high school being studied and asked if the superintendent would consider allowing the researcher to conduct the study with teachers at his high school. The district agreed to allow the researcher to conduct the study on twenty teachers at the high school.

Smaller sample sizes are typical of qualitative research that uses interviewing case studies to retrieve rich data. The researcher was, therefore, able to dive deeply into understanding the perceptions of the participants and develop rich descriptions of the subjects' experiences (Creswell & Creswell, 2017).

Teachers involved in the study were selected by utilizing a criterion sampling method. The advantage of this method is the ability of the researcher to choose specific subjects based on the research questions (Bloomberg & Volpe, 2016). A cross-case analysis was utilized to

analyze the data. Eligible teachers were selected to participate based on the following criteria. The teacher must:

1. currently work as a teacher in a redesigned classroom space;

2. have been involved, in some capacity, in the design and/or layout of furniture for that space;

3. have had experience teaching in both a traditional classroom prior to teaching in a redesigned space.

The district administration of the high school agreed to provide the researcher with a list of the twenty teachers who met the aforementioned criteria. The researcher, with the assistance and permission of the district, emailed the eligible teachers via their school email address and provided them with an overview of the expectations for participating in the study. Nineteen teachers responded to the request for participation. After verifying the criteria for teacher selection, all nineteen teachers were qualified and willing to be interviewed. Ultimately, seventeen teachers followed through with an interview. The researcher worked in conjunction with the administration to inform them of the selection and interviewing schedule for the teachers selected.

After teachers were selected for the study, the researcher issued a letter to the selected subjects outlining the process for the interviews, a request for their contact information, and information regarding the teacher's experience including:

● Age

● Years of teaching experience;

● Number of years teaching in a traditional classroom;

● Number of years teaching in a redesigned learning space;

- Subject matter taught in those space(s).

The demographic and background information was then compiled in a table to be used for data analysis (Appendix D).

Research Procedures

Participants selected as subjects of the research study were not sent an informed letter of consent from the Internal Review Board as the Seton Hall University Internal Review Board stated that informed consent was not necessary for this study (Appendix A). Instead, the researcher issued a consent form to each participant that included the following details: a brief background on the researcher, confidentiality agreement, contact information for the researcher's mentor, and specific details such as the date, time, location, and approximate duration of the interview.

The individual interviews were conducted on-site in the specific high school teacher's redesigned learning space or traditional classroom setting. Crotty (2015) suggests that the location of the interview is important, as a constructivist approach to this qualitative study suggests that placing the subject in the setting of the research allows the subject to relate more to the line of questioning and be better positioned to connect with the purpose of the space (Crotty, 2015). When scheduling conflicts prohibited the interview from taking place in the redesigned space, the principal's conference room was utilized for the interview.

The semi-structured interviews took place when the teacher was not committed to teaching a class and lasted between 30 and 40 minutes—so as not to conflict with the teacher's instructional responsibilities. The teacher and the administration mutually agreed to the time and location of the interviews. The semi-structured approach provided consistency in questioning while allowing for flexibility within the conversation.

Data Collection

A predetermined list of open-ended questions was asked of each of the subjects, but was not presented to the subjects prior to the interview (Appendix E). A semi-structured interview format was utilized to guide the interviewer through the exploration of the various questions. Although the questions were identical to each of the subjects, the semi-structured interview was conducted as more of a conversation, with the ability to ask follow-up questions in an effort to obtain greater detail and gain deeper insight into the subject's responses (Bloomberg & Volpe, 2016). Individual interviews were imperative to the study as the researcher was striving to gain meaningful responses regarding experiences, feelings, perceptions, knowledge, and opinions from the subjects of the study (Patton, 2014).

Interviews were face-to-face between the interviewer and each individual teacher, were recorded digitally, using the audio recording feature on the researcher's mobile device. Upon the completion of the interview, the audio file was transferred to the researcher's password protected Google Drive account, so it could only be accessible by the researcher. The titles of the files do not specify the subject's name, but are instead listed as Interview_1, Interview_2, and so forth; in the order in which the respondents were interviewed. Teachers were referred to in this study using fictitious names coded to the interviews. The purpose of creating anonymously titled audio files was to ensure subject confidentiality. The transcripts of the interviews used the same title of each of the subjects for research consistency, as well as subject anonymity (Interview_1, etc.). All subjects who agreed to be interviewed were assured that their identities would be protected as indicated on their signed consent form.

Field notes were taken throughout the interview by the researcher to record observations that would otherwise not be captured by the audio recording during the interviews. Sharing

specific student-based evidence, describing the physical layout of a classroom, or identifying features of the learning space, proved vital when learning how the features of the space's design might influence engagement (Miles, Huberman, & Saldana, 2014).

Reflecting upon the key concepts, themes, questions, and issues uncovered after each interview had the potential of getting lost without documenting such details soon after an interview. In an effort to collect such information and summarize the data from the interview, the researcher used a contact summary form. Utilizing such a form allowed the researcher to capture and document personal, initial impressions of the interview. The form allowed the researcher to provide information on the main theme of the subject's interview, what research questions were of most interest to the subject, what new assertions or suggestions were posed by the subject that the researcher may not have addressed, and what additional information should the researcher focus on after receiving input from the subject? (Miles, Huberman, & Saldana, 2014)

Data Analysis

Analyzing data concurrently with data collection provided the researcher with an opportunity to examine current data while developing techniques and ideas for how future data could be enhanced to provide the researcher with richer and more meaningful data. The contact summary allowed the researcher to cycle between collecting data and discovering more efficient and more powerful discussion points within the semi-structured interviews (Miles, Huberman, & Saldana, 2014). The contact summaries were reviewed between each interview to allow the researcher to adjust or add supplemental questions in the subsequent interviews.

Once the interviews were complete, each audio recording was played back for transcription using a transcription service. Labels were generated in an effort to establish first-

level, symbolic meaning coding categories. Specifically, In Vivo coding was employed by the researcher to link phrases and terms related to redesigned classroom space to phrases and terms related to 21st Century Learning and Innovation Skills. These In Vivo terms and phrases were identified with quotation marks as a method of designating an In Vivo code (Miles, Huberman, &Saldana, 2014).

Second level pattern codes were subsequently applied to derive additional subcategories and themes. Establishing second order pattern codes allowed the researcher to identify richer and more developed themes that emerged from analyzing the interview data. Themes uncovered throughout the second order pattern coding process resulted in more focused theme development, uncovered a more purposeful concept map for interactions between the data, and laid the groundwork for linkages to other research studies (Miles, Huberman, & Saldana, 2014).

Important visual observances, such as seating arrangements, general layout of the learning space, furniture type, location of a teacher desk, lighting, wall art, writing surfaces, and other design-related elements were chronicled and recorded via the memoing technique as outlined by Miles, Huberman, and Saldana (2014). The researcher jotted down notes, during the interviews. The notes were the first impressions of what was heard or seen by the researcher. Memoing consisted of ideas and were not a summary of the interview. The memos were reviewed after each session and the notes were then expanded upon to provide additional clarity that the researcher needed when analyzing the data. The coded data allowed the researcher to link research questions to the common concepts that were established in the pattern coding process. (Miles, Huberman, Saldana, 2014)

Role of the Researcher

Early in his professional career, the researcher was a physics teacher who was provided with an opportunity to co-write a "physics & technology" curriculum, implement the course, and redesign a classroom to meet the needs of the coursework with a specific focus on the needs of the learner. Although the researcher was involved with that initiative over twenty years ago, the lasting impression of how innovative spaces can influence student motivation and learning outcomes has remained as an important area of study with the researcher.

After teaching for seven years, the researcher took on a variety of supervisory and administrative roles within the district. Presently, the researcher serves as the superintendent of the district, a role he has held for seven years. In addition to his school-based responsibilities, the author authored a reference physics book and also co-authored four editions of a technical college physics textbook. Furthermore, the researcher has presented on a variety of progressive educational practices at a variety of regional and national conferences and has been featured in publications such as "The New York Times" as well as a variety of regional educational journals. Finally, the researcher has partnered with the National School Boards Association, Apple Computer, and the New Jersey Department of Education, to host hundreds of visiting educators to observe how technology affected instructional methods and student learning within the researcher's district.

Under the researcher's leadership, the district applied and was accepted as a member of Digital Promise's League of Innovative Schools, of which the researcher currently serves as a member of its advisory committee. As a member of the organization, the researcher has been exposed to a multitude of school districts that have redesigned instructional learning spaces. However, most of the districts have focused on redesigning large, common learning spaces such

as libraries, cafeterias, lobbies, maker spaces, and other large places where students gather. The researcher has found there has been little consistent effort to truly redefine and modify individual classrooms to address the needs of the 21st Century Learning and Innovation Skills that students must acquire.

Fourteen years ago, the researcher's district embarked on a 1:1 laptop program. The purpose of introducing the technology into the district was to shift the learning paradigm to evoke a greater sense of student-centered learning throughout the district. Classroom management practices to accommodate the technology and the physical layout of traditional desks and chairs was adjusted to meet the needs of the learner with this new tool, but the redesign did not go as far as to promote significant collaboration between students, encourage communication, enhance critical thinking, and promote creativity within the classroom.

In the last four years, the researcher has worked with his administrative team and teachers to redesign individual classroom spaces to specifically address curricular, instructional, and pupil needs. High-top bistro tables, soft couches, writable surface desks, glass boards, interactive projectors, conference tables, booths, video-conferencing stations, and the like have been introduced into a variety of redesigned classrooms to meet the needs of the learner. In addition, the researcher has learned that there are additional superintendents in the League of Innovative Schools who have introduced similar changes into their classroom instructional spaces to promote such instruction.

The researcher has been excited to empower teachers to have a voice in redesigning their instructional spaces and is pleased to see that there are other educators who are thinking progressively about how the physical space can impact the learning within that space. However,

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the researcher has become increasingly frustrated by the lack of research regarding how individual classroom layouts might impact the level of engagement for students.

For this study, the researcher contacted a fellow superintendent who has allowed teachers to have a voice in how to redesign classroom spaces to improve teaching and learning. The researcher decided to conduct the study in this particular district because the district has purposefully engaged in such redesign, but it is not clear if research guided the decisions that were made by the teacher and the administration to redesign the space. In addition, there is no consensus about whether the modifications made have influenced the level of student engagement taking place in those classrooms. The district is well-funded, and decisions made regarding educational matters tend to be decided with the influence on the student being at the center of the decision-making process. Conducting research in such a district will allow the researcher to recognize that developing a quality educational experience for students is central to the mission of the district and, therefore, central to the focus of this research study.

The connection between the researcher's prior experiences and current initiatives must be controlled within the study itself. In an effort to limit bias within the study, the researcher limited personal biases and feelings during the interview and data analysis phases by having objective individuals confirm interview questions, review data, and confirm conclusions that are drawn by the researcher (Patton, 2014).

Validity and Reliability

Memoing or field notes generated during the interview were used to indicate any particular researcher biases in each of the interviews. In addition, the contact summary form was completed at the conclusion of each interview. Within the summary form was a section for the researcher to comment on overall thoughts and perceived experiences throughout the interview.

This information indicated the researcher's perception of the interview. As highlighted previously, all interviews were transcribed as well as coded and pattern coded for concept mapping. Coding the transcripts allowed the researcher to indicate if any personal interpretations of the information gathered in the interviews demonstrated a bias or influenced any possible conclusions gathered by the researcher.

Caution was taken throughout the study to ensure that personal experiences and biases did not influence the data analysis and conclusions drawn from the study. Understanding the difference between recognizing perspectives of subjects and biases of the researcher in narrative qualitative studies was not as simplistic as in other qualitative studies. Instead, the researcher needed to rely more heavily on the strength of the data that was collected and conduct a deep analysis of the transcripts via coding methods (Patton, 2014).

The combination of memoing during interviews, the transcription of the interviews, contact summary forms completed by the researcher, digital images collected, and other possible artifacts observed or collected added validity to the research study.

Limitations

The limitations of this research include the following:

- Only one school district was selected limiting a broader view of the affect that redesigned classrooms can have on student engagement.
- The particular features of a redesigned classroom are not necessarily defined for this study. What one teacher may perceive as a redesigned classroom to enhance student engagement, might not fit the researcher's definition of a redesigned classroom space. The lack of consistency between classrooms could play a role in the level of student engagement.

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- The curriculum that is implemented in the redesigned classroom could also play a role in influencing the level of student engagement. A teacher, in the same classroom, but implementing different curriculum, could yield differing levels of student engagement.

- Unknown biases in the recruitment of subjects within the district that was studied. There was a possibility that teachers who express a willingness to participate in a study are intrinsically more engaging as teachers, therefore putting into question the importance of the redesigned physical layout and structure of the classroom.

- The study was limited to a suburban, high school environment that had the financial ability to purchase and renovate classrooms. Lower cost efforts to redesign classroom spaces to enhance engagement levels may or may not have similar outcomes.

- The researcher's own bias regarding work within the researcher's district to redesign classroom spaces to elevate student engagement via 21st Century Learning and Innovation Skills may bias the interpretation of subject responses.

The interviews were expected to reveal that educators who design and work in redesigned learning spaces take greater ownership over the inspiring space and would design lessons and units of study that might take further advantage of the innovative instructional space. It is expected that an educator who is given the opportunity to work in such a unique space might pay extra attention to how students are grouped together to collaborate, might emphasize the importance of presentation and communication skills, which in turn, might foster a sense of overall creativity.

Those in the workplace design field have recognized that there is a link between work behaviors and the layout and features of the space where employees are engaged in their work. This research found a link between the engagement levels of students and the layout and features of redesigned learning spaces where those students learn.

CHAPTER 4

RESEARCH FINDINGS

Introduction

A thorough analysis of the data, including corresponding patterns, themes, and other

relevant observations that emerged after interviewing seventeen teachers who educate students in

the redesigned classroom will be presented in this chapter.

The purpose of this study was to investigate and examine the whether redesigned learning

spaces influence student engagement levels; specifically the extent to which redesigned learning

spaces facilitate possible enhanced levels of 21st Century Learning and Innovation Skills, such

as communication, collaboration, critical thinking, and creativity skills. Teacher feedback from

the semi-structured interviews revealed patterns and themes that addressed the research questions

for this study. Features of the redesigned classroom, teacher impressions of instruction in the

redesigned space, and how a redesigned space could influence engagement are presented.

Clear patterns emerged throughout the interviews regarding the characteristics of the

space and how those features may have been able to foster improved student engagement. This

was the focus of the first research question. Teachers were asked to identify and provide a

rationale for the features of the redesigned classroom that they believed were most influential in

motivating students to be engaged, specifically through the acquisition of the the 21st Century

Learning and Innovation Skills. Teachers did not solely focus on specific furniture features, but

also addressed the overall features of the classroom and what those design elements meant for

students acquiring the 21st Century Learning and Innovation Skills. Features of the the

redesigned space, the importance of understanding how that space may have influenced specific

aspects of engagement, and teacher input into the design of the space are examined to better address this question.

To address the second research question, a pattern of two distinct groups of teachers were identified and emerged during the interviews. When identifying these groups it was discovered that a teacher's motivation to embrace a redesigned learning environment played a role in the teachers' perspective of how their instruction has been influenced by the redesigned learning space. A clear difference emerges between those eager to have the opportunity to experiment with a newly designed learning environment and those who needed to see such an environment in action before requesting to work in a redesigned space.

Finally, the third question seeks to address which of the 21st Century Learning and Innovation Skills are acquired by students in a more effective manner because the students immersed in a redesigned environment. Teachers shared which of the 4 C's were most impacted by the new learning environment. Also, teachers shared how real-world connections played a role in how the learning environment was designed by the teacher and how curricular connections played a role in the development of the 21st Century Learning and Innovation Skills as emphasized by the teacher.

Design Elements Vital for Learning in a Redesigned Space

The first research question seeks to identify the features of the redesigned classroom space. Three themes emerged. The first theme, centered around the concept of flexibility of space. The second theme emerged when teachers revealed how valuable moveable, writable, whiteboard tables were to the functionality of the redesigned space. The third theme was focused on student autonomy, specifically how students were able to choose where and how to form their learning experience in the redesigned space.

The theme of flexibility emerged as early as when the principal of the high school formed a committee to develop the concept for what a redesigned classroom should include in their high school. The principal and committee members, of whom were interviewed, developed a framework for their instructional needs and proceeded to explore a variety of furniture, seating, lighting, colors, and other classroom options they believed would be integral and would create a more engaging educational learning space. Although a framework was developed by the committee that specified the types of reconfigurable tables and seating options, that framework evolved from feedback received by teachers and new furniture options were discovered on an annual basis over the last four years.

The need for flexible seating was apparent in the early model of the redesigned classroom. Caitlin, one of the teachers on the principal's committee to establish a model for the first redesigned learning spaces, talked about how the committee focused on introducing moveable tables that could place students together in collaborative groups. Trapezoid-like shaped tables for two students were purchased that allowed teachers to have students sit in pairs or, when joined together with two other tables, allowed groups of six students to face one another in an octagon-shaped arrangement. Rolling chairs, soft couches, and high top tables for two or three students were also part of the first iteration of the redesigned classroom.

Although whiteboard tables are now widely utilized in the redesigned classrooms, Lia, a math teacher who worked with the principal on the options for redesigned classrooms said, "I wanted whiteboard tables, but the committee didn't think that they were durable enough. There was a concern that with so much use, the marker would not be able to be wiped off properly." However, the need for flexibility and the benefits it yielded were further expanded upon by Lia:

> One size does not fit all. Some students stand at the high-tops in the back, and some sit on the round couch, and some prefer the circular tables… If it was all round tables, or all

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couches, or all high tops, I don't think the redesigned classroom would be as successful. (Lia)

Caitlin, another math teacher, was excited for the possibility of what a redesigned classroom could do for her and her students. "As much as I had worked to reconfigure my traditional classroom into groups, we always went back to rows and columns... I thought [a redesigned classroom] would be an interesting way to challenge myself… to be student-centered." Within the first year of implementation, Caitlin found that the new furniture configurations promoted a more student-centered environment that some students found more valuable than others:

> My honors students want to sit the way I sat in math class - staring at the teacher. My lab kids, who are my weakest academically, have done some pretty exciting things. They seem to get the most out of the engaging, student-centered environment. (Caitlin)

Teachers were asked what characteristics or features of the classroom were most important to address the needs of the learning and innovation skills needed in the 21st Century. The results are illustrated in Table 3.

Flexibility of the Space

The data from Table 3 illustrates that flexibility proved to be most important to seven teachers and was mentioned as influential by all seventeen teachers throughout the interviews. The ability to arrange student seating where pairs of students or teams of eight students could work together proved beneficial to the teachers when they were implementing lessons that promoted student-to-student interactions. These teachers shared that it was the ability to move tables, chairs, and rearrange how students grouped together as being the most important feature to them as they implemented activities and lessons focused on the acquisition of 21st Century Learning and Innovation Skills.

Table 3

Important Features of Redesigned Classroom

Interview	Subject Taught	Important Feature (Bold = Most Important)		
		Flexibility	Student Autonomy	Whiteboard
Jennifer	Computer Science	**X**		x
Brent	Social Studies	x	**X**	
Barbara	Computer Science	x	x	**X**
Chase	Social Studies	x	x	**X**
Kirsten	Social Studies	x	x	**X**
Anette	English	**X**		x
Chloe	Math	**X**		x
Madison	English / Special Ed	**X**	x	
Caitlin	Math	x		**X**
Alexa	Music	**X**		
Taylor	Math	x		**X**
Krista	Math	x		**X**
Kayla	Math	**X**	x	x
Kennedy	Math / Special Ed	x	x	**X**
Jasmine	Social Studies/Special Ed	x		**X**
Lia	Math	x	**X**	
Sydney	English	**X**		x
	Totals (most important)	17 **(7)**	8 **(2)**	13 **(8)**

Jennifer, a computer science teacher, expressed how perceived ease of use of the furniture and how the flow and flexibility of the furniture allowed the teacher to efficiently "group them by what they're working on at that point. It's extremely easy to just quickly move tables together for students to [collaborate]. It's amazing." Jennifer continued, expressing that

the flexibility of the furniture can promote student-to-student collaboration, but the flexibility

also proves useful by "just pulling the tables apart, so the students were working more

independently as well." Efficiency was seen as beneficial to teachers as well. Jennifer

explained:

> I like that we can go to groups and do partner work and solo work without having to
> move the tables around. Okay, so they can just slide their chair over. Whereas before,
> when I had desks, you had to rotate a desk and you had to rearrange. So the thing I like
> better is we can rearrange with minimal loss of instructional time. (Jennifer)

> Brent, a social studies teacher, reinforced this notion of the importance of flexibility

through his own observations of what is taking place in other classrooms:

> Teachers have been given complete creative autonomy to just do whatever we want, we
> can move things and you see that, you know, if you go into various classrooms today,
> you'll see people have the high top tables in the middle, people have the high top tables
> on the outside, people have couches in corners, people have couches pushed up along
> tables, and oftentimes will move things around on a period by period basis. (Brent)

The variety of furniture within the redesigned classrooms was interesting. Although teachers

tended to find the flexible whiteboard tables appealing, they also wanted the opportunity to

assign or allow students to choose other types of learning spaces in their classrooms that might

prove valuable. Every redesigned classroom had multiple options for student seating. No

classroom had only soft seating, all whiteboard tables, or all high top tables. Only traditional

classrooms had one-size-fits-all student seating. However, each classroom redesign allowed

teachers a limited variety of furniture for the teacher and/or students to choose from.

Moveable, Writable Surfaces

The second major theme that emerged regarding the characteristics of space, centered

around the versatility of whiteboard tables and what that functionality could do for student

learning in the redesigned space. Teachers conveyed that the whiteboard tables provided

teachers with a tool to elevate student engagement in the classroom. Barbara, a computer science teacher, was excited to share how valuable the whiteboard tables have been for her classes, "I've just seen kids be able to jot things out, talk about their ideas, and work things out on the tables… They'll just start talking and writing immediately using the whiteboard." Chase, another social studies teacher, expressed, "So the whiteboard table creates so many options now because they can write all over them, take pictures of their ideas on their iPad, and flip up the desk for small group instruction." Brent discussed the efficiencies of the whiteboard tables and how the tables promote a more student-centered approach in his social studies, redesigned learning space:

> These are great tables. They have a lock, they roll, it's very easy to move them around, which again, is a step up from when I had 33 desks and everyone's sliding the desk across the floor and it takes us five minutes to create group seating arrangements. It was a ridiculous, arduous and already a process of like, piecing together these small desks, which, you know, students don't always want. (Brent)

Anette, an English Teacher, further highlighted the value of the collaborative nature of the whiteboard tables and the preference that students have toward the value of the writing surface. Students are more apt to want to collaborate on the whiteboard, as it is more kinesthetic than collaborating on a Google drive document:

> I am able to ensure and hold students accountable as I can see what they are writing from a distance on their whiteboard surfaces. In addition to that, they take a picture of what is written on the whiteboard table, put it into their Google drive, and then we can even share it and project the work to the board to share with the entire class. (Anette)

The mobility of the rolling tables, the option to tilt the surface of the whiteboard tables for presentations, and the size of the whiteboard tables have all been advantageous to the teachers interviewed. However, according to eight of the seventeen teachers interviewed, it was the writing feature of the whiteboard tables that have generated the most excitement. Teachers

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expressed that the whiteboard surfaces have greatly influenced and enhanced student

engagement. Teachers provided examples of how the surfaces have promoted student-to-student

communication by enhancing group brainstorming activities, coding abilities, pre-writing

activities, math problem-solving skills, and peer-editing techniques in ways that large format

tables, technology, and handheld whiteboards have not been able to accommodate.

Kirsten, an English teacher, expressed how the basic benefits of using a whiteboard

causes more of his students to be actively participating in class:

> So the whiteboard table creates so many options now, because, you know, just for lesson planning and class activities, they can write all over them, they want to take notes on them… and some of the desks flip up. So you can even do small group instruction with the desk right there, which is great. (Kirsten)

Barbara shared her excitement about this new surface for students to work on in her computer

science learning space and why she views it as extremely valuable for enhancing student

engagement:

> Because I've seen kids just be able to jot things out and work things out on the whiteboard tables. And if you've got two kids sitting, they're talking and they just start writing immediately. You know, it's second nature, we have the markers all over. I see it in every single one of my classes. One of my classes, we do it explicitly as part of the lecture. So when I lecture, I present and then I say to the students, 'try to solve this problem.' They all write it down on the whiteboards and I'm able to walk around and see their progress. But in the other classes, honestly, it's usually organic, and they're using them all the time writing out things like writing code and drawing diagrams. So it's, it's amazing.(Barbara)

Anette expressed how she is able to quickly scan her English classroom from a distance and hold

students accountable for working, since she can see the work they are producing on the

whiteboard surface, observe that pupils are engaged with one another, and perform a quick

assessment to check for understanding:

The students are using the whiteboard tables and they're just so beyond engaged, because the accountability is raised, each student has to produce something, and it's visual to the other students what they're producing. So, for some activities, we may do a Socratic seminar, for example, and then the desk will be set up in a square format. We will have whiteboard tables around in a square and the two high tops in the middle. The students who are in the middle are, the ones who are speaking for most of the time and the students surrounding them are diligently writing. They are making some type of connection to the conversation in the middle. Through the environment, I am able to ensure and hold accountability in the kids. In addition to that, they just take a picture of the whiteboard table, put it into their Google drive, and then I bring it up on the board. So a lot of people would say, oh, it's a whiteboard surface, so it's going to be erased, but you have a way to memorialize what you are writing and share it on the Google Doc [with the teacher or whole class]. (Anette)

All four social studies teachers in the study verbalized that the whiteboards encourage students to create and contribute in an easy format, and how much the technology that was used allowed students to share information among their peers in an even more effective manner. Kirsten explained, "In the past [before whiteboards], I would have big post-its and we would write on them and stick them to a wall because we couldn't write on desks." The students would post them around the room, and then the teacher would have to save them. With whiteboards, you have to erase the board before the next class or activity, but the teacher has the students take a picture with the iPad and use Edmodo to share the information. Krista, a math teacher, also expressed her opinion that the whiteboards are better than iPads in isolation:

We can collaborate with one another, whether it's on Google Docs, or whatever type of application you may be using on the iPad, we can collaborate that way… It's better because you're not huddled around a small iPad screen. Instead, students are looking at a big canvas… All students have a marker in their hand and can make a mark on the work. (Krista)

Student Autonomy

Although the concept of allowing students to express choice in where they want to sit and how they want to work was important to many teachers, two teachers, in particular, expressed that student autonomy was the most important feature in promoting student engagement.

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Although few teachers expressed that student autonomy was the most important characteristic of redesigned space, it is still considered a theme as it was mentioned by many teachers as being a beneficial characteristic of the space.   Brent shared that teachers do not like being told where to sit, so it should not be any different for his social studies students:

> So it's the same concept. And for the rest of your life, people are not going to tell you where to sit, you don't go into a meeting knowing you have an assigned seat. You just kind of sit where you want to sit. So, again, how can we replicate the real world for students, not to prepare them to survive, but to help them go out and improve on things? So the space allows students to kind of work on projects and engage themselves in activities more effectively. (Brent)

The other teacher who said that student choice was the most important aspect of her redesigned space indicated students are not in assigned seating for large blocks of time. Although she will sometimes assign groups of students to work together, those groups are able to choose their ideal working environment within the classroom. Math teacher, Lia specified,

> There is no one-size-fits-all. Some students like to stand in the back, some like to be on the couch and some prefer regular chairs and tables. I think if it was all round tables, all couches, or all high tops, I don't think it would be as successful for students. (Lia)

Instructional Practice Influenced by a Redesigned Space

Four years ago, the high school principal asked a few trusted teachers to join him in developing a model for what a redesigned classroom instructional space should look like in order to enhance teaching and learning experiences in those classrooms. Administrators from the district had been exposed to several examples of redesigned learning spaces through several League of Innovative Schools site visits around the country. The concept of redesigning a classroom to provide teachers and students with greater flexibility to best meet the needs of their subject area and instructional practice was a new concept to all but a few teachers in this

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seventeen-person study. Fifteen of the teachers had previously only taught in traditional

classroom environments. Traditional environments consisted typically of classroom seats

attached to an individual desk. These classrooms, set up with desks lined up in columns and

rows, limited what teachers could do with the furniture to engage students in a more meaningful

way.

Teachers as Designers of Space

All but two of the teachers interviewed had the opportunity to design their classrooms

according to how they felt the classroom would best promote student learning. Several teachers,

in a variety of subject areas, embraced the opportunity to design their classroom through the use

of color, the orientation of the furniture, and other features of the classroom.

Anette articulated how she involved her students in the design of the redesigned English

classroom:

I have ownership over this room. If you look around, the students contributed to each and every

part of this classroom… There are no rows of desks, we have a lot of space to move around and

I ask the students for their ideas on how to occupy the space with their work. We have a 'values

collage', a door that is 'the door of inspiration', and a classroom 'wall of fame'. Every part of

the classroom is linked to every other part… Students get to choose a positioning in the room

that makes them feel most successful. (Anette) Anette continued to explain how the space has

helped her evolve as a teacher, indicating that she has gradually released her need to control what

takes place in the classroom and has turned more decision making over to the students to develop

a classroom that "is now student-centered, where the teacher is the facilitator, and the students

are crafting, creating, and collaborating. So through this environment, with this environment, the

students are able to execute exactly that."

According to Anette, the concept of a redesigned classroom fits in well with the

philosophy of what is expected of the teachers and students in this particular high school:

> When I first started teaching in a different district, the administration had the belief that if
> your classroom was quiet, you were doing a great job. And so working here, it's the
> absolute opposite. A classroom that is loud, collaborating, speaking, analyzing and
> sharing ideas is a great classroom. So when asked what colors I wanted my walls, I
> wanted energy, so I chose yellow and blue to symbolize the sun and the ocean… In an
> English language arts class, students need to have energy. (Anette)

Brent articulated how he was allowed to make decisions regarding the redesign of his social

studies classroom that made the most sense to him and his curriculum, and explained how the

psychological effect of the classroom on students is of central importance:

> I feel like we're given complete creative autonomy to just do whatever we want. We can
> move things and you see that, you know, if you go into various classrooms today, you'll
> see some people have the high-top tables in the middle, some people have the high top
> tables on the outside. People have couches in corners, people have couches pushed up
> alongside the tables, and, oftentimes, people will move things around on a period by
> period basis… I'm big on evolutionary psychology, so the classrooms are bright, the
> tables are clean and white, and the space has this kind of positive, alive kind of energy for
> students, as well as teachers.(Brent)

Barbara discussed how, by redesigning her computer science classroom, it enabled her students

to move from a traditional computer lab experience, where each student faced a desktop

computer against a wall and the large empty space in the middle of the classroom was where she

would observe what students were working on. The previous design was focused on the teacher

monitoring what each individual student was working on and provided little inherent opportunity

for students to collaborate. This contrasts significantly to the redesigned classroom she was

given the opportunity to construct, given the frustrations she had with a traditional computer

science classroom environment. Barbara expressed her frustration:

> Some of the classrooms here already have been redesigned. So I touched on them
> [teachers and the redesigned classrooms] for inspiration. One of the things I really

wanted in the classroom were whiteboard tables so students could collaborate about their ideas. They are as amazing as I thought they would be. And then, in general, I wanted some couch seating because I thought that would be comfortable for students to collaborate and create. I also wanted laptops so we could have places to move around instead of being stuck at our bulky, old desktops. (Barbara)

Barbara also identified with Brent's sentiments about the psychological effect the redesigned classroom has on students:

I wanted to pick the color and the design of the walls to include wavy features. We printed out bubble shapes on our vinyl cutter… The old classroom was sterile and cold, and this you walk in and it brings a smile to the faces. (Barbara)

Here, Barbara points out that the walls, painted to resemble waves, included three different shades of blue with vinyl-cut bubbles adhered to the walls.

A third unique feature of the computer science redesign was the four large flat screens that were located on the walls throughout the classroom. Each screen had two whiteboard tables below/in front of them, where students met to create code and collaborate to solve the issues they were encountering. The tables allowed the students to write out and conceptualize their work, the screens allowed the teams of students to communicate how to adjust specific code, and the couch and seminar area in the front of the classroom was a presentation-type space for students to discuss and present their concepts to one another or the teacher.

Alexa, a music teacher, was provided the opportunity to design the choral music space in a way that provided students with a variety of different needs, the area to thrive and engage in the work they needed to perform to become successful. Specifically, the teacher redesigned the practice/performance area to create efficiencies through the use of classroom risers that could be moved if needed. The choral music room is a windowless environment, so bright colors were chosen and the walls were adorned with famous quotations chosen by students, from people in

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history or pop culture that have a particular meaning or resonate with students. The emphasis on

classroom openness and space was important to the teacher, but she also expressed a need to

create a specific area in the music room where students could gather to collaborate in a more

organic fashion, without being directed by the teacher. Alexa recognized the need for this type

of instructional area, but allowed the students to prioritize their needs and asked the students to

assist her, and actually take the lead, in the design of the space. She commented:

> We had a series of committee meetings that spanned several months. The kids
> brainstormed what they wanted, in terms of technology and furniture that would invite
> them to collaborate proactively and independently. And that was the big goal, because, in
> terms of music, it can be hard for kids to find independence. I could show you the
> brainstorming board for the space, but they just barked out 100 things. I mean, they went
> from, 'I just need to be able to reach for the book' to, 'can we have a radio station,' to,
> 'can I have software to write music?' I mean, they just let it all out. And then slowly
> over months, they met with me and then we just kept following through with the next
> meeting.(Alexa)

Alexa expressed that the redesigned classroom, including the collaborative space, or lounge, as

the students call it, has caused her to "feel inspired… Students will come in and they'll be at the

board and one-thousand ideas will be jotted on the board, the excitement translates to me, and we

can capitalize on that energy together."

Two teachers interviewed shared classrooms with others, which caused them to express

that they felt restricted or limited regarding how much flexibility they had in creating unique

classroom configurations specific to the needs of their classes. Jasmine, a social studies teacher,

expressed:

> Every time we do group work, we screech the desks together and make all this noise.
> Then, I also had to move it all back at the end of class because the next teacher coming in
> did not want the classroom set up that way. (Jasmine)

Madison, an English teacher, expressed dismay when she was first assigned to share a classroom with another teacher who had one of the early versions of a redesigned classroom:

> Her room was spacious, but for my academically challenged kids, with the rolling chairs, how can we arrange this so it is going to best benefit the students and also myself so we don't all lose our minds? It was challenging. I was challenged. (Madison)

However, despite the perceived limitations and challenges, these same teachers saw opportunities and made improvements in student engagement in re-designed spaces over the traditional classroom. Jasmine articulated, "I feel like it opened up more opportunities for my social studies students, and at the same time, it was a bit of a challenge, because I was always used to the traditional seating." Jasmine shared that the redesigned classroom eventually provided her with the reason to attempt to relocate desks in the traditional classroom as well. Madison indicated that exposure to the redesigned classroom, even though the teacher did not have full autonomy of the room, caused her to request a redesigned classroom of her own the following year. She mentioned, "I don't know if I would have put my name in for that [redesigned classroom] if I hadn't shared one previously and been challenged."

Teachers with Previous Experience

Two teachers were unique to this study as compared to their colleagues as they shared that they had prior experience, before employment at this high school, which provided them with a unique perspective on the redesigned learning spaces. When hired to teach in the high school at the center of this study, the teachers were forced to return, at least temporarily, to a traditional classroom environment.

A math teacher named Kayla had taught previously in a program that utilized the concept of personalized learning in a large format classroom learning space. Over 150 students were

assigned to different centers or learning spaces where teachers would work with students on the particular standard they were tasked with completing. The teacher's experience with non-traditional learning spaces was specific to a large open-concept space with flexible seating.

Sydney, an English teacher, expressed that her prior experience in a middle school caused her to continually foster a more collaborative working environment for her students. She articulated, "I became a teacher in the middle school when the district was very involved with professional development around the cooperative classroom. I always felt my middle school room was more of a workshop [environment] than a lecture hall." The classroom Sydney taught in promoted engagement between students, she said, because the ability to reconfigure tables promoted communication between students during the class period. Sydney then expressed frustration about being transferred to a traditional classroom environment in the high school:

> All of a sudden I was in a classroom with rows and individual desks that changed me in a way that I never thought could happen to me - not in a good way… And I saw people using these great [whiteboard] tables. That is why I threw myself into the running for [the redesigned classroom lottery] the next year. (Sydney)

The Mindset of Early and Recent Adopters

Fifteen of the seventeen teachers interviewed who did not have prior experience in redesigned environments, became motivated to teach in a redesigned space in a variety of ways. Early adopters of the redesigned space, those who sought to be part of the lottery system in the first three years of implementation, expressed words such as "excitement", "energized," and "challenged" when asked how teaching in a redesigned classroom made them feel. Brent expressed:

> I walk [into my classroom] and it's a positive environment where my students and I feel positive, energetic, and encouragement. I think my students and I end up taking more risks because the open, bright, environment inspires us to do so. (Brent)

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Brent and other early adopters who were eager to experiment with redesigning classrooms all had less than seven years of overall teaching experience and expressed in their interviews that they were intrigued by the concept, identified themselves as experimenters who were willing to take a risk, as they were still actively seeking how to improve upon their individual teaching practices.

Teachers who have only recently requested to enter the lottery for a redesigned classroom did so after expressing that they were inspired to do so after observing what their fellow colleagues were able to do with a redesigned space. Kennedy, a special education and math teacher, talked about how one of the early adopters, a teacher in a classroom next door to her, had been able to "do different things with her students [with the flexible furniture] and I had worked with her previously, and I just saw [what she did] with it and I wanted to do it. It just intrigued me." Sydney, an English teacher who had prior experience in a redesigned classroom in the middle school environment, but was currently teaching in a traditional high school classroom, credited fellow math teacher Lia, with "reminding me that this is what I used to do in my [middle school] classroom with this new setup. This is what my classroom was always like, and should be [now]... It was refreshing to see that it could still happen for me."

The more recent adopters of the redesigned classrooms tended to demonstrate more confidence in their prior and ongoing teaching abilities and expressed that the early versions of the redesigned classrooms, weren't "good enough" and it wasn't worth the effort to take the step to apply for the lottery. In fact, the interviews demonstrate that the teachers who more recently applied for a redesigned learning space were very particular about not mentioning "risk-taking" or "experimentation" in their interviews. Instead, these teachers talked about how the redesigned

space enhanced what they were already doing in their classrooms, by engaging students in a more impactful manner, but the redesigned space did not transform their teaching practice.

Assigned a Redesigned Learning Space

The administration assigned two teachers, not necessarily reluctant to teach in a redesigned classroom, but not seeking out the opportunity either, to teach one or two periods in a redesigned classroom while teaching the remaining classes in a traditional environment. Jasmine, a social studies and bilingual teacher expressed, "I feel like [the redesigned classroom] opened up a bit more opportunities and, at the same time, was a little bit of a challenge because I was used to traditional seating." The Jasmine continued to say that for her second year in the district, "I put my name in for the lottery and I was super excited when I got the opportunity to make it my own space for all [of my classes]." A math teacher, Chloe, was also placed in two separate redesigned classrooms upon being hired by the district. These classrooms were shared with other teachers, and only one of the classrooms included whiteboard tables, which are perceived by many teachers as advantageous, compared to the non-whiteboard tables. Chloe indicated that she was initially hesitant to believe the perceived benefits of the redesigned classrooms. "At times it [the classroom setup] can be really challenging. And I would say the only drawback that I do find in this space is that when things are a little bit distracting for students, they have a difficult time focusing." Despite hesitation about the benefits of a redesigned classroom, Chloe did indicate that, over time, being in the redesigned classrooms caused her, "to pick more activities that involve group work," and shared, "I am having them work together to check each other's work more often."

Influence of Redesigned Space on 21st Century Learning & Innovation Skills

The rationale for redesigning the traditional learning space was to provide teachers and students with an environment that might enhance their ability to acquire the 21st Century Learning and Innovation Skills, known as the 4C's. Subjects of the study were asked which of the four aspects of 21st Century Learning and Innovation Skills: Communication, Critical Thinking, Creativity, and Collaboration were influenced most by their efforts to redesign their classrooms to promote student engagement. First and foremost, all of the teachers indicated that the purpose in redesigning their instructional spaces was to positively engage students at a higher level. However, the space and corresponding curricular area influenced what types of 21st Century Learning and Innovation Skills were predominantly enhanced by the new space.

Influence on Collaboration

All but one of the teachers interviewed expressed that their redesigned space allowed students to collaborate more frequently and with greater ease than when they taught in more traditional classroom environments. In fact, twelve of the teachers interviewed indicated that collaboration increased more than any of the other four C's. An additional four teachers shared that collaboration was ranked second in their list of 21st Century Learning and Innovation Skills that they believe benefited from their redesigned classroom. Alexa, the music teacher, felt that collaboration was influenced the most by her redesigned classroom. "This space is set up for us to talk. Look at our natural position that we fell into, you know, the way we came here. It is a comfortable environment, where you can look everybody in the eye. It is easy to find our own space." She continued to elaborate on how her classroom is a multi-functional space and how each area is conducive to different types of activities, all of which promote students working and collaborating together.

All seven math teachers were uniquely aligned regarding their opinion that collaboration has benefited greatly by their redesigned classroom spaces and that math particularly has benefited from this collaborative opportunity that the space provides. Math teachers discussed the benefits of quickly mobilizing students into pairs and then transitioning into larger groups with relative ease. Regardless of if the individual classrooms had the early versions of the trapezoidal tables that could seat two students, or when joined together, seat eight students, or if the classroom had the new whiteboard tables that allow six students to gather around two tables joined together, the teachers expressed that students in all versions of the redesigned classrooms were observed collaborating significantly more than they when in traditional classrooms.

Table 4

Teacher Ranking of the Most Acquired Skill in the Redesigned Classroom Learning Space

Interview	Subject	1st	2nd	3rd	4th
Jennifer	Computer Science	Collaboration	Creativity	Communication	Critical Thinking
Barbara	Computer Science	Creativity	Collaboration	Communication	Critical Thinking
Anette	English	Critical Thinking	Collaboration	Communication	Creativity
Sydney	English	Critical Thinking	Collaboration	Critical Thinking	Communication
Madison	English / Spec Ed	Collaboration	Creativity	Critical Thinking	Communication
Chloe	Math	Collaboration	Critical Thinking	Communication	Creativity
Caitlin	Math	Collaboration	Creativity	Critical Thinking	Communication
Taylor	Math	Collaboration	Communication	Creativity	Critical Thinking
Krista	Math	Collaboration	Communication	Critical Thinking	Creativity

Kayla	Math	Collaboration	Creativity	Communication	Critical Thinking
Lia	Math	Collaboration	Creativity	Communication	Critical Thinking
Kennedy	Math / Spec Ed	Collaboration	Communication	Critical Thinking	Creativity
Alexa	Music	Collaboration	Creativity	Communication	Critical Thinking
Brent	Social Studies	Creativity	Communication	Collaboration	Critical Thinking
Chase	Social Studies	Communication	Collaboration	Creativity	Critical Thinking
Kirsten	Social Studies	Collaboration	Communication	Creativity	Critical Thinking
Jasmine	Social Studies / Bilingual	Collaboration	Communication	Creativity	Critical Thinking

Taylor, a math teacher, shared that the whiteboard tables in the classroom allow his math students to write and work on problems together in the classroom:

> Students can do their problems together in class. The whiteboard tables help engage them in a way that makes them work together more often and easier. I think with the iPad, one of the bad things is students develop tunnel vision and work individually… So the whiteboards in class are fixing that for me by providing the students with a better way of working together. (Taylor)

Whiteboards are not the exclusive answer for increasing levels of student collaboration in mathematics. Kayla, who does not have whiteboard tables in her math classroom, but does utilize larger tables for two students at a time, shared her initial skepticism for if students would work effectively together in class if paired together. The teacher explained,

> It was really amazing the way they sat together and only asked each other questions about the topic and spoke to one another about the math problems they were tasked with solving. So I feel like in that aspect, the collaboration that those tables has fostered is really cool. (Kayla)

Further, Kennedy discussed how her prior need to be "king of the classroom" has changed as a result of the newly designed math classroom:

> I'm still getting used to it as a teacher, but I find that when they are closer together, talking, and working more. The right lesson is what they need and I must encourage

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them to do that by developing those types of lessons that take advantage of the collaborative nature that the furniture allows for. (Kennedy)

Teachers repeatedly articulated the need to develop lessons and learn from other teachers that emphasized greater student engagement in their learning, and that the process of getting students more engaged is an evolutionary process for educators.

The redesigned classroom has promoted student collaboration for Kennedy, who has employed a flipped classroom for her math students. In Kennedy's math class, students watch a video at home or review something that previews the concept in one of the math applications. The following day, students work together at the whiteboard tables and conduct collaborative problem solving sets. Students are seen in the class referring to the videos or apps for assistance, but working together—collaborating with one another before approaching the teacher with questions.

Computer Science teachers discovered that collaboration and creativity were both enhanced by their newly redesigned learning spaces for students. The teachers believe the whiteboard tables primarily allow students to collaborate on assignments but also have observed that the flexibility that the classroom allows has increased levels of creativity among the students as demonstrated in their work output. Jennifer shared, "Because of the versatility of the tables, and because of shifting everything around, it allows students to become more creative because there are so many more options for them as they develop their product." When pressed to explain how she recognizes students are being more creative she shared, "I see them thinking so much, and when they walk into the room, I can feel the energy from them and they say, 'I love this classroom' and, 'this class is so much more interesting.'" Barbara shared that the solutions they generate may be due "to [a] variety of spaces and seating. It gets their juices flowing and

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[the solutions] have taken on a higher level of uniqueness that wasn't apparent in the traditional classroom - especially as many of the students in the computer science program meet for a ninety-minute instructional block."

The exchange of ideas is of critical importance in the social studies curriculum. Although collaboration efforts seemed to outrank communication slightly for social studies, the teachers felt that communication skills seemed to be enhanced by the redesigned classroom environment. Chase verbalized his thoughts regarding how the redesigned seating has fostered communication skills among his social studies students:

> The level of communication has increased in my class. Mostly because they're sitting with their natural groups. In my first period class, you know, I have four kids here who are, first of all, they're strong students. But, secondly, they're friendly. And the communication piece, you know, the first day of school, they sat here, they chose to sit together, but they were quiet. And now, I'm sure you've experienced this when you're in a classroom, and you have the kids working on something, and they should be discussing it - and it's silent - right? Here, in these classrooms, it's a lot easier for them to be prompted into that discussion. Sometimes they still need the prompting, but it's easier because they're sitting together, they're sitting on the couch together there, they are sitting across from one another and we don't have to drag desks for them to face each other. The classroom is great for conversation, is there a sense of community around these tables, and there's a sense that the kids really want to talk to one another about their ideas. (Chase)

Influence on Critical Thinking

Critical thinking was the element of 21st Century Learning and Innovation Skills that teachers overwhelmingly felt was the least impacted by the redesigned classroom environment. Ten teachers expressed that critical thinking is something that they value and has an important role to play throughout their curriculum, but they did not believe that the redesigned classroom impacted, in a significant way, how students critically think. Instead, most teachers expressed that they felt critical thinking was inherent in the learning activities and were not influenced by the learning space as much as collaboration, communication, and creativity. Jasmine stated,

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> The classroom structure is getting them to think a little bit less independently on their own because they are seated next to and across from someone who may be writing on the whiteboard surface and therefore students may not be focusing internally and thinking as critically as they otherwise would. (Jasmine)

In fact, all four social studies teachers unanimously indicated that critical thinking was not influenced greatly by the redesigned classroom environments. Kirsten shared, "I like to have students think critically, but I feel like maybe that is a process in their own brain. [The redesigned classroom] allows for them to share their critical thoughts with other students, to share their different perspectives." Chase, explained, "I'm not saying that I don't see a connection to critical thinking, but the lines are blurred, and I don't see that as consistently increasing in students."

Teacher Understanding of Real World Skills

Three teachers spoke passionately about the importance of connecting the future world of work or college to why it is important for students to acquire 21st Century Learning and Innovation Skills. Social Studies Teacher, Chase, stated:

> [I have] thought deeply about preparing students for the outside world. It is important not to have students memorize what has happened in history, but how students can identify a problem, propose a solution and then look at the limitations of their proposed solutions. And, you accomplish that more effectively in a different style classroom. (Chase)

He and other teachers state they have done a lot of reading, research, and have reflected on how technology start-up companies have spurred innovative practices. Brent finds that much of that research points back to establishing a culture where employees are able to collaborate, communicate, think critically, and create.

Four teachers discussed how they recognize the importance of creating learning environments that mimic what students will experience in college and perhaps in their careers.

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Kennedy referenced how a relative of hers works for a power distribution company where every employee works on a team. Specifically, she stated:

I tell my special education students all the time that we are doing these types of activities because you have a hard time working with each other sometimes. No matter what you do in life, you are going to have to work with people, learn to collaborate with others and solve problems that are sometimes changing too. (Kennedy)

Brent discussed how a local company has eliminated all individual workstations and desks. Instead, the company has created an environment that is, "a great giant room with a bunch of tables. All of their employees are around the tables working together to communicate, collaborate and solve problems. They do that because more minds are better, more minds are more creative, and they can solve their problems." Brent then linked his comments about work environments to what his expectations are for students. "I want my students to be proficient in both collaborating and communication through technology. To me, I just see there is a real natural connection between schools and the business world and we should model what they will experience."

Two other teachers recognized the importance of creating spaces to promote 21st Century Learning and Innovation Skills in high school because students may likely experience similar learning environments in college as well as in their careers. Two teachers referenced their own learning experiences and how limiting traditional classrooms are for promoting creative teaching for student teachers. Chase shared, "I am thinking back to my college experience. There were no desks, just tables that students were sitting around as we worked together." It is not just the fact that the space included tables instead of individual desks, but what the instructor expected of the students and what type of work that they were engaged in. The learning needs to be

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authentic and if the expectations are realistic and the learning space is conducive for promoting that type of thinking, then that spells a recipe for success.

Kirsten shared that she wanted her students to feel more mature and independent in her redesigned social studies room; specifically, because if they are treated with more respect then they will rise to the occasion and the expectations of them. If they are in a college-like environment, the feel is more prestigious and real-life to the students.

CHAPTER FIVE

DISCUSSION OF FINDINGS AND RECOMMENDATIONS

Introduction and Overview of the Study

The final chapter of this study will consist of a brief overview of the study, followed by a detailed examination of the findings and implications of the research that was conducted. Subsequently, the theoretical, practical and policy implications of this study will be examined. Finally, future research recommendations will be presented so additional evidence may be gathered to learn more about how redesigned classroom learning spaces may be used to influence student engagement through the acquisition of 21st Century Learning and Innovation Skills.

The goal of this study was to investigate and examine whether redesigned learning spaces influence student engagement levels—specifically the extent to which redesigned learning spaces facilitate the level of communication, collaboration, critical thinking, and creativity that takes place in the learning space. The research questions were designed to help uncover what or if there is any connection between the redesigned classroom learning space and student engagement:

- Research Question 1: What are the characteristics of a space that would address the needs of the Learning and Innovation Skills within the Framework of 21st Century Learning, specifically: collaboration, communication, critical thinking, and creativity?

- Research Question 2: How does an instructional space, designed by a teacher, influence the teacher's perspective on instructional practice?

- Research Question 3: Can a redesigned classroom learning space influence student engagement?

Qualitative data was acquired to construct meaning as participants shared valuable information through semi-structured, open-ended questions with the interviewer (Crotty, 2015). The open-ended questioning was carefully designed in an effort to address the research questions.

Seventeen teachers from one high school participated in face-to-face interviews with the researcher. They provided valuable insight into their perceptions of what specific features of their redesigned classrooms they believe influenced the acquisition of 21st Century Learning and Innovation Skills among their students. Data acquired from the interviews were analyzed using In Vivo coding procedures, information from contact summaries, and memoing (Miles, Huberman, & Saldana, 2014). The findings from this study suggest that redesigned classroom spaces, which are designed by teachers and where students can exercise certain levels of autonomy, enhance certain 21st Century Learning and Innovation Skills more than others. The interpretation of the findings from this study provides policy-makers, educators, researchers, and designers with answers about the impact that redesign efforts have on student engagement.

Discussion of Findings

Characteristics and Features of the Redesigned Instructional Space

Two major studies, conducted by measuring student perceptions of engagement, attempted to provide information on how space influences student engagement. A study conducted on students at the Bridges Centre for Excellence in Teaching and Learning at the University of Bedfordshire discovered that features of creative spaces such as flexibility,

writable surfaces, and technology may result in heightened student engagement and enthusiasm (Jankowska & Atlay, 2008). In addition, a study at the University of Queensland indicated that flexible spaces enhanced student engagement due to their ability to foster active learning in the college environment (Matthews, Andrews, & Adams, 2011). Both sets of research are missing the perspective of the teacher regarding how the features of a redesigned classroom may influence student engagement as per the 21st Century Learning and Innovation Skills Framework. Throughout the interview process in this study, teachers expressed clear and consistent ideas on what features most influence student engagement.

School design elements have been an influential factor in how teachers educate and how students learn (Baker, 2012). Redesigning educational learning spaces to reflect what is needed in the future workplace has caused educators and architects to discover the most effective lighting levels, color schemes, acoustical features, furniture layout, and type of seating that will create the ideal 21st-century learning space (Monahan, 2002). Feedback from teachers interviewed in this study may provide designers and educators with feedback on what factors of the learning environment are most influential for student engagement.

All seventeen teachers who participated in this student indicated that flexibility of furniture was a necessary feature as it allows for different types of lessons and promotes student-to-student interactions. Specifically, seven teachers indicated they felt this was the single-most influential feature of the redesigned classroom. The efficient ability to pull tables together or apart, clear an entire floor to create an open space, and rearrange student learning centers depending upon the unit of study, were seen as beneficial and reinforced the research that Monahan conducted on students.

The University of Bedfordshire study highlights that the type of furniture, along with writable surfaces and technology, influenced motivation levels in students and engaged them at higher levels (Jankowska & Atlay, 2008). The University of Bedfordshire research findings is reinforced in this study as eight teachers believed that the moveable and writable whiteboard tables were the single-most valued piece of furniture among teachers. The introduction of whiteboard tables played a major role among teachers looking to have students engage more with one another, work collaboratively to solve problems, and communicate ideas with one another using a large-format, very visible piece of furniture that also allowed teachers to assess student learning and understanding.

Student autonomy (i.e., an ability to make their own choices with where and how they learn) is a feature of the redesigned classroom that two teachers prioritized as most important. Eight additional teachers mentioned student autonomy as an important feature, just not the most important feature of the redesigned classroom space. The University of Queensland study on college students indicated that flexible learning and common areas fostered active learning among students (Matthews, Andrews, & Adams, 2011). Teachers in this study suggested that allowing students to find alternative seating in their classrooms allowed students to work in an environment that suited their needs as well. Teachers expressed they would allow a student to work at one of the whiteboard tables, gather at the standing-height group table, sit in the collaborative couch area, or even use one of the rocking ball-like seats during class. Each of these seating arrangements allowed for teams of students to gather and work together in a space they favored to suit their learning needs.

Lighting, colors, and other sensory features were mentioned by teachers who believed strongly in evolutionary psychology and felt those features were important in their classroom

design. The three teachers focusing on these aspects felt that the colors, lighting, and flow of the room helped make the learning environment more comfortable for students and allowed them to become more engaged in their learning. However, classroom flexibility, the features of the whiteboard tables, and the ability to promote student choice/autonomy were the most influential aspects of the classrooms that teachers believed promoted student collaboration, communication, critical thinking, and creativity.

Teacher Perspective on Instructional Practice

All seventeen teachers interviewed for this study previously taught in traditional classrooms and were able to compare their prior impressions of student engagement in a traditional classroom with their current experiences in a redesigned classroom. Demographic data collected from the subjects, along with responses during the semi-structured interviews, revealed patterned differences between how quickly a teacher embraced the concept of teaching in a redesigned classroom and the classroom characteristics they felt were most impactful on student engagement levels.

For the purpose of this analysis, early adopters were those teachers who transitioned, with little hesitation, to the new educational space in the first, second, or third year of the school-wide redesign lottery. More recent adopters were more cautious in their reasoning to shift to a redesigned classroom environment and made that shift sometime during the most recent two years of the school-wide redesign lottery.

Regardless of whether a teacher was an early or more recent adopter of the redesigned classroom, both groups of teachers were equally passionate about providing their students with the most effective learning opportunities, yet the characteristics of the redesigned space that they

believed were most influential in increasing 21st Century Learning and Innovation Skills in those classrooms were different.

Seven teachers, with varying levels of experience, were considered early adopters of a redesigned classroom. When asked about their impressions of how the redesigned space has influenced their perspective on their instructional practice, early adopters uniformly expressed that their redesigned spaces provided motivating, exciting, and transformative instructional activities that targeted 21st Century Learning and Innovation Skill acquisition. It is the researcher's opinion that the early adopters of the redesigned space embrace experimentation because the early adopters recognized that their instructional methodologies might need to change when they encountered challenges. Having a flexible learning environment, therefore allows the teacher to shift group dynamics, realign learning spaces, and introduce different activities, in a manner that will best promote student engagement. This sentiment is supported by a study that purported for a learning environment to achieve its goals of supporting 21st Century Learning and Innovation Skills, the learning environment should offer opportunities to "change situations" and that the environment must be flexible to adapt to the needs of the students and teacher interactions (Nissim, Weissblueth, Scott-Webber, & Amar, 2016).

The overall perspective expressed by early adopters was that their redesigned classroom now allowed them to discover new ways to engage students, make the classroom come alive, and reflect what students will be expected to do in their future world of work. These teachers shared that they felt excited, nervous, and energized about working in a redesigned classroom. Their perspective was that they are characterized as risk takers, experimenters, and eager to be on the cutting edge of educational practice. All seven teachers articulated that they were interested in

taking risks to improve student engagement and that this opportunity would allow them to become more creative and dynamic teachers.

When recent adopters—who have all taught for more than six years—were asked about their impressions of how the redesigned space has influenced their perspective on their instructional practice they tended to share that their redesigned spaces provided greater efficiencies and more engaging aspects to their already engaging instructional activities. The four recent adopters stated that, although they had been able to engage students in collaborative activities in their previous traditional classrooms, they felt their lessons became more efficient to implement. In addition, they expressed that there were enhanced opportunities for communication among students due to the flexibility created by the movable and writable whiteboard tables. The introduction of these flexible features, viewed by the teachers as beneficial to students, allowed the teachers to expand upon their existing methodologies to further enhance student engagement.

The overall perspective expressed by recent adopters was that the redesigned classroom allowed them to engage students in a more impactful manner than when they were teaching in a traditional classroom. Recent adopters expressed significant confidence in their own teaching abilities, both prior to and after shifting to a redesigned classroom. The shift to a redesigned classroom was not necessarily to experiment with new methods of teaching and implementing new lessons. Instead, the teachers articulated that shifting to a redesigned learning space allowed them to enhance their activities, but did they did not necessarily seek out new activities that could be viewed as revolutionizing their instructional practice. In addition, all six teachers did not express words of excitement or risk but expressed feelings of improved confidence, pride,

and empowerment in their teaching skills as they engaged their students at a higher level in the redesigned learning environments.

It was clear, through the research and demographic information collected, that the teachers who were quickly open to embracing a redesigned classroom environment were not more or less experienced teachers, but were teachers who were inherently eager to take calculated risks and open to experimenting to transform their craft. More recent adopters, who tended to have more overall teaching experience, were confident in their teaching practice and were not as open to disrupting their current instructional methodology.

It should be noted that teachers expressed purposeful consideration throughout the interviews about how their instructional methodologies might be influenced when choosing to shift to a redesigned classroom environment. These teachers spoke about how their lessons and activities might be improved or become more efficient in a redesigned learning space. There are more teachers, who were not interviewed, who have not embraced or even considered a shift to a redesigned classroom. Research supports that creating learning environments that support 21st-century learning must be differentiated based on the clientele and the varied abilities and experiences of teachers (Kiefer, 2012).

Kiefer (2012) states that because teacher abilities and experiences are varied, the expectations from administration must be varied to meet the needs of all teachers involved in change. Teachers shared that the administration encouraged teachers to embrace the concept of a redesigned classroom, but they were purposeful and patient as not every teacher was as eager or able to embrace such a shift. This was viewed as a welcomed approach from all the teachers interviewed in this study.

Two teachers in the study had prior experience working in a redesigned classroom when they taught in a different school and lent a different perspective on how the redesigned space influenced their practice. These teachers expressed that coming to this current district and teaching in a traditional classroom was a challenge for them, as they were previously immersed in more flexible and dynamic learning environments that fostered student engagement. Matthews, Andrews, and Adams (2011) shared findings that learning spaces enhance student engagement when the space fosters active learning and student-to-student interactions, and that the design features of the space play a role in a student's perception of that space. Both of the teachers who had prior experience talked about how student-to-student engagement was reduced as a result of their transition to a traditional learning environment in this district. These teachers were motivated to redesign their classroom and felt "empowered" and "refreshed" to return to a classroom space that provided teachers with flexibility and students with some autonomy in their learning. As a result, they shared that they felt more passionate and energized about their teaching.

Redesigned Classroom and Influencing Engagement

Enhancing collaboration skills requires students to not simply communicate with one another, but specifically develop skills to work with members of a team, forge consensus, and negotiate. Instructional practices include having students evaluate one another via peer evaluation and having students form teams with each participant taking on a specific role or task (Plucker, Kennedy, & Dilley, 2015). Technology can be utilized to assess students on how they collaborate, via Google Drive and other interactive collaboration tools, but teacher observations of students while working in teams can successfully measure collaborative skills.

All seventeen teachers indicated that student collaboration skills were enhanced via the redesigned classroom, and several teachers discussed how they rely on technology to help them assess that skill. Predominantly, teachers shared that due to the redesigned nature of the classroom, they were able to effectively listen to and see what students were working on as they circulated through the classroom, listening and viewing the progress of team-based projects. The whiteboards, with each student having a specific marker color, allowed the teacher to witness what students were contributing to the team, while the flexibility of the moveable tables allowed the teachers to circulate with ease throughout the classroom to listen to what students were discussing in their groups.

Overall, twelve of the seventeen teachers indicated that, from their perspective, the redesigned learning space has seen collaboration and communication skills benefit significantly more than critical thinking and creativity. Of particular interest, all seven math teachers who were interviewed stated that collaboration in their classrooms benefited most significantly from the features of their redesigned classrooms. Math experts, which is a subject that is perceived as a subject where a student works in isolation to develop necessary skills, recognize the benefits of having a learner-centered classroom. Teachers shared their optimistic outlook that mathematics is reaping the benefits of the heightened student engagement levels that the redesigned classroom is able to provide.

On the opposite end of the spectrum, ten teachers felt that critical thinking was affected the least as a result of teaching in a redesigned classroom learning environment. Although the classrooms themselves were redesigned to simulate a more authentic work environment, the classroom itself is not as conducive to promoting this skill, as critical thinking relies more heavily on curricular units and instructional activities that create authentic, although sometimes

simulated, real-world problems. Critical thinking relies on providing students with performance tasks, and therefore may not be as reliant on the design of the classroom space as opposed to instructional design (Dilley, Kaufman, Kennedy, & Plucker, 2015).

David Ross's (2017) work with the Partnership for 21st Century Learning and Innovation Skills was developed with input from over four hundred members of a varied set of companies and organizations representing over two million workers. The 21st Century Learning and Innovation Skills were established in response to the need from the global business community that recognized the highest driver of change in the workforce is the fluidity of the work environment itself and how these flexible environments will facilitate innovative thinking and collaboration. In fact, the World Economic Forum suggests that out of the top five skills needed for the future world of work, four of those skills are found in the 21st Century Learning and Innovation Skills (The Future of Jobs - World Economic Forum, 2016).

When asked why it was important to expose students to the 21st Century Learning and Innovation Skills, three teachers were able to clearly express the importance of the 21st Century Learning and Innovation Skills framework that is used to prepare students with the skills necessary for what they will experience in college and in their careers. These teachers talked about how they have provided their students with authentic examples of how progressive start-up companies place tremendous emphasis on collaborative environments, where teams of individuals ideate and build models for products and services that previously would have been developed in isolation by separate groups. Creating authentic experiences to mimic or replicate what the workforce is engaged in can be an opportunity for teachers to motivate and engage their students at even greater levels. Having teachers know what is expected in the workforce, and

perhaps even having real experience in the workforce, is a tremendous asset to students in the classroom.

Implications for Theory

The work of David Ross and the Partnership for 21st Century Learning is responsible for crafting a collaborative partnership between educational leaders, governmental officials, and businesses. The theoretical framework, known as the 21st Century Learning and Innovation Skills, stipulates and provides guidance to educators on the four most important skills that students must acquire in order to be successful in the future world of work. Those skills, also known more casually as "The 4 C's," include critical thinking, creativity, communication, and collaboration (P21 Framework for 21st Century Learning, 2016).

This study was crafted to analyze if a redesigned classroom environment might, from a teacher's perspective, influence the acquisition of those learning and innovation skills. This study examined the reflection and feedback from seventeen high school educators who are currently working in a redesigned classroom to discover what characteristics of a space might better address the Learning and Innovation Skills that students require. The work and analysis presented expands the research field and has implications for theories that have been developed in the area of classroom design and student engagement.

This study has implications on the research conducted at the University of Bedfordshire. That study specifically cites that the flexibility of classroom space, writable surfaces, and technology increased engagement and enthusiasm (Jankowska & Atlay, 2008). Teacher feedback received throughout this study indicates that there were specific aspects of the classroom that positively influenced the acquisition of 21st Century Learning and Innovation Skills. This study adds to the work at Bedfordshire by revealing that the flexibility of the

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classroom furniture and space, the opportunity for students to utilize the dynamic whiteboard tables, and the option for students to make their own decisions regarding how they utilized the features of the classroom were the key features of the redesigned classroom environment that increased student engagement via the acquisition of 21st Century Learning and Innovation Skills.

This study also influences theoretical concepts surrounding how a teacher-designed instructional space may influence a teacher's perspective on his or her instructional practice. All the teachers who were interviewed for this study responded that their redesigned space had positively influenced aspects of the 21st Century Learning and Innovation Skills. Motivation and rationale for embracing the concept of a redesigned classroom learning space may greatly influence a teacher's perception of their ability to engage students (Cornelius-White, 2007). Three teachers in this study were involuntarily assigned to teach one or more classes in the redesigned learning environment. Those teachers did not express that they had transformed their learning environment in a meaningful way during their first year assigned to the redesigned classroom. However, these teachers expressed enthusiasm for having the opportunity to teach in such a classroom and they applied for their own redesigned classroom as they experienced the potential for increasing student engagement. However, the research from Cornelius-White suggests that by being assigned to that space and not playing a role in the ground-level design experience, the teachers might be less motivated and enthusiastic about their ability to enhance student engagement levels as compared to a teacher who was intrinsically motivated to apply for the redesign lottery.

Keifer's (2012) theory that new models of teaching and learning have outpaced the modifications that are needed within schools has caused educators to get creative about the space that they currently have at their disposal. Expensive reconstruction is not an option for many

districts, but the evidence presented in this study—that redesigned classrooms are able to influence student engagement—is a viable alternative to expensive renovations of classroom space. In this study, simply painting walls and investing in flexible, writable, and varied furniture options shifted the dynamic to a more student-centered approach and increased student engagement. The outcomes of this study also reinforce Monahan's (2002) claim that educators are working with designers to promote the needs of 21st-century learners by redesigning existing spaces.

The research indicates that student learning environments should not solely focus on the needs of the students (Savin-Baden, 2007). Focusing singularly on the needs of students, while not paying attention to the efficiencies and needs of a teacher, will not provide the teacher with enough motivation to design lessons and activities that will take full advantage of the potential for the redesigned learning space. This is evident in the two sets of adopters discovered in this study. By singularly focusing on the needs of students, the more recent adopters would not have embraced the changes. In fact, those who waited three or more years before embracing the concept of a redesigned classroom did so, in large part, because they believed that the new features of the classroom would create efficiencies for them, just as much as the redesigned classroom would potentially benefit student engagement.

The HEAD project (Holistic Evidence and Design), conducted in 2015, reinforces the notion that teacher ownership of the classroom design and space, especially around the concept of flexible furniture, was the primary factor that influences student learning. However, the HEAD Project was focused on primary grades (Barrett, Zhang, Davies, & Barrett, 2015). This study suggests that teacher ownership and voice into the design of the classroom would add a

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dimension to the HEAD Project's theory by expanding the theory to high school-aged students and their acquisition of 21st Century Learning and Innovation Skills.

Finally, Doorley and Witthoft's theory states that the form, functionality, and finish of a learning space reflect the culture, behavior, and priorities of the people who occupy that space. This is reinforced by the teachers who spoke supportively of the administration's desire to shift classroom learning to a more student-centered approach to learning. One teacher specifically referenced how her previous school embraced traditional rows and teacher-centered spaces and evaluated teachers on how attentive, focused, and quiet students were in class. When transferring to the school at the center of this study, the teacher was encouraged to learn that the administration wanted students to be speaking with one another, moving throughout the learning space, and actively involved in learning with other students. This philosophy, the teacher stated, was in line with the notion that teachers apply to have the opportunity to redesign their learning space to help foster a more student-centric and dynamic learning environment. In fact, Doorley and Witthoft would claim that the administration, as well as the teachers in the learning space, are cultural translators and builders of the student-centered culture they aspire to develop.

Implications for Practice

Expensive, time-consuming renovations of existing educational learning spaces is not a practical approach to establishing learning environments that promote the acquisition of 21st Century Learning and Innovation Skills. The school at the center of this study solicited support and assistance from several teachers in the first phase of shifting the learning environment to a more student-centered approach that employed flexible and dynamic furniture layouts. Soliciting teacher input into the design of classrooms was a practical approach that established buy-in from influential teachers. Recent adopters of the redesigned classrooms applied for the lottery after

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witnessing their peers experience success. The administration's approach of seeking volunteers and gradually getting more teachers to embrace redesigning their classrooms has yielded positive results for infusing 21st Century Learning and Innovation Skills into the school. Creating opportunities for administrators to partner with influential teachers will continue to build momentum for initiatives such as this and may be a more productive approach than a wholesale, fast-paced change of educational practice.

Gaining traction with the remaining teachers who have not embraced the shift to redesigned classrooms could be accelerated by scheduling teachers in a redesigned classroom for a period or two during the day or otherwise exposing teachers to those teaching in a redesigned environment. Several teachers in the study were exposed to the redesigned classroom for one or two periods and recognized first-hand the benefits the new space yielded to student engagement. Although not ideal, as the teacher did not have full ownership or control of the classroom redesign, it provided the teacher with a better glimpse of what could be possible for their students' engagement level. This was a technique employed by the administration of three teachers. All three teachers subsequently applied for their own redesigned classroom. Immersing teachers in a redesigned environment allows the teacher to witness colleagues in that space, experiment, and reflect on the experience to see if they would like to engage further in the shift to an environment that better promotes the acquisition of 21st Century Learning and Innovation Skills.

Interesting commonalities were revealed as a result of this study. For example, all seven math teachers in the study expressed that their redesigned classrooms allowed their students to build collaborative skills that they otherwise would not have acquired in a traditional math classroom. However, when asked what type of professional development the math teachers

received regarding how to take advantage of the redesigned learning environment, the response was that there was no formal articulation on the matter. Math teachers are recognizing that their students are acquiring collaboration skills, but each math teacher seems to be establishing their own techniques. Establishing professional learning cohorts to share successes and challenges, and present best practices to one another could result in tremendous advances as teachers strive to enhance critical thinking and creative learning skills.

Teachers and students are playing a role in the design of classrooms to influence the acquisition of 21st Century Student Learning and Innovation Skills. The impetus for the redesign is in large part due to the needs of the future workforce. Local, progressive businesses should be consulted to help educate teachers, as well as students, about the needs of the workforce, how work is done in the "real world," and what skills are most important. Establishing a strong link to business would not only affect classroom design but, more importantly, translate to creating authentic learning experiences for students that might directly include local businesses. Such opportunities could pave the way for more real-world learning opportunities for students and support for local schools.

County or State education associations should establish programs that highlight and reward schools or teachers for their progressive work in redesigning classroom spaces that improve the acquisition of 21st Century Learning and Innovation skills among students. Doing so would highlight best practices among educators, designers, and policy-makers. In addition, it would promote the need for flexible learning spaces among taxpayers who may question why schools are funding classroom redesigns that may be perceived as fancy and unnecessary.

More school districts are allowing teachers the autonomy to redesign their learning spaces to provide for greater flexibility and versatility. As indicated in this study, opportunities

for professional learning networks or formalized professional development programming within school districts or regions should be considered to allow those who are new to such flexible learning spaces the opportunity to learn how to mesh curriculum and instructional methodologies to take maximum advantage of the redesigned space.

Implications for Policy

The World Economic Forum has announced that students must be proficient in the 4 C's to expect them to be employable in the 21st Century. To put these skills into practice in classrooms, the Partnership for 21st Century Learning has established a framework to foster the inclusion of collaboration, creativity, critical thinking, and communication skills throughout all aspects of the curriculum. These two organizations have made it clear that the educational sector must accelerate its efforts to establish greater student-centered learning environments that result in the development of 21st Century Learning and Innovation Skills. As a result, policy-makers must create methods in which local educators can establish connections with and receive mentorship from progressive businesses that are invested in educating youth via the Partnership for 21st Century Learning framework.

School construction authorities and state educational adequacy policy-makers must shift their focus from a square-foot per pupil mentality and focus more on the particular instructional needs of a learning space. It is not appropriate to restrict the size of a classroom because funding will only support so many students per square foot of space. Instead, instructional needs must be a priority and educators should be involved in providing administrators or state regulators with the rationale for flexibility within learning spaces. Limiting all classrooms to conform to a particular size restriction is an industrial age type of mentality that is not supported by 21st Century research.

In some states, quality assurance statements and reports are conducted to ensure that students are receiving an education that meets the standards issued by their respective state and federal departments of education. Quality assurance protocols should be in place that would allow districts to be flexible with the definition of a classroom. Shifting the terminology to a learning space would broaden the definition of where students are engaged with a teacher and would encourage more dynamic, flexible, and curriculum appropriate spaces for students to learn. Quality assurance protocols must also recognize that flexible furniture should not include furniture that is not specifically designed for the safety requirements of schools. Facility checklists must provide flexibility for furniture, but must also require that all furniture be fire retardant, durable, and free of dangerous chemicals that are sometimes permitted in residential furniture.

Future Research

Evidence presented in this study suggests a redesigned learning space may result in a greater and more effective ability for students to acquire 21st Century Learning and Innovation Skills. Specifically, collaborative and communication skills were acquired more effectively in this study than creativity and critical thinking skills. Future research could seek to discover how less influenced skills such as creativity and critical thinking could be amplified in redesigned classrooms. Related to that research, studies could be launched to uncover how much the features of a redesigned classroom play a role in the acquisition of 21st Century Learning and Innovation Skills versus how specific curricular and instructional methodologies might play a role in the acquisition of such skills.

The study was limited to high school teachers in one district. Since this study did not include teachers in other school districts, future research should be considered to expand this

research to teachers in other districts. Doing so would allow researchers to explore how other districts transition teachers to redesigned classrooms, what those classrooms look like, and how much of an emphasis in the design of those spaces is placed on the need for students to acquire 21st Century Learning and Innovation Skills. Redesigning classrooms looks different in other districts and recognizing the features and the influence that those learning spaces may have on students would expand the field of research in this area.

In addition to teacher perspectives, learning how students believe redesigned spaces have affected their levels of engagement and 21st Century Learning and Innovation Skill acquisition should be studied. Although teachers are able to speak directly to pedagogical aspects of how curriculum, teaching, and space intertwine, students would be able to provide first-hand experiences and feedback regarding how space engages them, as opposed to when they are in class in a more traditional learning space.

Although this study sought to explore how an instructional space, designed by a teacher, influenced the teacher's perspective on instructional practice, the study only focused on teachers who have been teaching in a redesigned space. Questioning sought to uncover what motivated early and more recent adopters to apply to the school's redesigned classroom lottery, but teachers who were resistant to apply for that lottery and embrace the redesigned classroom model was not explored. Future research could seek to uncover what causes teachers to reject the notion of a redesigned classroom and how they believe students are acquiring the skills of collaboration, communication, critical thinking, and creativity.

Finally, the implications for flexible learning spaces on special education students should be examined. Three special education teachers were included in this study and expressed concern for students being distracted and losing focus in a redesigned classroom. The benefits

for general education students and special education students may or may not be the same in a redesigned learning environment and should be examined.

Summary

Workplaces are placing increasing emphasis on designing office environments that limit barriers between employees in an effort to create spaces that facilitates teams of people working together to achieve the mission of the company. Architects, classroom furniture companies, educators, and educational policy-makers are designing spaces that reflect similar environments in schools. Although there is research to suggest that 21st Century Learning and Innovation Skills are necessary for student success in the future world of work, there is little research suggesting that redesigned classroom spaces may influence the acquisition of those skills (Merrill, 2018).

A historical review of physical classroom design indicates that classrooms have evolved little throughout the course of American educational history (Barrett, Zhang, Davies, Barrett, 2015). Educators and designers have limited experience with changing the design of the classroom itself, yet there is a quickly developing trend in innovative schools to revolutionize learning spaces in an effort to improve the acquisition of the 21st Century Learning and Innovation Skills that are needed for future success. Although, there is limited research suggesting that engagement increases in an instructional space that is designed to reflect the instructional needs of students and mimic the future workspace, this research study has demonstrated a connection that student engagement, specifically in the areas of collaboration and communication, have been positively impacted as a result of having teachers work in redesigned classroom spaces that generate enthusiasm and a sense of pride for the teacher.

Policy-makers, designers, and educators are seeking answers to determine if redesign efforts influence student engagement. This study may influence overall policy decisions on whether there should be a more concerted effort to increase the effort to redesign classrooms, modify that effort, or eliminate it altogether. In addition, this study adds to the limited existing research about classroom redesign and its influence on the student acquisition of 21st Century Learning and Innovation Skills that are needed for future success. The study narrows that gap in the literature by examining the influence that the redesigned classroom may have on levels of student engagement.

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APPENDIX A

Internal Review Board Letter

SETON HALL UNIVERSITY
1 8 5 6

October 31, 2018

P. Erik Gundersen

Dear Mr. Gundersen,

This letter is a formal statement that your study, "The Impact of Renovated High School Classroom Learning Spaces on Collaboration, Communication, Creativity, and Critical Thinking" does not fall under the purview of the IRB. This is because, as you describe it in your Application of Oct. 17, 2018, the study is a non-generalizable case study on the impact of redesigned learning spaces in Mineola High School [New York] only.

Please remove the reference to the IRB office and myself in the Informed Consent document before you give it to the participants.

Sincerely,

Mary F. Ruzicka, Ph.D.
Professor
Director, Institutional Review Board

cc: Dr. Michael Kuchar

Office of Institutional Review Board
Presidents Hall • 400 South Orange Avenue • South Orange, NJ 07079 • Tel: 973.313.6314 • Fax: 973.275.2361 • *www.shu.edu*

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APPENDIX B

Informed Letter of Consent

COLLEGE OF EDUCATION
AND HUMAN SERVICES
SETON HALL UNIVERSITY

INFORMED CONSENT

TITLE OF STUDY: The Impact of Renovated High School Classroom Learning Spaces on Collaboration, Communication, Creativity, and Critical Thinking

PRINCIPAL INVESTIGATOR / RESEARCHER: P. Erik Gundersen is a student in the Education Leadership and Management Doctoral (Ed.D.) Program at Seton Hall University.

Purpose of the Study:

The purpose of this study will be to investigate and examine the impact that redesigned learning spaces may have on student engagement levels - specifically the extent to which redesigned learning spaces facilitate the level of communication, collaboration, critical thinking, and creativity that takes place in the learning space.

Procedures:

The subjects who volunteer and are selected to participate in the research will be asked to do the following:

1. Participants will participate in one in-depth interview.
2. The interview will take place for approximately 20 – 40 minutes.
3. If permission is given to be audio recorded it will be recorded and transcribed; otherwise the researcher will type notes on a laptop.
4. The researcher will transcribe the interview and a copy will be sent to the participants for accuracy checking.

Instruments:

The interview protocol will include semi-structured, open-ended questions. The nature of the questions will seek to understand how the teacher has structured the physical design of the classroom to enhance student abilities to develop communication, collaboration, creativity, and critical thinking skills.

Voluntary Nature:

Participation in this research study is voluntary and participants do not have to answer any questions they do not want to answer. If at any time, the participant decides that he / she does not want to participate in the study, he/she can withdraw at anytime without prejudice.

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Anonymity:

There is no anonymity in the study due to the face to face interviews being conducted by the researcher.

Confidentiality:

All information gathered in this study will be kept confidential. No reference will be made in written or oral materials that could link participants to this study.

Records:

All records will be stored in a locked facility for a minimum of three years after completion of the study. After the storage time, the information gathered will be shredded and the USB drive with the digital audio recording files will be kept in a safety deposit box.

Potential Risks and/or Discomforts:

There are no known risks associated with this research study.

Potential Benefits:

There are no direct benefits to participants.

Compensation:

No compensation is associated with participation.

Contact Information:

If the participant has any questions about the research, he/she can contact the Primary Investigator / Doctoral Student P. Erik Gundersen at: Telephone (551) 486-6261, email gunderpe@shu.edu or the Faculty Advisor Dr. Michael Kuchar: Telephone (973) 761-9397 email: Michael.Kuchar@shu.edu .

Participant Consent:

I have read the above information and agree to participate in this study. A copy of this signed and dated Informed Consent form will be provided to the participants.

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<u>Agreement to be Audio-Recorded or Not:</u>

Please check your preference about audio recording or not:

_____ I agree to be audio recorded.

_____ I do not agree to be audio recorded.

_____	_____	_____
Participant Name (Please Print)	Signature of Participant	Date

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APPENDIX C

Letter to Participants

From: **Peder E Gundersen** <peder.gundersen@student.shu.edu>
Date: Thu, Dec 13, 2018 at 8:21 PM
Subject: Dissertation test email
To: egundersen@pascack.org <egundersen@pascack.org>

Dear Teacher,

Thank you for agreeing to participate in my research study regarding how redesigned classroom learning spaces may effect various levels of student engagement.

I look forward to meeting you in the principal's conference room at the date / time indicated on the Google Doc sign-in sheet.

Please review, print and sign the informed consent form which grants me permission to record our interview and provides you with additional information regarding this study. I will have extra copies on hand if you don't have a chance to print out the form.

Finally, please complete this brief demographic questionnaire.

Thank you very much for your time and willingness to participate in this research study! I look forward to meeting you.

Sincerely,
Erik Gundersen

Demographic Questionnaire

Classroom Design Demographic Questionnaire

Thank you for your participation in this study, "The Impact of Renovated High School Classroom Learning Spaces on Collaboration, Communication, Creativity, and Critical Thinking."

In order to facilitate the interview, please fill out the following demographic questionnaire. Please note that any identifiable information will be kept confidential.

First Name

Short answer text

Last Name

Short answer text

Please provide an email address where I may reach you with any potential follow up questions.

Short answer text

Age

○ 20 - 29

○ 30 - 39

○ 40 - 49

○ 50 - 59

○ 60 +

How many years experience do you have teaching?

◯ Less than 2 years

◯ 2 - 5 years

◯ 6 - 10 years

◯ 10 or more years

How many years have you taught in a redesigned classroom?

◯ Less than one year.

◯ 1 - 3 years

◯ 4 - 7 years

◯ more than 8 years

How many years experience do you have teaching in a traditional classroom?

◯ Less than one year.

◯ 1 - 3 years

◯ 4 - 6 years

◯ 7 - 15 years

◯ More than 15 years

Please indicate the course / subject that you teach in a redesigned classroom.

Short answer text

APPENDIX E

Semi-Structured Interview Script and Questions

Interview Script:

"Thank you for your participation today. My name is Erik Gundersen and I am a doctoral candidate in the Education Leadership, Management and Policy program at Seton Hall University. You were invited to participate in this study because you shared on your that you identify as teacher who:

1. currently works as a teacher in a redesigned classroom space
2. been involved, in some capacity, in the design of that space
3. had experience teaching in both a traditional classroom prior to teaching in a redesigned space.

During this interview, I will ask you questions about your background, academic experiences and how your experience in a redesigned classroom may have impacted, from your perspective, a student's engagement level in the classroom.

The purpose of this study is to investigate and examine the impact that redesigned learning space may have on student engagement levels - specifically the extent to which redesigned learning spaces facilitate the level of communication, collaboration, critical thinking , and creativity that takes place in the learning space. Particular attention will be paid to how the teacher perceives how such space may influence the level of engagement of students. The title of this study is: "The Impact of Renovated High School Classroom Learning Spaces on Collaboration, Communication, Creativity, and Critical Thinking."

As stated in the Consent Form that you signed, your participation in this study is voluntary and the interview will be recorded with a digital voice recorder so that I may accurately document your responses. If at any time during the interview you wish to discontinue the use of the recorder or the interview itself, please feel free to let me know. Information from this research will be used solely for the purpose of this study and any presentations or publications that may result from this study. All conversations will remain confidential; your name and other identifying

Interview Question Research Questions Addressed

What are the characteristics of a space that would address the needs of the Learning and Innovation Skills within the Framework of 21st Century Learning, specifically: collaboration, communication, critical thinking and creativity?

1. What can you tell me about your experience / role in designing the classroom and what motivated you to participate in redesigning the classroom?

2. Explain what you think, feel or behave when you enter your redesigned classroom environment.

3. What characteristics of a redesigned learning space were most important to you when redesigning your classroom learning space and why?

4. How has the new space influenced you as a teacher?

   a. What types of activities do you plan for your students that are different because of your classroom location?

   b. How has the new space influenced lessons that you have developed?

   c. Examples of lessons that have been enhanced - that the new physical space helps facilitate?

5. Which of the 4 C's have you seen be most / least influenced by the redesigned space?

   a. Can you provide me with some specific examples of how the space is perhaps responsible for enhancing (collaboration, communication, creativity, critical thinking)

   b. What do you believe would be needed to enhance the 4 C's that you don't believe may have been enhanced as much or inhibited the acquisition of the 4 C's?

6. What do you see in your redesigned space that suggests your students are engaged at a higher level?

7. Is there anything else that I should know about?