PERCEPTIONS OF PUBLIC HIGH SCHOOL DESIGN CHANGES IN VIRGINIA SINCE THE IMPLEMENTATION OF A PROFILE OF A VIRGINIA GRADUATE

Robin Accetta Riley

Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Doctor of Education
In
Educational Leadership and Policy Studies

M. David Alexander, Chair
Jodie L. Brinkmann
Carol S. Cash
Gary R. Snyder

November 18, 2024
Blacksburg, Virginia

Keywords: 21st-century school design, school architecture, 21st-century skills in education

Perceptions of Public High School Design Changes in Virginia Since the Implementation of a Profile of a Virginia Graduate

Robin Accetta Riley

Abstract

The design of school buildings has shifted over the past several decades in response to social and political trends, as well as shifts in educational philosophy. Despite the educational system's efforts to adapt teaching and learning to prepare students for the 21st-century workforce, the design of school buildings has not kept pace with these changes. In the Commonwealth of Virginia alone, many schools are over 50 years old, and their infrastructures are failing, necessitating billions of dollars in repair, renovation, or new builds. This study was designed to add to the existing literature on school design, emphasizing the importance of fostering collaboration, creativity, critical thinking, communication, and citizenship skills—the 5 C's—as essential components of 21st-century learning skills.

The findings obtained from interviewees (four architects and four public school facilities directors) in this study were analyzed for common themes. Among the predominant themes found from the qualitative data were that architects and school facilities leaders indicated that high school building designs have evolved to better support 21st-century pedagogy and the 5 C's through the use of variety and flexible school spaces. Collaboration with stakeholders to communicate the influence of building design on academic achievement, coupled with the role of 21st-century skills in preparing students for the global workforce, is essential in gaining community buy-in and advocating for adequate funding. The alignment between 21st-century pedagogy, building design, and funding will ultimately create learning environments that support all students as future members of a global society.

Additionally, educators are working hard to meet the diverse learning needs of students, while also fulfilling federal, state, and local curricular expectations to prepare students for the future workforce. However, due to significant funding deficits across the country, many schools are over 40 years old, with failing infrastructure—overcrowded spaces, poor air quality, and limited technology access—which adversely impacts student achievement. Local school divisions cannot continue to "do more with less;" they need a shift in mindset and advocacy for increased funding at the state and federal levels.

Perceptions of Public High School Design Changes in Virginia Since the Implementation of a Profile of a Virginia Graduate

Robin Accetta Riley

General Audience Abstract

The design of school buildings has shifted over the past several decades in response to social and political trends, as well as shifts in educational philosophy. Despite the educational system's efforts to adapt teaching and learning to prepare students for the 21st-century workforce, the design of school buildings has not kept pace with these changes. In the Commonwealth of Virginia alone, many schools are over 50 years old, and their infrastructures are failing, necessitating billions of dollars in repair, renovation, or new builds. This study was designed to add to the existing literature on school design, emphasizing the importance of fostering critical thinking, creativity, communication, collaboration, and citizenship skills—the 5 C's—as essential components of 21st-century learning skills.

The findings obtained from interviewees (four architects and four public school facilities directors) in this study were analyzed for common themes. Among the prevalent themes found from the qualitative data were that architects and school facilities leaders indicated that high school building designs have evolved to better support 21st-century pedagogy and the 5 C's through the use of variety and flexible school spaces. Also found to be important was the emphasis on providing professional development for staff on how to best utilize the newly designed spaces. Additionally, common barriers or challenges were identified when it came to budgetary constraints and stakeholder buy-in.

Dedication

This dissertation is dedicated to my Grandpap, Dr. Michael Angelo Accetta. He is the reason I am a passionate educator and lifelong learner. He devoted his life to making the world a better place through the education of others. Whether impacting students and staff during his tenure as a teacher, administrator, and superintendent or tutoring countless individuals in retirement, he truly exemplified the qualities of a servant leader.

Grandpap, you taught me to seek understanding of the world through the gift of knowledge, but most importantly, through investing in people. Thank you for being my inspiration, my cheerleader, and one of the greatest humans I have had the opportunity to know. Your legacy lives on in the hearts of the many you have touched, and I am proud to carry on the name of Dr. Accetta.

Acknowledgments

To my favorite son and daughter, Vincent and Juliana, thank you for being kind, encouraging, and responsible young adults, and for your understanding and patience when I wasn't always available. I love you both oodles and oodles.

To my mom, Cindy, for instilling in me strength, faith, and perseverance.

To my sister, Jenica, for being my biggest cheerleader always.

To the "Board of Directors," Jesse, Jordan, and Sarah thank you for your encouragement, support, laughter, and guidance through all the ebbs and flows over the past three and half years.

To my best friend, Jessica, thank you for always listening, encouraging, and creating a space for me to re-energize and recommit to my work when I had "imposter syndrome," or just wanted to give up.

To my assistant principal, Debbie Whaley, thank you for doing a lot of "extras" to lighten my load, and most importantly, for your prayers.

To my chair, Dr. Alexander, whose encouragement, guidance, support, and passion have been instrumental in my doctoral journey. I am grateful for your insightful feedback, wisdom, and connections you helped to facilitate.

To my committee members, Dr. Brinkmann, Dr. Cash, and Dr. Snyder each of you brought unique perspectives to my research through both the coursework you have taught me and individual conversations. Thank you for challenging me to think critically about my work.

To my cohort members, Kristin, Mallory, Diana, Chris, Karen, and Jason, who have stuck by me through the very end. Without your support, encouragement, laughter, time, and feedback I would not be here today.

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

School building design trends have been shaped by political and social movements, new technologies, and growing awareness of what is required to support meaningful student learning (Baker, 2012). Cash (2012) stressed the connection between student outcomes and the physical environment of schools. However, educational researcher Glen Earthman (2019) stated that despite innovations in design and teaching strategies, these have had little impact on changes in modern school architecture. Although there have been changes in educational pedagogy to support a more student-centered approach to learning, many school buildings, regardless of their architectural era, continue to impose limitations on 21st century teaching and learning (Snyder, 2020).

In 2016, the Virginia Assembly and the Virginia Department of Education (VDOE) adopted *The Profile of a Virginia Graduate*, which outlines four domains of knowledge and competencies that high school graduates need to be successful in the workforce and as members of the global community. These domains include content knowledge, workplace skills, community engagement and civic responsibility, and career exploration. This profile also identified essential 21st-century skills for K-12 education in Virginia, known as the "5 C's"—critical thinking, communication, collaboration, creativity, and citizenship—which must be integrated into the learning framework across the four domains (VDOE, 2016). As educational goals increasingly target the importance of global citizenship and soft skills like the 5 C's, physical shifts in school design have been implemented to support these learning goals (French et al., 2022). This study seeks to explore what, if any, changes have been made to public high school design in response to the implementation of Profile of Virginia Graduate.

Statement of the Problem

A leading architect in school design, Prakash Nair (2014), argued that most contemporary school designs prioritize functional efficiencies, such as the ability to accommodate large numbers of students, or quickly moving students through spaces like cafeterias, over prioritizing the needs of 21st-century learners. The design importance of 21st-century school spaces goes beyond mere functionality; they must offer versatile, welcoming spaces that support a variety of learning activities and foster positive behavior (Nair, 2014). Moreover, 21st-century schools must also be able to accommodate different teaching styles, such as collaborative group work, independent study, and hands-on learning (Nair, 2014). In contrast, school buildings that have not been well-maintained or updated present significant challenges to both teaching and learning, in that they can be unwelcoming, inhibit creativity, and even pose health and safety concerns that have the potential to hinder educational outcomes (Vincent & Heming, 2021).

According to VDOE's 2021 Needs and Conditions of Virginia School Buildings (VDOE), half of the school buildings in Virginia are more than 50 years old, with Capital Improvement Plans (CIP) projects totaling over $25.8 billion (2021). At the same time, The Profile of a Virginia Graduate and the 5 C's framework emphasize the importance of 21st-century skills to best prepare students to be successful in the future workforce and as global citizens (VDOE, 2016). Despite the growing focus on these developing these competencies in both teaching and learning, many school buildings have remained largely unchanged for half a century or more (Snyder, 2020). Strong teachers, administrators, and curriculum alone cannot compensate for failing infrastructure, as the physical environment of a school plays a critical role in achieving high quality education (Snyder, 2020). One way to support the implementation of

the 5 C's is modernizing the design of new schools being built across the Commonwealth of Virginia.

Purpose of this Study

The purpose of this qualitative study was to explore the perceptions of Virginia architects and local school directors of facilities regarding any changes in high school designs in response to the implementation of Virginia 5 C's—collaboration, critical thinking, creativity, communication and citizenship—as outlined in the 2016 *Profile of a Virginia Graduate*. Information was gathered to identify themes in 21st-century building design that align with educational design specifications, contemporary pedagogy, and architectural trends. This study also sought to determine whether the pedagogical shift towards 21st-century skills has impacted the educational specifications of new high schools, and if so, what architectural changes have been made in Virginia schools since the adoption of the *Profile of a Virginia Graduate.*

Research Questions

This study was guided by one primary research question: How has high school design evolved in response to the pedagogical focus on 21st-century, particularly following the adoption of the *Profile of a Virginia Graduate* in 2016?

Overview of the Study

This qualitative study used data compiled through in-depth, semi-structured, person-to-person, open-ended interviews. This research focused on analyzing the perceptions of Virginia architects and local-level school facilities directors who have collaborated on designing new high schools since the adoption of the *Profile of a Virginia Graduate*. Although the researcher sought input from state-level facilities directors, no responses were received. Interviews were conducted with representatives from four architectural firms in Virginia, as well as with local school

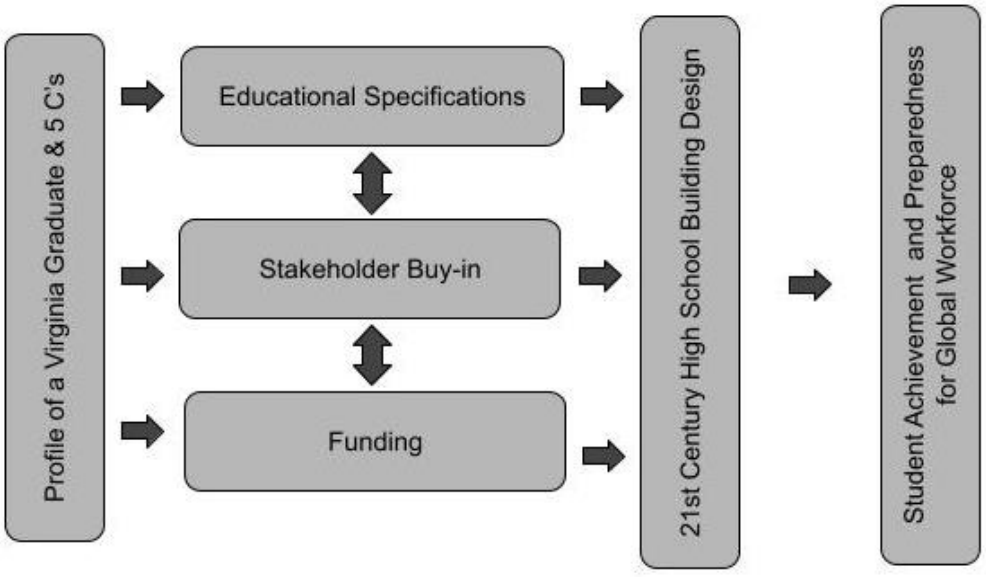
facilities directors who partnered with these firms on the design of new high school buildings. The interview transcripts were coded and analyzed to develop themes related to the research questions, with additional themes emerging organically during the interviews. These findings were compiled and are presented as part of this study's results.

Conceptual Framework

The conceptual framework illustrated in Figure 1 outlines the potential interplay between state policies, the condition of school facilities, and emerging trends in school design, all aimed at enhancing 21st-century learning skills through the 5 C's in the school setting. To reiterate, well-maintained, modernized school buildings that reflect contemporary design trends are critical in creating spaces that support active learning, student engagement, and skill development (French et al., 2022, Nair, 2014, Vincent & Heming, 2021, Snyder, 2020).

Figure 1.

Conceptual Framework of the Study



Definition of Key Terms

This section provides a list of key terms and their definitions that will be utilized throughout this study.

Citizenship: The capacity to make connections within the community through civic engagement, demonstrate respect for diversity, and uphold integrity while promoting personal health and wellness (VDOE, 2016).

Collaboration: The ability to work together with others to improve practice, share ideas, and solve problems (ISTE, 2021).

Communication: The ability to articulate thoughts and ideas effectively through oral, written, digital media, or nonverbal communication, to express themselves, as well as the capacity for active listening and collaboration with others to achieve goals (ISTE, 2021).

Creativity: The ability to explore new possibilities when addressing situations by posing questions and harnessing their imagination (Commonwealth Learning Partnership, 2020).

Critical Thinking: The ability to develop questions and hypotheses, consider evidence, and synthesize information when exploring a variety of real-life issues (Commonwealth Learning Partnership, 2020).

Educational Specifications: Descriptions of the learning activities intended for a school, including educational needs, spatial requirements, and any other special requirements a designer or planner should consider (National Council on School Facilities, 2019).

21-Century Learning Environments: The physical environment and architectural designs that support the teaching and learning of 21st-century skills, enabling students to engage in real-world, relevant contexts (Battelle for Kids, 2019).

21-Century Learning Skills: A comprehensive set of skills, knowledge, character traits, and work habits believed to be critical for success in contemporary society, applicable across educational, career, and civic settings (The Glossary of Education Reform, 2024).

The 5 C's: A core skill set of critical thinking, creative thinking, collaboration, communication and citizenship, emphasized in the development of *The Profile of a Virginia Graduate* (Profile of a Virginia Graduate, 2022).

The Profile of a Virginia Graduate: The knowledge, skills, experiences, and attributes that students must gain to be successful in college or the workforce and be "life ready" (Profile of a Virginia Graduate, 2022).

Limitations and Delimitations

This qualitative study is subject to several limitations that cannot be controlled by the researcher, as identified by Miles (2019). First, the depth and transparency of participant responses could have been limited, impacting the quality of the data collected. Second, participants were aware of the researcher's role, which may have limited the depth of their answers, leading to the generalization of educational terms or the use of educational jargon. Third, the researcher is a current elementary school principal, and could have been subject to bias towards responses and data analysis based on personal experiences. To help mitigate this risk, reflexive journaling was utilized though out the data-collection and analysis process to help the researcher better understand their role in the research process.

The delimitations of this study refer to the components controlled by the researcher, as noted by Miles (2019). Specifically, the perspectives of the four architects and four local level school facility directors were confined to those with high school design experience since 2016. The sample population was also limited, as there are multiple architectural firms across the

Commonwealth of Virginia involved in school construction; that said, only three were selected for this study. Similarly, the sample population of school division facilities directors was limited to just four out of the 135 school divisions in Virginia. Additionally, timelines and cost factors that influence the ability to design 21st-century schools that meet the vision of the architects and school divisions are acknowledged as delimitations of this study. Lastly, all participants volunteered for this study and possessed backgrounds in architecture or school facilities.

Organization of the Study

Chapter 1 provides, an overview of the study, including the statement of the problem, purpose statement, research questions, and definition of key terms. Chapter 2 presents a review of empirical research on the history of school design, the importance of 21st-century skills, the *Profile of a Virginia Graduate*, and contemporary trends in school design. Chapter 3 outlines the methodology of the study including sample selection, data collection and analysis procedures, as well as a discussion of validity and reliability. The results of the study are presented in Chapter 4. Finally, Chapter 5 includes the findings, implications, recommendations for further research, and the researcher's reflections.

Chapter 2: A Review of Literature

A leading architect in school design, Prakash Nair (2014), argues that the current design of most schools prioritizes functionality—such as the ability to accommodate large numbers of students and facilitating quick transitions through facilities such as cafeterias—over prioritizing the needs of 21st-century students. Instead, schools should focus on creating versatile, welcoming spaces that support a variety of learning activities and foster positive behavior (Nair, 2014). Research indicates a significant relationship between student outcomes and the school's physical environment (Cash, 2012). The design of the physical environment can serve as a change agent for transforming teacher-centered learning into student-centered (Nair et al., 2019).

To varying degrees, technology has transformed daily life for thousands of years, from advancements in agricultural tools to the invention of the cell phone (Jerald, 2009). The computer age has ushered in rapid changes, significantly impacting both work and social lives (Jerald, 2009). This technological evolution has prompted discussions from educational reformers that schools must equip students with 21st-century skills, as traditional school curricula is insufficient to keep up with the rapidly changing world (Jerald, 2009). One of the most visible ways that schools can enhance a student's educational experience is through the learning environment in which children are placed.

Despite advancements in technology and the influence of 21st-century teaching and learning, school buildings have remained largely unchanged for over half a century or more (Snyder, 2020). According to the National Center for Educational Statistics (Alexander & Lewis, 2014), an estimated 53% of schools in America needed renovation, repairs, or modernization, with the average age of these buildings being 44 years old (21st Century School Fund, 2021). A worsening trend of underfunding of maintenance and repairs, coupled with insufficient

investment in new school construction, has exacerbated this issue as school buildings continue to age (Vincent & Heming, 2021). The 2021 *State of Our Schools Report* revealed that the annual funding gap for school facilities has reached $85 billion a year (Vincent & Heming). In addition, according to Earthman (2019), aging schools often lack essential and appropriate building elements—such as ample daylight, air conditioning, and access to working science and technology equipment—necessary for creating effective physical learning environments to serve today's students. Moreover, poorly maintained or outdated school buildings contribute to inadequate conditions for teaching and learning (Vincent & Heming, 2021).

Purpose and Structure of the Review

This literature review discusses the need to reconsider the physical design of schools and classrooms to support the skills required of 21st-century learners. An overview of the history of school architecture will be provided, delivering some context on the impacts that social, political, and educational movements have had on the building of schools. The condition of schools in the United States and the Commonwealth of Virginia will also be reviewed. Additionally, this review discusses the importance of teaching 21st-century skills in the classroom and the role school architecture plays in preparing students for the modern world. A key focus is on identifying emerging themes in the design principles for tomorrow's schools that address the functionality of building while supporting 21st-century teaching and learning. Furthermore, the review highlights successful strategies to support the transition of staff from traditional classrooms to innovative school designs to align pedagogy with physical learning spaces.

Search Process

The search process for this literature review was executed using the Virginia Tech Online Library search engine and online search engines (i.e., Google Scholar) between September of

2021 and November of 2024. EBSCOhost, an electronic database, was used to access peer-reviewed articles and research studies from 2012 to 2024. Additional journal articles were secured through the Virginia Tech interlibrary loan program. Key search terms included "21st-century learning," "21st-century learning," "21st-century skills," "physical school design," "physical learning environments," "flexible school design," "school architecture," "innovative schools," "building conditions," "educational impact," and "transition from traditional learning environments."

The search began with broad terms like "school architecture," which yielded 561 results, and "21st-century skills," which returned over 7,000 hits. To narrow the focus, the search was refined to emphasize school innovations, 21st-century skills within educational settings, while prioritizing a shift in learning and teaching practices. However, the scope was occasionally broadened beyond the last ten years when the information was relevant to the history of school architectural design and to enhance our understanding of school design trends.

Organizationally, all research was uploaded into Mendeley, categorized into research themes, and evaluated for usability. After reviewing articles, abstracts, and other literature reviews, deeper searches for primary sources were conducted using reference lists from scholarly articles and Google search findings on key researchers and architects in the field of school design. The research was separated based on relevancy to this paper and a total of 34 sources were utilized to summarize the relevant research in this literature review.

Overview of the History of School Architecture

School building design trends have long been shaped by political and social movements, advances in technologies, and a growing awareness of what is required to support meaningful student learning (Baker, 2012). The changes in school design across the 19th and 20th centuries

illustrate the strong connection between pedagogy and architectural design (Darian-Smith & Willis, 2017). However, according to the educational researcher Glen Earthman (2019), despite innovations in teaching strategies, school building designs have seen only minimal change. In fact, many newer schools resemble older schools. According to the United States Department of Education, the average age of school buildings is 42 years (United States Environmental Protection Agency, 2023). On average, $110.1 billion is spent annually on the maintenance, operation, and capital construction of school facilities, with an estimated $51 billion spent on new school construction (Vincent & Heming, 2021). Despite these investments, a growing financial gap makes it difficult for school divisions to modernize facilities in ways that ensure that school facilities that are updated, healthy, and safe while supporting the changing pedagogical needs of 21st-century learning standards (Nair, 2014).

During the first half of the 19th century, education reformer Horace Mann introduced the concept of the common school, designed to produce individuals capable of replicating results and following directions, much like workers on assembly lines (French et al., 2022). These schools consisted of standard rows and desks with windows on two sides, a utilitarian design that maximized the number of students within a single space (Baker, 2012). This cells and bells model of school, where students start the school day in a cell and move between classrooms when the bell goes off, is a relic of the Industrial Revolution. It represents the idea that education can be mass-produced in a factory-like setting to churn out "educated" students ready to tackle college and careers (Nair et al., 2019).

However, educational reform surrounding the ideas of child-centered learning was made popular by Maria Montessori and John Dewey during the period known as the Progressive Era (1930-1945). Architects of that time envisioned progressive schools that embodied this

philosophy, emphasizing the importance of fresh air, outdoor activity, and physical health (Baker, 2012; Darian-Smith 2017). This educational movement led to the design of open-air schools, which prioritized natural light, outdoor learning spaces, and ease of circulation throughout the school (Baker, 2012). After World War II, the baby boom necessitated another shift in school design. During this era of school construction, planners focused on logic and efficiency with parallel rows of classrooms through what is referred to as a "finger-plan" design, which continued to maximize fresh air and light, and classrooms having access to the outside through exterior doors (Baker, 2012). Between 1945 and 1964, $20 billion was spent on new school facilities to educate more than two million K-12 students during this period (Baker, 2012).

In the 1970s, the open classroom movement gained popularity in the U.S. (Nair, 2014). These designs consisted of large, open spaces with minimal divisions, intended to promote collaboration and student-centered learning (Baker, 2012). This concept was based on the belief that removing the constraints of the walled classroom would encourage teachers to work together in more flexible learning environments where students could be grouped by ability and interest. According to Nair (2014), however, the movement ultimately failed because of a misalignment between the building design and teachers' preferred teaching methods. Many teachers used furniture and dividers to create traditional classroom settings. As school enrollment began to decline, so did the focus and financial investment in school facilities (Baker 2012). From 1980-2000, most school design efforts consisted of small renovation projects to help maintain aging facilities. A 1995 report from the Government Accountability Office (formerly the General Accounting Office) estimated that $112 billion was needed to bring schools back to good condition (Baker, 2012).

Supplementing the need to repair aging schools, new trends in school design emerged in the 1990s-2000, including a focus on green buildings and high-performance facilities, influenced by the introduction of the Leadership in Energy and Environmental Design (LEED) certification system (Baker, 2012). Despite the various trends in pedagogy and school design that emerged during the 20th century, the "cells and bells" model of the schoolhouse continues to dominate school architecture worldwide, which is widely considered to be ill equipped to educate students in the 21st century (Nair, 2014).

Needs and Conditions of Schools in the United States

Due to chronic underfunding in essential maintenance and capital improvements, school facilities across the U.S. are falling short of providing students with environments conducive to 21st-century learning (Filardo, 2021). Elementary and secondary schools in the U.S. are the second-largest public infrastructure investment after highways, yet most of the capital costs for schools come from local school districts. Between 2009-2019, elementary and secondary schools received 77% of funding for capital projects from local school districts, 22% from states, and just over 1% from federal funds (Filardo, 2021). This persistent funding gap to invest in school facility infrastructure has ballooned to $85 billion annually, largely due to chronic underfunding of maintenance and repairs (Vincent & Heming, 2021).

As a result, outdated schools often suffer from overcrowding, poor air quality, disorganized layouts, mold, and insufficient lighting (Chmlelewski et al., 2023). These inadequate conditions have been linked to negative outcomes for academic success (Chmlelewski et al., 2023). Indeed, without proper funding, it becomes challenging for school administrators to create safe, healthy, and effective learning environments that align with the needs of today's educational standards (Chmlelewski et al., 2023).

Conditions of Virginia School Buildings

Currently, local Virginia school divisions receive 14% less state funding on average when compared to all other 50 states (Howell et al., 2023). The Commonwealth of Virginia utilizes the local composite index (LCI) to determine the contribution ability of local-level government with the state paying the higher share (JLARC, 2023). This LCI formula is outdated, over 50 years old, and does not use the most updated data available to accurately and fairly determine a locality's ability to pay. This type of funding creates disparities in funding of facilities across local school divisions.

An estimated half of the school buildings in Virginia are over 50 years old, with Capital Improvement Plans (CIP) projects totaling over $9.8 billion (VDOE, 2021). The most frequently identified renovation projects in these CIPS are HVAC repair/replacements and parking and grounds maintenance, as outlined in the 2021 *Needs and Conditions of Virginia School Buildings* report presented by the Virginia Department of Education (VDOE). As of 2021, Virginia's school divisions reported 2,005 existing elementary, middle, high, combined, and alternative school centers (VDOE, 2021). For the 1,040 school buildings that are over 50 years old, the total replacement cost across the Commonwealth of Virginia exceeds $24 billion (VDOE, 2021).

Despite the aging infrastructure, the VDOE requires school divisions to develop long-range capital improvement plans that address both new construction and the maintenance of existing facilities, based on age, current condition, and the ability to meet the functional demands of educational programs (VDOE, 2021). The *Guidelines for School Facilities in Virginia's Public Schools* provide recommendations that should be considered when planning for school facilities projects, as well as define minimum standards that all Virginia schools should meet. Local school divisions bear the primary responsibility for determining how their facilities should

be designed to support educational programing (VDOE, 2021). According to a joint publication by the 21st Century School Fund, Inc, the International WELL Building Institute, and the National Council on School Facilities (*2021 State of Our Schools: America's Public School Facilities*), excellent teachers, administrators, and well-designed/implemented curricula cannot compensate for the negative impact that crumbling school facilities could have on educational outcomes (Vincent & Heming, 2021).

The Importance of 21st-Century Skills

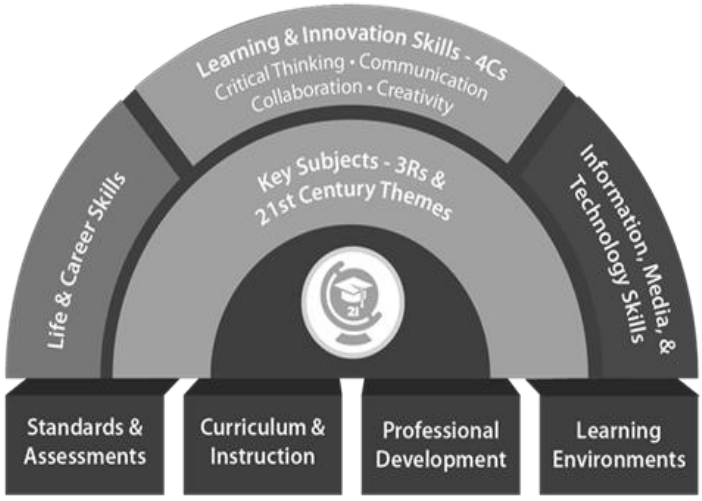
Traditional school buildings and classrooms are increasingly seen as insufficient to meet the demands of 21st-century learning, which requires students to be collaborative and innovative global citizens. This shift in focus emphasizes preparing students for success in their adult lives (Benade, 2017). The International Society for Technology in Education (ISTE) has developed standards that outline the knowledge and skills students need to thrive and contribute to an ever-changing global society (ISTE, 2021). These standards, which have been adopted by all 50 U.S. states and many countries worldwide, describe future-ready students as those who can collaborate, create, think critically, solve problems, innovate, communicate, and demonstrate digital citizenship (ISTE, 2021). School leaders can utilize these frameworks to guide the development of educational specifications that foster student-centered learning environments.

Another organization focused on cultivating 21st-century skills among students is Battelle for Kids (BFK), a national nonprofit organization dedicated to supporting educational leaders in transforming school systems with an emphasis on equitable systems and deeper learning outcomes (BFK, 2023). Like ISTE, BFK created a framework for 21st-century learning known as *Partnership for 21st Century Learning* (P21), which was created with input from education experts, business leaders, and educators. The P21 Framework, as shown in Figure 1, emphasizes

creativity, innovation, critical thinking, problem-solving, communication, and collaboration, helping educators integrate these essential life skills into academic content (P21, 2016).

Figure 2.

Framework for 21st Century Learning Definitions



With the widespread adoption of these 21st-century standards, current educational practices are falling short when comparing classroom experiences with the evolving demands of the global workforce, which increasingly values creativity and flexibility (Nair, 2011). As a result, schools and educational systems face growing pressure to ensure that students acquire the necessary lifelong skills to succeed as global citizens. A number of scholars suggest that the solution to this current pressure is to redesign learning spaces to support 21st-century teaching and learning practices, such as student-centered teaching, project-based learning active learning, critical thinking, and problem-solving (Benade, 2017; Nair, 2011; Fisher, 2005; Pearlman, 2010; Tanner, 2009). According to Pearlman (2010), the design of new learning environments or 21st-century schools must start by identifying the desired outcomes, which include knowledge and skills, pedagogy and curricula, assessments, technology, and ultimately, the learning

environments. One example of a state addressing these outcomes is Virginia's 2016 policies regarding high school graduation requirements, encapsulated in the *Profile of a Virginia Graduate* initiative.

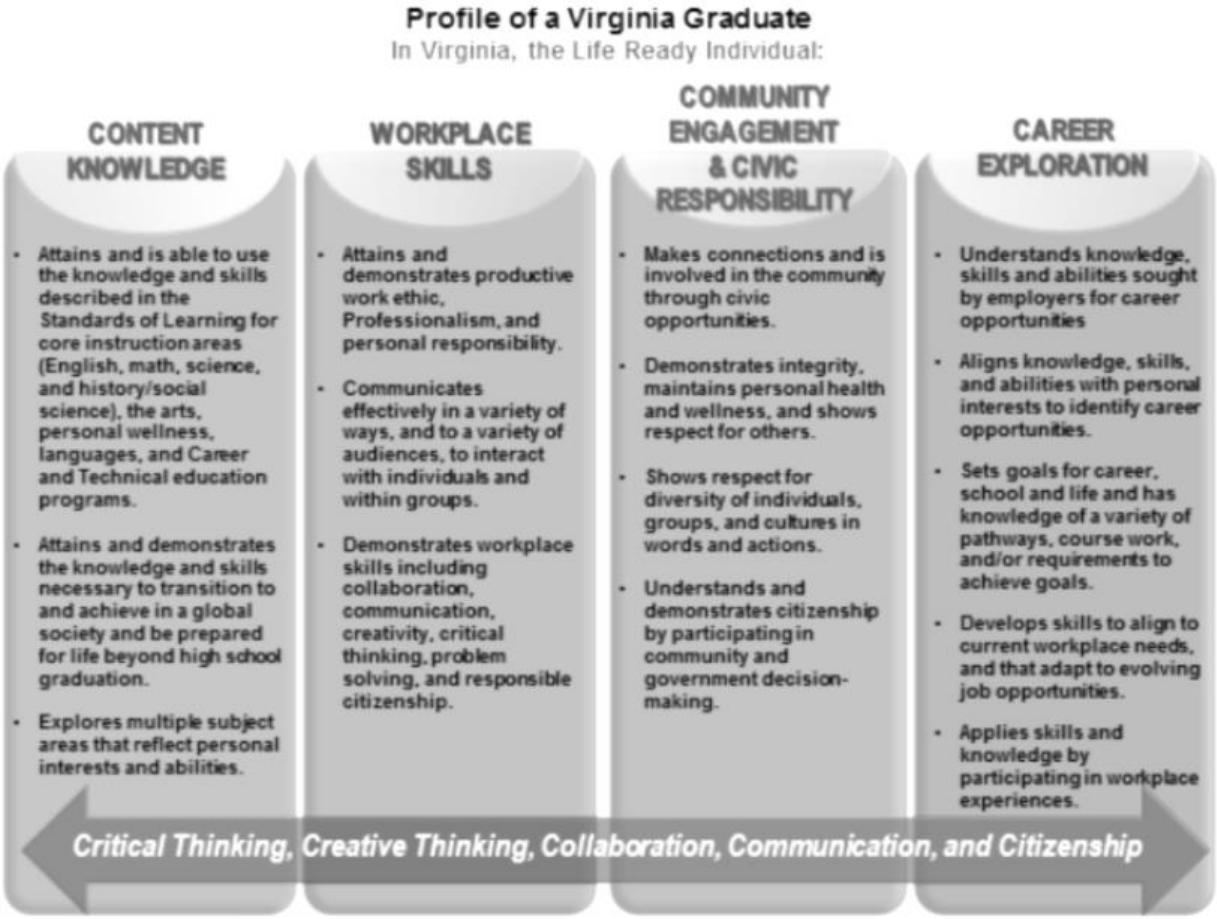
The Profile of a Virginia Graduate

In 2016, the Virginia General Assembly passed section 22.1-253.13.4 of the Code of Virginia, which emphasizes the need to prepare students for the 21st-century workforce. Embedded within this policy is a focus on the "5 C's:" creativity, collaboration, critical thinking, communication, and citizenship (Standard 4. Student Achievement and Graduation Requirements, 2016). The policy established new high school graduation requirements, mandating that each local school board, in collaboration stakeholders, develop and implement a *Profile of a Virginia Graduate*. This profile outlines the knowledge and skills that students should attain during high school in order to be successful contributors to the economy of the Commonwealth, with particular attention to the 5 C's (Standard 4. Student Achievement and Graduation Requirements, section D).

The VDOE formalized these new requirements in a policy document entitled *The Profile of a Virginia Graduate* (VDOE, 2016). Figure 2 displays the four key domains a K-12 student should experience to be well-prepared for life after graduation, with an emphasis on critical thinking, creative thinking, collaboration, communication, and citizenship.

Figure 3.

Profile of a Virginia Graduate



Note: Permission granted informally from the Virginia Department of Education (2016). Progress Report on the Board of Education's Development of a Profile of a Virginia Graduate

The Commonwealth Learning Partnership, which is a network of nonprofit organizations and educational institutions across Virginia, is dedicated to advancing, aligning, and enhancing high-quality professional learning resources throughout the Commonwealth. One of its key initiatives has been translating the *Profile of a Virginia Graduate* from vision to practice

(Commonwealth Learning Partnership, 2020). The organization defines student success in mastering the 5 C's as follows:

Critical thinking: Students will be able to develop questions and hypotheses, consider evidence, and synthesize information when exploring a variety of real-life issues.

Collaboration: Students will be able integrate diverse perspectives and learn from fellow peers to achieve common goals.

Communication: Students will be able to use verbal and nonverbal method to speak, listen, read and produce information to benefit themselves and others.

Creativity: Students will be able to explore new possibilities when addressing situations by posing questions and harnessing their imagination.

Citizenship: Students will be able to achieve a common goal by working with others within a diverse community.

These key policies are designed to ensure that students have ample opportunities throughout their K-12 education to practice and develop essential 21st-century skills across a variety of settings so that they can be successful global citizens. Within the Commonwealth of Virginia, the *Profile of a Virginia Graduate* emphasizes four key areas: career exploration, workplace skills, content knowledge, and community engagement with civic responsibility. These policies, centered around the 5 C's, aim to equip students for the modern workforce. Virginia high school graduates are expected to demonstrate these competencies, while younger students are expected build these skills progressively throughout their K-12 educational journey (Reed et al., 2021) As schools increasingly engage students in 21st-century learning, physical learning spaces will need to evolve to support these practices (Pearlman, 2010).

Aligning Pedagogy with Learning Spaces

Current school designs have primarily addressed the functional needs of the school, such as classroom capacity, efficient cafeteria services, and the necessary equipment for technology labs (Nair, 2014). However, focusing solely on building functionality without considering the social well-being and emotional needs of students has hindered the creation of thriving educational environments (Nair, 2014). Research by van Merriënboer et al. (2017) suggests that a misalignment between educational vision, pedagogy, and the physical design of schools can negatively impact educational quality. This highlights the need for learning spaces that support specific learning outcomes and learning philosophies.

Although modern educational approaches—such as problem-based learning, project-based learning, student-centered learning, social-emotional learning, and competency-based education—may differ, they share common characteristics (Nair et al., 2019; Pearlman, 2010; van Merriënboer et al., 2017). These approaches aim to develop 21st-century learners by encouraging students to engage in real-world tasks and apply the skills they've acquired in both personal and professional contexts (van Merriënboer et al., 2017). Additionally, advancements in information technology are also changing the ways that schools are built, as the need to reconfigure traditional spaces to allow for new learning modes and practices are facilitated via technological advances (Baker, 2012). As education increasingly emphasizes global citizenship and soft skills such as the 5 C's, shifts in school design have been implemented to support these evolving learning goals (French et al., 2022).

Designing for Tomorrow's Schools

Educational institutions often create mission statements that outline their goals and strategies for achieving them. Likewise, architects create mission statements for the physical

spaces they design, which frequently align with a school's educational objectives (French et al., 2022). These documented plans are known as education specifications and detail the relationship between a building's physical characteristics and the institution's described mission and vision (National Council on School Facilities, 2019a).

The *Guidelines for School Facilities in Virginia's Public Schools* provide specific guidance on the planning and designing of public schools that goes beyond the Virginia Uniform Statewide Building Code. These guidelines aim to help school divisions ensure that facilities promote effective teaching and learning and establish minimum standards for all schools in Virginia (VDOE, 2021). One of the key recommendations is to develop an educational program that reflects the school's educational goals and philosophy. This program is then used by design professionals to create an architectural plan for the types of spaces needed, building use, and number of students to be served. Another recommendation emphasizes the strategic placement of the library media center on the ground-floor, making it easily accessible from all learning areas in the school. It also calls for sufficient electrical outlets and robust internet connectivity to support digital learning resources (VDOE, 2021).

When designing schools for the future, researchers agree that collaboration among all stakeholders—including school boards, school staff, parents, community members, and architects—is crucial from the outset of the design process (Nair, 2011; Sigurdardottir & Hjartarson, 2011; van Merriënboer et al., 2017). Incorporating community input through open and honest feedback loops is essential for learning environments that truly support 21st-century learners (Baker, 2012). Educational architect Prakash Nair (2011) proposed a set of universal design principles for tomorrow's schools, adaptable to the specific needs of individual communities: (1) personalized; (2) safe and secure; (3) inquiry-based; (4) student-directed; (5)

collaborative; (6) interdisciplinary; (7) rigorous and hands on; (8) embodying of a culture of excellence and high expectations; (9) environmentally conscious; (10) connected to the local community and businesses; (11) globally networked; and (12) conducive to lifelong learning. Stakeholders can utilize these design principles to facilitate discussions surrounding school renovations or new construction to better support 21st-century learners.

Impact of School Building Design on 21st-Century Teaching and Learning

Physical learning environments frequently have been viewed as having secondary importance to the educational process (Szpytma & Szpytma, 2019). However, educators are increasingly recognizing the critical role that school architecture plays in preparing students for the demands of the modern world (Szpytma & Szpytma, 2019). As a result, there has been a growing effort to design learning spaces that align with 21st-century learning standards, shifting away from traditional environments toward more flexible and innovative ones (Carvalho et al., 2020; Kariippanon et al., 2017; Patrix & Benade, 2018; Sigurdardottir & Hjartarson, 2011).

Traditional learning environments, often characterized by confined spaces, closed doors, rows of individual desks, and teacher-centered instruction, are being replaced with flexible and innovative learning environments that feature varied furniture arrangements, open spaces with minimal walls, and small breakout areas to support a broader range of teaching and learning activities (Kariippanon et al., 2017). Researchers continue to explore the influence of physical learning spaces on teaching and learning outcomes (e.g., Carvalho et al., 2020; Kariippanon et al., 2017; Sigurdarottir & Hjartarson, 2011).

As pedagogical practices have evolved to better support 21st-century learners, classroom environments have also been reimagined. Desks formerly arranged in traditional rows have given way to flexible furniture that can be reconfigured in various ways to facilitate teaching and

learning (Kariippanon et al., 2017). These modifications have been found to support collaboration, engagement, student autonomy, self-regulation, and student-centered pedagogical teaching practices (Kariippanon et al., 2017). For example, the qualitative case study conducted by Kariippanon et al. (2017) examined the experiences of school leaders, teachers, and students in flexible learning spaces in New South Wales, Australia. Focus groups were held with personnel from 12 schools that had transitioned from traditional to flexible learning spaces. Based on data collected from eight school leadership teams, 35 classroom teachers, and 16 student focus groups, five main themes were captured: student-centered instruction, engagement, teaching and learning challenges, social and emotional well-being, and physical well-being. The study found that flexible learning environments fostered a shift from teacher-led instruction to student-centered approaches, improved student engagement, and increased collaboration due to the larger, more adaptable group spaces (Kariippanon et al., 2017).

However, Kariippanon et al. (2017) also noted challenges with teaching and learning in flexible spaces. The openness of flexible spaces, often designed to accommodate larger groups of students with minimal barriers, led to higher noise levels with the potential for distracting students and teachers. Teachers also reported the need to establish clear expectations and guidelines on how students should interact with flexible spaces and furniture. An emphasis on professional development, coupled with ongoing support for teachers on the ways to maximize the use of flexible learning environments, should be considered when transitioning from a traditional space to a flexible learning space. Ultimately, Kariippanon et al. (2017) concluded that when the physical design of a school is utilized effectively, flexible learning spaces can be beneficial to teaching, learning, and student well-being.

Another study by Sigurdardottr and Hjartarson (2011) examined the relationship between changes in school design and the impact on teaching practices in Iceland. This research compared teachers working in traditional school buildings to those who taught in more modern, flexible settings. The researchers focused on a random sample of 20 schools, 16 of which were designed in the 20th century, and four in the 21st century, as part of larger research project on teaching and learning in Icelandic schools. A four-part survey consisting of 244 items was distributed electronically to staff in all 20 schools, covering topics such as teaching facilities, teaching practices, staff collaboration, and attitudes toward classroom environments. With a 92% response rate, 601 respondents were teachers, while the rest were non-teaching staff. Among the teachers, 62% had primarily taught in traditional classroom settings, while 18% had taught mostly in open, flexible spaces (Sigurdardottr & Hjartarson, 2011).

The study conducted by Sigurdardottr and Hjartarson (2011) demonstrated a direct shift in school design from traditional classrooms to more, flexible settings with movable boundaries and shared spaces. Overall, the majority of teachers were satisfied with their school buildings, with 70-80% of teachers in both traditional and open settings reporting that their classroom environments supported their instructional practices. Approximately 23% of respondents were dissatisfied and indicated their preference to change their classroom setting; however, the study did not indicate what changes this group desired (Sigurdardottr & Hjartarson, 2011). No significant differences were found between teachers in open versus traditional classrooms regarding their preferences for instructional practices. However, flexible learning spaces were noted for promoting student choice in instructional tasks and fostering teacher collaboration. Similar to the findings of Kariippanon et al. (2017), Sigurdardottr & Hjartarson (2011) also highlighted the importance of close collaboration between educators and architects in the school

design process. To conclude, the researchers emphasized the need for further exploration of the relationships between physical environments, pedagogical practices and educational outcomes.

A third study conducted by Carvalho et al. (2020) examined the experience of teachers and school leaders within New Zealand in both traditional and innovative learning environments. This investigation utilized a mixed-methods approach with a concurrent nested strategy. The study utilized the Organization for Economic Cooperation and Development (OECD, 2018) "School User Survey: Improving Learning Spaces Together," which included questions on physical design (referred to as the set design), learning design (epistemic design), and social design. This survey, divided into eight sections for primary and secondary teachers, captured input from 511 participants, including 222 primary teachers, 126 secondary teachers, and 163 school leaders (Carvalho et al.). Survey data were analyzed using the Activity-Centered Analysis and Design (ACAD) framework, which is a meta-theoretical framework for understanding and improving complex, learning situations (Carvalho et al., 2020; Goodyear et al., 2021).

The study found that primary teachers were more likely than secondary teachers to adopt an innovative learning environment. Carvalho et al. (2020) also confirmed that when schools were transitioning to innovative learning environments, the process needed to be carefully managed to ensure the effective onboarding of staff. The study also explored the types of spaces available in schools and their frequency of use. Access to libraries and assembly halls was reported by 85% of primary and 87% of secondary teachers. However, 55% of primary teachers reported access to collaborative learning areas, compared to just 38% of secondary teachers. Traditional learning spaces, without break-out areas, were the most frequently used, with daily use reported by 42% of primary teachers and 47% of secondary teachers. In contrast,

collaborative teaching areas were used daily by only 32% of primary teachers and 9% of secondary teachers. Carvalho and coworkers (2020) concluded that understanding how the design of space, tools, tasks, and social arrangement can support student learning is critical. To make the shift toward innovative learning environments sustainable, educators must understand which design elements to focus on and ensure alignment between physical space design and educational learning practices.

The New Zealand Ministry of Education has made significant investments in upgrading and modernizing school buildings to support its vision of creating innovative learning environments that encourage and support diverse form of learning (Patrix & Benade, 2018). As part of a broader qualitative study on teacher experiences in flexible learning environments, researchers examined two case-study schools: Innovation Primary and Angelus School in Auckland, New Zealand. Both schools featured flexible furniture arrangements with open learning spaces designed to accommodate about 100 students and three teachers (Patrix & Benade, 2018). These schools also included smaller breakout areas with single-cell spaces branching off from the larger open environments. Over a six-week period from May to June 2015, classrooms were observed, and data were collected through detailed observation notes as well as teacher and principal focus groups. While previous research suggested that modernizing school buildings could promote innovative teaching and learning practices, Patrix and Benade (2018) concluded that such a shift might require more than just changes to physical space. They argued that for flexible learning environments to truly succeed, educators must first make an internal shift, embracing and committing to modern pedagogical practices.

A related qualitative case study conducted by Reinius et al. (2021) examined the types of teaching and learning activities that occurred in newly developed flexible learning environments

in Finland, referred to as a “deskless school.” In this design, classrooms were replaced by open areas with separate breakout rooms, designed with windows for visibility. The study focused on a second-grade general education class of five girls, twelve boys, a lead teacher, a teaching assistant, and a resource teacher. Data were collected through observations and interviews.

Both students and teachers reported that flexible spaces encouraged a collaborative culture of learning (Reinius et al., 2021). Teachers noted that the open design enhanced social connections and made them more approachable, while students appreciated the increased access to their peers. The flexibility of the spaces facilitated interaction, knowledge-sharing, and collaboration. Furthermore, teachers emphasized that these flexible spaces supported the implementation of a modern curriculum more effectively than traditional classroom setups. However, akin to the findings of Patrix and Benade (2018), the study concluded that while the physical space enhances collaborative teaching and learning, it ultimately falls to the teachers to make corresponding changes in their pedagogical practices (Reinius et al., 2021).

Transitioning from Traditional School Design to Innovative School Design

Transitioning from traditional learning environments to flexible learning environments and innovative school design requires educators to adapt, experiment, and carefully evaluate what is both valued and feasible in the new spaces (Carvalho et al., 2020). The process involves considering team collaboration, teaching pedagogy, and the integration of new technologies (Carvalho et al., 2020). Flexible learning spaces challenge teachers to think differently about their teaching practices.

Niemi (2020) conducted a study of six primary schools in Finland, either newly built or renovated into flexible learning environments, where 21 teachers were interviewed about their adaption and experiences teaching in a flexible learning environment. The findings emphasized

the importance of purposeful preparation when transitioning to new learning environments. This preparation should include teacher input in the design phase, the creation of a shared vision and goals, and the alignment between teachers' preferred pedagogical practices and the learning space (Niemi, 2020).

According to Baker (2012), 21st-century school designs will serve as community hubs, featuring flexible and ergonomic furniture, mobile classrooms, privacy niches, and enhanced technology access to allow students to participate in distance learning. Moreover, building trust and developing skills to support the teaching process and manage student behavior are critical during for transitioning staff to more open and flexible learning spaces (Deppeler & Aikens, 2020). To ensure a successful transition, it is essential to provide authentic and sustainable professional development opportunities that can guide staff in reshaping their teaching practices in alignment with changes in school design (van Merriënboer et al., 2017).

Prominent Design Themes in 21st-Century Schools

Researchers Lafortune and Schnoholzer (2017), as well as Neilson and Zimmerman (2014), have demonstrated that the construction of new schools with flexible spaces and innovative design elements can positively impact attendance, test scores, and even local housing prices. Conversely, inadequate school facilities can hinder the delivery of basic school instruction and impede the implementation of educational reforms. For example, teachers require essential physical resources such as science labs, technology, and special education spaces to effectively deliver 21st-century education.

Studies by Cash (2012), Krueger (2018), and Nair (2019) highlight the importance of incorporating mobile furniture and flexible-use rooms to facilitate differentiated instruction and adaptable curricula. Spaces designed to accommodate a variety of activities, from large-group

instruction to small-group collaboration, can promote a more robust learning environment (Krueger, 2018). This type of flexible school design can be referred to as "learning studios," or space design that intentionally provides for a variety of learning modalities to occur (Nair, 2014). Mobile furniture plays a key role this flexibility, enabling the creation of individualized, group, or productive open spaces for teaching and learning (Krueger, 2018). Moreover, flexible design spaces allow for the optimization of shared resources and project-based learning, as noted by Arsenault (2022). In conclusion, while there is no single definition of a 21st-century school, the most common design feature noted in this literature review is the flexibility of learning spaces, coupled with the incorporation of mobile furniture.

Summary

As traditional school models age and persist across the globe, the shift in educational pedagogy towards inculcating essential 21st-century skills—notably, communication, collaboration, critical thinking, creativity, and global citizenship—is permeating to the physical design of schools. Appropriately designed learning environments can play a crucial role in supporting modern teaching and learning practices (Szpytma & Szpytma, 2019). Flexible learning spaces are typically characterized by large open spaces with permeable boundaries and mobile furnishings, all designed with a focus on student comfort, health, and flexibility.

To ensure that school designs effectively support 21st-century learning, it is essential for stakeholders to collaborate closely throughout the design process. This collaboration will help align the physical space with the larger educational vision of supporting today's and tomorrow's learners. Further research is needed to examine how flexible learning environments can be implemented to support 21st-century learning standards and educational practices, the best strategies for transitioning staff from traditional to flexible learning spaces, and how policy,

pedagogy, and physical design can be effectively aligned when building or renovating schools for 21st-century learners.

Chapter 3: Methodology

The purpose of this qualitative study was to explore perceptions of Virginia architects and local level school directors of facilities regarding changes, if any, in high school designs in response to the implementation of Virginia 5 C's: collaboration, critical thinking, creativity, communication and citizenship, as outlined in the *Profile of a Virginia Graduate*. Additionally, the study aimed to identify themes in 21st-century building design that align with educational design specifications, modern pedagogy, and architectural design. This research sought to determine whether the pedagogical shift towards 21st-century skills has influence the educational specifications for designing new high schools and, if so, what architectural changes have been implemented in Virginia schools since the adoption of the *Profile of a Virginia Graduate* in 2016.

According to the 2021 Needs and Conditions of Virginia School Buildings report, 81 new schools are planned for construction between fiscal years 2021 and 2030, at a projected cost of $3.834 billion. Additionally, in 2016, the Virginia Department of Education (VDOE) introduced the *Profile of a Virginia Graduate*, which outlines the skills and knowledge that students should acquire in high school in order to be successful. The 5 C's—communication, collaboration, critical thinking, creativity, and citizenship—are central to this profile.

As a result of this educational philosophy shift, school systems are facing additional pressures to ensure that students acquire these critical skills. One approach to support the implementation of 21st-century learning is through the design of learning environments and the development of educational specifications used in constructing new schools across the Commonwealth of Virginia. This qualitative research study examines how the emphasis on 21st-century skills and the adoption of the *Profile of a Virginia Graduate* have impacted the

architectural design of newly built high school buildings in Virginia and their role in supporting this pedagogical shift in student learning.

Educators have become increasingly aware of the significant role architecture plays in preparing students for the modern workforce. There has been a marked shift away from traditional learning spaces—such as rows of desks facing the front—toward more innovative learning environments. These modern spaces may feature flexible and ergonomic furniture, open collaborative spaces, small break-out spaces, and enhanced technology access (Carvalho et al., 2020; Kariippanon et al., 2017; Patrix & Benade, 2018; Sigurdardottir & Hjartarson, 2011). An additional focus of this study was to identify common design themes that emerge when creating learning environments that facilitate the 5 C's in classroom settings.

Research Design

The study utilized qualitative analysis of data obtained through person-to-person interviews. This approach allowed for an in-depth examination of the perceptions of Virginia architects and directors of school facilities personnel from public school divisions. All participants had experience in public school building design both before and after the adoption of the *Profile of a Virginia Graduate* in 2016. Interviews are considered an effective tool for collection data on perceptions, behaviors, or feelings that cannot be directly observed (Creswell & Poth, 2018; Merriam & Tisdell, 2016). The qualitative approach, featuring responses from personal interviews, enabled an analysis of the participants' experiences and perspectives on the impact of the 5 C's on school design trends. Interview questions were open-ended so that participants could freely express their individual experiences and insights.

There are three types of interview structure: highly structured, semi-structured, and unstructured or informal. Highly structured interviews use predetermined questions in a specific

order, often to gather demographic information, whereas unstructured or informal interviews are open-ended, flexible, and conversational, with the goal of developing further questions (Creswell & Poth, 2018; Merriam & Tisdell, 2016). In contrast, a semi-structured interview uses a structured set of questions as a guide, but allows for flexibility and follow-up questions. The interview questions in this study were semi-structured (Creswell & Poth, 2018), which enabled the researcher to prompt for additional details about each participant's experiences and perceptions related to the impact of the 5 C's on high school building design.

Research Question

This study was guided by one primary research question: How has high school design evolved in response to the pedagogical focus on 21st-century skills, particularly following the adoption of the *Profile of a Virginia Graduate* in 2016?

Site/Sample Selection

According to Merriam and Tisdell (2016), purposeful sampling enables the researcher to gain understanding, discover insights, and gather valuable information from individuals with experience and expertise on a given topic. For this study, participants were selected based upon having experience in high new school design in one of the following domains: architects from firms that have built a new high school in the Commonwealth since 2016, and local school divisions facilities leaders involved in high school construction since 2016. Four participants from each domain were interviewed to capture data on the impact of the 5 C's from both perspectives. The participants included four architects from three different architectural firms, and four facilities leaders from four different public-school divisions in Virginia.

The architects were recruited from firms headquartered in Virginia, with extensive experience in designing public schools across the state. These architects were selected based on

their involvement in designing public high schools in Virginia both before and after 2016, and their employment at prominent Virginia architectural firm during that time period. The architectural firms identified as having built high schools in Virginia since 2016 include Moseley Architects, Stantec, Grimm and Parker, and Quinn Evans.

In addition to architects, four participants were selected from local school divisions that have overseen the construction of new high schools in Virginia since 2016. These individuals held key roles in school facility planning and design, such as directors or executive directors of facilities or construction. Although the researcher attempted to recruit state-level facilities directors from the VDOE, no responses were received. These state-level participants would have contributed to the establishment of *Guidelines for School Facilities in Virginia's Public Schools* or had experience in school facility planning. Thus, their input could not be considered during data analysis.

Sample size is dependent on the data being collected, the questions being asked, and the information available to support the study (Merriam & Tisdell, 2016). In selecting participants for this study, at least one participant from three of the four identified architectural firms met the eligibility criteria, being considered an expert in their field. A screening form was sent to a select number of architects from each firm, providing an introduction of the researcher and an explanation of the study. Upon completion of the screening, four participants were selected based on the criteria from three different architectural firms.

At the local school level, four participants were selected from four different Virginia public school divisions, each of whom had experience participating in the school design process both before and after the implementation of the *Profile of a Virginia Graduate*. The architecture firms and local school divisions selected for this study had collaborated on new high school

building projects and had a history of working together. The researcher reviewed architectural firm websites to identify high schools built since 2016 and consulted the VDOE's list of new school construction from 2017-2024 to contact local level operations and facilities directors.

Data Collection Procedures

After identifying eligible participants, the researcher contacted them to request an interview. Participants were asked to provide consent before being interviewed. Synchronous, person-to-person interviews were conducted using the video conferencing platform Zoom. This online platform allowed for both video recordings and transcriptions of each interview, supporting a thorough and accurate data analysis.

Each interview began with an introduction during which the interviewer thanked the participant for their time, explained the purpose of the interview, outlined how the data would be used, and reminded them of the confidentiality that would be maintained. Several types of interview questions can be used to elicit responses during interviews, including experience and behavioral questions, opinion and values questions, feeling questions, knowledge questions, and background or demographic questions (Merriam & Tisdell, 2016). High-quality interview questions are typically open-ended, encouraging participants to provide detailed and descriptive data (Merriam & Tisdell, 2016).

The interview questions in this study were open-ended and included experience and behavioral questions, opinion-based questions, and knowledge-based questions to prompt participants to reflect on their experiences and opinions regarding the shift of school design toward 21st-century skills and the 5 C's. The questions focused on the impact of the 5 C's on school design, changes in the design process when partnering with local school authorities, design themes that promote the 5 C's, and the evolving role of architects in this context. An

interview guide was developed with specific questions to be asked of all interviewees. Probing questions were also used to gather additional insights based on participants' responses.

Study Approval Process and Timeline

Prior to seeking IRB approval, the researcher completed CITI training on social and behavioral research (see Appendix B). Upon successfully passing the prospectus examination, an IRB application was submitted and approved (see Appendix C). Once approval was granted, participants who met the study's criteria were contacted via email. They were provided with the Virginia Tech Research Study Information Sheet (see Appendix D), which included an overview of the study's purpose and details, a confidentiality statement, and contact information for the researcher and the university. The recruitment email followed a pre-approved script (see Appendix E).

Instrument and Design Validation

This qualitative study was designed to explore the perceptions of Virginia architects, and state and local-level directors of facilities and/or construction with experience in school design, both before and after the adoption of the *Profile of a Virginia Graduate* in 2016. As Maxwell (2013) notes, "Validity is also relative: It has to be assessed in relationship to the purposes and circumstances of the research, rather than being context-independent property of methods or conclusions" (p. 121).

Triangulation is one of the most well-known strategies for evaluating internal validity (Merriam & Tisdell, 2016). The interview questions for this study were developed following an analysis of current and relevant literature. The interview questions were semi-structured and open-ended, addressing themes related to the literature, including the *Profile of Virginia Graduate* and the 5 C's, changes in school design trends, common themes in 21st-century school

design, and perceptions of school design factors that enhance the 5 C's and 21st-century learning environments.

To assess the validity of both the instrument and the data collected, a combination of interview questions, and pilot interviews were utilized. To ensure that participants consistently interpreted the questions in alignment with the research objectives, the interview questions were reviewed and pilot-tested for clarity, conciseness, and understanding by three people with varying levels of knowledge in school design. The guiding research question and corresponding interview questions are shown in Table 1.

Table 1.

Research and Interview Questions

Research Question(s)	Interview Questions
RQ1. How has high school design evolved in response to the pedagogical focus on 21st-century skills, particularly following the adoption of the *Profile of a Virginia Graduate* in 2016?	1. What changes have you seen evolve in the design process of school buildings since you started as an architect? 1a. What differences are you finding when designing schools in 2024 compared to designing schools 10 years ago? 2. a. What information is provided by a school division to best meet their high school building needs? 2. b. Do school divisions mention the Profile of a Virginia Graduate or the 5 C's 2c. What input do architects have on design features? 4. How have the 5 C's informed the design of elementary schools? 5. How do you use school design to advance the 5 C's- communication, collaboration, critical thinking, creativity and citizenship 6. What kinds of challenges or barriers do you encounter when designing a school for a locality?

To ensure the validity of the study, respondent validation and reflexive journaling were utilized. The reflexive journal captured the researcher's experiences, perceptions, and observations throughout the research process. Respondent validation, on the other hand, enabled participants to review preliminary findings and verify the accuracy of their interview transcripts.

During the research and interview process, the reflexive journal documented the researcher's thoughts and reflections. After each interview was transcribed, every participant was provided with an electronic copy of their transcript to review for accuracy. They were also given the opportunity to offer any additional feedback or information related to the topics discussed.

Data Treatment Management

Labeling was employed to facilitate identification while ensuring anonymity; all personal identifiers were removed from the reported research. The architects and local facilities directors (i.e., school leaders) participating in this study were assigned identification numbers (e.g., A1, A2 for architects, and SL1, SL2 for school leaders). Each interview recording and its corresponding transcription were organized in labeled electronic folders to enhance accessibility. These folders were secured with password protection through a dual login on Google Drive.

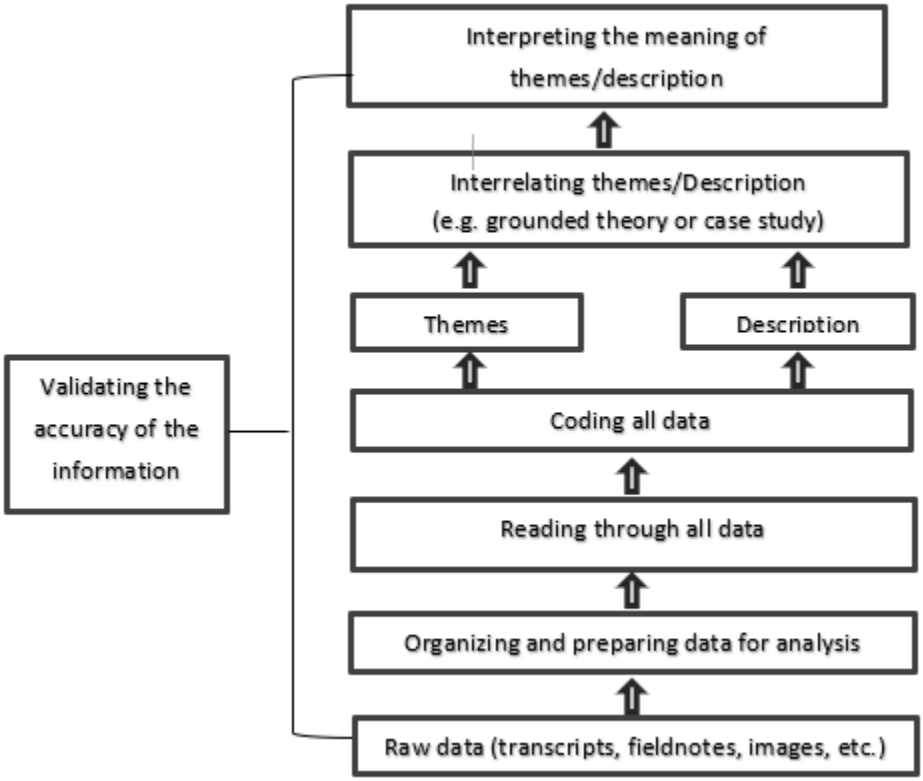
Data Analysis Techniques

Data analysis occurred concurrently with data collection, as recommended by Merriam and Tisdell (2016). The researcher recorded thoughts, speculations, and insights in a reflexive journal throughout the transcription process in alignment with the research questions. Coding in qualitative research provides a systematic method for organizing text derived from interview responses (Creswell & Poth, 2018). Each interview transcript was carefully reviewed, while highlighting and recording relevant notes pertaining to the research questions. Coding was performed to distill the data into a limited number of common themes identified during the research, alongside any emergent sub-codes based on response patterns. Each interview questions were coded individually for themes. Frequencies in responses were recorded and categories were developed and revised throughout each interview question to develop common themes across all interview responses. Electronic spreadsheets were utilized to analyze and

collate the data. A qualitative software program was used to support the researcher in organizing, sorting, and storing the collected information. An overview of the data analysis process is illustrated in Figure 4 (Creswell, 2014).

Figure 4.

Data Analysis of Qualitative Research



Summary

This qualitative study employed person-to-person interviews to analyze the perceptions of architects from three Virginia architectural firms and four local school facilities directors—all of whom were involved in designing new schools since the adoption of the *Profile of a Virginia Graduate* in 2016. Semi-structured, open-ended interviews were conducted with four architects

and four school facilities directors, each representing different public school divisions. The interview transcripts were coded and analyzed to identify themes related to the research questions, as well as additional themes that emerged from the interviews. These findings were compiled and are reported as this study's results.

Chapter 4: Data Analysis and Results

Chapter 4 is organized into the following sections: purpose of the study, participants, research questions, and qualitative data findings. The qualitative data are presented by interview questions, with corresponding participant responses. Themes are identified for each question, accompanied by summaries and frequency tables. This chapter concludes with a summary of the research findings, organized by categorical themes for individual questions, and an overall summary of the qualitative results.

Purpose of the Study

The purpose of this qualitative study was to explore the perceptions of Virginia architects and local school directors of facilities regarding changes, if any, in high school design in response to the implementation of the Virginia 5 C's—collaboration, critical thinking, creativity, communication, and citizenship—as outlined in the 2016 *Profile of a Virginia Graduate*. Participants were selected based on the following criteria: experience working for an architecture firm that has designed high school buildings in the Commonwealth of Virginia since 2016, or experience in a comparable role within the public high school system, such as Director of Facilities involved in the design of public high schools.

The study's participants represent a range of award-winning architectural firms serving the Commonwealth, and school division leaders from a blend of urban, suburban, and rural localities in Virginia. At the time of the interviews, all architectural firm participants had over thirty years of experience in school design in Virginia and self-identified as having advanced knowledge and understanding of 21st-century skills and the 5 C's of collaboration, communication, creativity, critical thinking, and citizenship. The public-school participants had

between 9 and 17 years of experience in the school design process, with their understanding of 21st-century skills and the 5 C's ranging from competent to advanced.

Research Questions

This study was guided by one primary research question: How has high school design evolved in response to the pedagogical focus on 21st-century skills, particularly following the adoption of the *Profile of a Virginia Graduate* in 2016?

Codes

Codes were assigned for confidentiality during the data-analysis process. The identities of the participants were protected using pseudonyms, School Leader 1 (SL1), School Leader 2 (SL2), Architect 1 (A1), Architect 2 (A2) etc. to maintain anonymity.

Research Question 1

How has high school design evolved in response to the pedagogical focus on 21st-century skills, particularly following the adoption of the *Profile of a Virginia Graduate* in 2016?

When discussing design changes in Virginia high schools following the adoption of the *Profile of a Virginia Graduate* and the influence of the 5 C's, participants shared insights drawn from their firsthand experiences, observations, knowledge, and beliefs, all shaped by their professional roles.

Interview Question 1

What changes have you seen evolve in the design process of high school buildings since you started in your role? What differences are you finding when designing schools in 2024 compared to ten or more years ago?

Over half of the participants noted a shift away from a traditional "cells and bells" classroom model, towards designs that emphasize collaborative and flexible spaces, featuring

moveable furniture, and aligned with 21st-century pedagogy. Table 2 outlines the themes and participants' corresponding responses.

Table 2.

Differences in High School Design Since the Adoption of the Profile of a Virginia Graduate and the 5 C's

Changes in High School Design	A1	A2	A3	A4	SL1	SL2	SL3	SL 4
Traditional/Cells and Bells		X	X	X	X			X
Collaborative and Flexible Spaces	X	X	X	X	X	X		X
Moveable Furniture	X	X	X					X
Reflect 21st-century pedagogy			X	X	X	X		

*Blank spaces indicate that the topic was not noted by the participant

Traditional or "Cells and Bells" Design. Five participants—three architects (A2, A3, A4) and two school facility leaders (SL1, SL4)—noted that school building design from 10 to 20 years ago reflected an industrial-era model of education. In this design, classrooms lined both sides of a hallway, with desks arranged in rows and the teacher positioned at the front of the room. SL1 described this model as "cinder block walls with a single door into the classroom with a really narrow window that you could see into the room" (*ll*15-16). As A3 stated, "It's a sit-and-get kind of situation, and the school building designs reflected that . . . with cells and bells and classrooms on either side of a double corridor" (*ll63-65*). Similarly, SL1, A2, A3, and A4 offered parallel descriptions. A2 described the design as thinking within the "number of boxes we were going to have. We did not really go beyond that in terms of thinking about how education is delivered" (*ll*2-4). A4 added, "Back in the day, we used to do what we call a cells and bells approach. We create a corridor with double loaded classrooms on either side" (*ll*9-10). SL4

echoed this statement, describing earlier high school design as a "stereotypical 50-year setting, where we have a teacher in the front and rows of kids facing one teaching wall within the room" (*ll3-4*).

Collaborative and Flexible Spaces. Seven of the eight participants (A1, A2, A3, A4, SL1, SL2, and SL4) highlighted the inclusion of collaborative and/or flexible spaces in 21st-century school design, with all four architects and three school facility leaders discussing this trend. SL3 did not mention the use of such spaces in response to the first interview question. A3 emphasized that modern high school designs are "flexible at the moment and adaptable over time because the curriculum is not a fixed entity" (*ll*78-79). A2 also highlighted the diversity of spaces, describing that a group of spaces might have "two classrooms that are traditional or lecture type spaces, and a couple of half-size spaces for small group or seminar work, and the teacher's desk may be in a professional space" (*ll*15-17) outside of the classroom. A2 referred to the types of areas as "learning studios" (ll19).

A3, A4, SL1, and SL4 echoed the growing emphasis on collaborative spaces that offer extended learning areas for student interactions. SL4 noted the "specific intention to go back to areas where kids can have a little more freedom in the ability to be creative and collaborate" (*ll 1-2*). SL1 added that these spaces often resemble "open pod areas where kids can go and collaborate with the appropriate technology with whiteboards and soft seating to allow for more opportunities to engage in those 5 C's" (*ll*25-27). In contrast, SL2 expressed a different view, nothing that while collaborative spaces are frequently proposed in the design process, they are often "just too expensive and very difficult for the localities to attain" (*ll2-3).*

Moveable Furniture. Half of the participants—comprising three architects (A1, A2, A3) and one school facility leader (SL4)—highlighted the growing emphasis on the use of

moveable furniture, which allows for greater flexibility in room layouts. SL4 noted that "furniture is moving away from the stereotypical school furniture [fixed student desks and chairs]," (*ll*9-10) with desks arranged in rows facing the front of the room with one teaching wall "to furniture that is more flexible and allows for more opportunity for room layout" (*ll*10-11). A2 spoke about specific aspects of the flexible classroom:

> Before, we had a lot of fixed equipment. Now it is a lot less fixed. There is no teaching wall. It has all gone from overhead projectors to LCD Projectors and Promethean boards. So, whatever we use is a mobile piece of equipment that can be pushed around the room (*ll*6-9).

Similarly, A3 pointed out that "a variety of flexible and moveable furniture so that the room can be reconfigured for what is needed at the moment is where a lot of school design is now" (*ll*106-108).

Reflecting 21st-Century Pedagogy. Four participants—two architects (A3, A4) and two school facility leaders (SL1, SL2) noted the shift toward designing schools to support 21st-century pedagogy and curriculum needs. A3 commented that,

> 21st-century learning, or however you want to label it, has moved far enough away from the traditional industrial approach to education and is here to stay. For example, collaboration, student-directed learning, and neurodivergent teaching, etc. We are not going back to sitting everybody in rows and speaking to them that way. We are going to move forward (*ll120-124*).

A3 also emphasized that "Buildings must be designed from the inside out, with the understanding of the curriculum that is taught to the students that are served" (*ll*73-74). SL1 added that spaces are now designed "from an instructional perspective designed specifically to

allow for collaboration, for communication, and for creativity" (*ll*20-21). A4 also pointed to a growing trend in high school design focused on "interdisciplinary planning and interdisciplinary collaboration among students" (*ll*1-2), where teachers and students work together across different academic disciplines.

Interview Question 1 Summary.

The first interview question aimed to identify changes in the high school design process over the past decade or more. Both school architects and facilities leaders described a shift away from the traditional industrial model, with its single-cell classrooms, rows of desks, and a single teaching wall, to more flexible and collaborative spaces. These new designs incorporate moveable furniture and a variety of spaces that meet the needs of diverse learners while supporting 21st-century pedagogy and curriculum. Seven participants agreed that today's schools look vastly different from those designed decades ago.

Interview Questions 2

Interview Question 2a. What information is provided by a school division to best meet their high school building needs?

Interview Question 2b. Do school divisions mention the Profile of a Virginia Graduate or the 5 C's?

Interview Question 2c. What input do architects have on design features?

All participants responded to interview questions 2a and 2b, while only the architects were asked interview question 2c. Four of the eight participants (A1, A3, SL1, and SL3) referenced the use of educational design specifications provided at the school division level or by the Virginia Department of Education (VDOE). Six participants (A1, A2, A4, SL1, SL3, and SL4) mentioned incorporating the *Profile of Virginia Graduate* within these specifications or in

additional materials outlining the school division's goals and vision. Five participants (A1, A4, SL2, SL3, and SL4) highlighted the importance of stakeholder input in the design process. Three of the four architects (A2, A3, and A4) noted that architects play a significant role in shaping the design process, and often rely on site visits or previous design examples for inspiration. Table 3 provides an overview of the themes and participants' responses.

Table 3.

Information Shared to Support the High School Design Process

Types of information shared	A1	A2	A3	A4	SL1	SL2	SL3	SL 4
Educational Specifications	X		X		X		X	
Profile of VA Graduate/5 C's	X	X		X	X		X	X
Stakeholder Input	X			X		X	X	X
Architect Input		X	X	X				
Site Visits/Examples		X	X	X	X			

*Blank spaces indicate that the topic was not noted by the participant

Educational Design Specifications. Four of the eight participants (A1, A3, SL1, and SL3) referenced the use of educational design specifications provided at the school division level or from the Virginia Department of Education. A1 provided additional details:

> Facilities teams have led a discussion with the school staff and the school board itself to develop what are called design specifications that are facilities specifications that describe in great detail what kind of school they want and what to include from a design perspective (ll23-27).

Like A1, SL1 also noted, "Architects will ask for your educational specifications, they want to know what those are, and then will take it from there" (*ll*35-36). In addition to the locality's

established designed specifications, SL3 mentioned, “We have a set of design guidelines to help inform the physical space…We have to meet building code and VDOE guidelines as of 2021” (*ll20-22).* Four of the participants (A1, A3, SL1, and SL3) included capacity requirements when discussing the use of educational specifications for high school design. Additionally, A2 and SL4 referenced the use of capacity guidelines when providing information on building needs, though did not specifically mention educational design specifications.

Profile of a Virginia Graduate and 5 C’s. Six participants (A1, A2, A4, SL1, SL3, and SL4) emphasized the inclusion of the *Profile of Virginia Graduate* in either the educational design specifications or in additional information shared about the school division’s goals and vision. A4 stated, “Those 5 C’s are very prevalent all throughout Virginia and the school systems really embrace them” (*ll*56-57). SL4 noted, “We give them our learner profile, as well as our strategic plan” (*ll*31-32). However, SL4 also mentioned that “most designers are already coming to the table with a gage of our learner profile and plan. It is intertwined throughout the process” (*ll*34-35). The researcher noted that SL4’s learning profile and strategic plan included the integration of the 5 C’s. In contrast, participant SL2 highlighted a different approach, noting that the school board “has been pretty direct about keeping it simple. What we have been communicating with our architects is we want designs that are very cost efficient” (*ll*38-40).

Stakeholder Input. Five participants (A1, A4, SL2, SL3, and SL4) highlighted the importance of including stakeholder input in the design process. SL2 shared, “When the high school was in earlier conceptual design there was a lot of community involvement and community feedback” (*ll*29-30). Both SL3 and SL4 noted the use of stakeholder teams, which may include department chairs, directors, coordinators, and key content leaders. A4 stated, “Stakeholder meetings [involving school personnel, community members, school boards] are one

of the first things we do. We go and we listen to our clients, we also interview students and interview parents" (*ll*20-21).

Architect Input and Site Visits. Three of the four architects (A2, A3, and A4) mentioned having significant input in high school design features. Both A2 and A4 emphasized the use of previous designs and on-site visits to provide clients with real-world examples. As A4 detailed,

> We are engaged with the client from day one. We walk them through and tour different schools where we've done this, so they understand what they are buying with their new school. We just make sure they understand what we are doing and what we are doing for them (*ll*58-61).

A2 added, "We have a lot of input, [we] share our experiences across all jurisdictions and offer examples of what other people might be doing (*ll*49-50). SL1 echoed this, stating "We were able to go out and see six, seven or eight different schools that were designed differently, and bring those ideas and looks to see which ones met our instructional standards appropriately" (ll56-58).

Interview Question 2 Summary

The second interview question aimed to determine the information provided by school divisions and architects to support high school building design. Sub-question 2b specifically sought to identify whether the *Profile of a Virginia Graduate* and/or the 5 C's was included. Interview data revealed that half of the participants referenced the use of educational design specifications in communicating school building needs. Additionally, six participants noted that the *Profile of the Virginia Graduate* and/or the 5 C's was considered in some capacity. Stakeholder input was also a key factor, with five participants indicating its use. Three of the four school facilities leaders facilitated discussions with the community, teacher leaders, and

administrative staff within their school divisions. Architects contributed to the design process by engaging in discussion, conducting site visits, and providing examples and resources to align the design process with the school division's needs and vision.

Interview Question 3

How do you use school design to advance the 5 C's: communication, collaboration, critical thinking, creativity, and citizenship?

All participants identified at least one design feature used in high school designs to support the advancement of the 5 C's. The most frequently mentioned feature was the inclusion of flexible spaces, signaling a shift away from the traditional single-classroom model. Six participants (A1, A2, A3, SL1, SL3, and SL4) highlighted flexible spaces as a key factor in fostering the 5 C's. Additionally, three architects (A2, A3, and A4) and one school facility leader (SL1) emphasized how creative building designs can be particularly important in enhancing creativity and critical thinking. Three participants (A4, SL1, SL2) also mentioned the integration of outdoor learning spaces as a design feature. Table 4 provides an overview of the themes and participant responses.

Table 4.

School Design to Advance the 5 C's

Design Features	A1	A2	A3	A4	SL1	SL2	SL3	SL 4
Flexible Use of Space	X	X	X		X		X	X
Inspiring Building Design		X	X	X	X			
Outdoor Spaces				X	X	X		

*****Blank spaces indicate that the topic was not noted by the participant

Flexible Use of Space. Six out of eight participants (A1, A2, A3, SL1, SL3, and SL4) referred to the importance of flexible spaces when discussing the advancement of the 5 C's.

Collaboration and Communication. When considering design spaces that advance collaboration and communication, SL1 stated the following:

> When you look at a cells and bells school approach, there aren't wide open spaces that are flexible for kids to move, to have strong communication, whether it's through small group instruction, independent learning, or small group collaborative projects (*ll*66-69*).*

Similarly, A1 pointed out the significance of the "design of flexible spaces in the individual classroom, making sure furniture is not fixed" (*ll*42-54). These adaptable design areas foster collaboration and communication, allowing students to interact and engage comfortably. A2 echoed the importance of communication in project-based learning, stating that spaces are designed "for small-group presentations, so it might be a lecture-type space that could easily be adaptable for students to give presentations" (ll57-59).

Both A1 and A2 highlighted the use of learning stairs—a design element that enhances both communication and collaboration. Specifically, these wide, deep stairs, typically adjacent to a traditional staircase, function like bleachers, providing seating that may feature hard or soft surfaces (Wilson & Winebrenner, 2017). "It is a great space to have a gathering spot to communicate your ideas to the larger world" (ll59-61), stated A2. When discussing school design aligned with the 5 C's, SL3 stated, "areas that come to mind include extended learning areas, opportunities for special spaces for learning, and breakout spaces" (*ll*38-39).

Creativity, Critical Thinking, and Citizenship. This study's participants also spoke to the importance of flexible spaces for advancing creativity, critical thinking, and citizenship. SL1 asserted that "freedom and the agency to create knowledge is incredibly important in the creative

process . . . so being out of the classroom allows for a lot of creativity to come about in these spaces" (*ll*85-90). A4 expanded on this notion in reference to smaller collaboration spaces: "There are also individual nooks for kids to go off by themselves to pull up an iPad or read" (*ll*65-67), as well as "spaces for art and for music" (*ll*81-82), ensuring that creativity can flourish in various forms. Similarly, A3 observed that "getting out of the normal classrooms into different spaces fosters this [citizenship] and creativity as well" (*ll*187-188). SL4 reinforces this concept, recognizing the value of these unique spaces in fostering creativity:

> Taking the school rooms out of the traditional teacher in the front with four or five rows of kids in perfect synchronization is probably the biggest thing that allows kids to start thinking differently and, hopefully, to see the world a little bit differently (*ll*46-48).

Inspiring Building Design. Four participants (A2, A3, A4, and SL1) highlighted the role of school building design in advancing the 5 C's, particularly with regard to creativity and critical thinking. As A2 stated, "giving them [students] spaces that are a little bit more inspiring than seen as going to [school] in an institution [like a hospital or jail]" (ll63-64). A3 argued that "a school building itself can be designed in ways that are creative and lend itself to creativity…there are ways to modulate [the building] like having something asymmetrical…that can be used as a catalyst or creativity" (*ll*168-173). Noting the ability to use building design as a teaching tool to support critical thinking, A4 used real-world examples of "making the door glass [to the mechanical room] so students can see what mechanical equipment looks like, and signs outside to explain how the heat pump helps heat the building" (*ll*71-74). SL1 added that when students are in spaces that inspire, they feel a sense of ownership—the "idea [that] this space is yours…and we own it together" (*ll*106-107) when discussing how school design advances citizenship.

Outdoor Learning Spaces. Three participants (A4, SL1, and SL2) discussed the value of outdoor spaces in advancing the 5 C's. SL2 remarked that while teachers were "responsible for introducing opportunities for creative thinking and collaboration" (*ll*63-64), they added that "we can offer these opportunities through outdoor features like a courtyard" (*ll*64-66). SL1 referenced outdoor learning spaces as "another aspect of citizenship" (*ll*115) when describing student-led collaborative beautification projects. Furthermore, SL1 pointed out that outdoor learning spaces also provide "open space for art where kids are creating art in spaces that weren't there before in older buildings" (*ll*121-122). A4 also noted outdoor spaces provided a place "that kids can be creative outside, not just with artwork, but really understand ecology and biology" (*ll*82-83).

Interview Question 3 Summary

The third interview question sought to explore how school design can be utilized to advance the 5 C's. Participants were asked to identify specific school design features and explain how these features advanced one or more of the 5 C's. Six participants highlighted that moving away from the traditional school model toward more flexible spaces had significantly impacted both teaching methods and student learning, fostering the development of each of 5 C's. Key examples of flexible learning spaces included learning stairs, collaboration spaces, individual learning spaces, and technology nooks. Additionally, five participants emphasized how the school building design itself could play a crucial role in inspiring creativity and encouraging critical thinking; moreover, three participants observed that the incorporation of outdoor learning spaces could promote creativity and citizenship.

Interview Question 4

How do you ensure that school leadership has the knowledge and skills to utilize the new learning spaces as intended?

Area of Growth. One major theme emerged in the participants' responses to this question. Five of the eight participants (A1, A2, SL2, SL3, and SL4) identified the relationship between the efficacy of school leadership and utilizing new learning spaces as intended as an important area for growth. A2 referred to the process of educating all staff who will use the new building and maximizing its potential as "educational commissioning," but added that "we talk about it a lot more than it [the process of educating stakeholders on the new building] actually happens" [ll78-79].

The goal of educational commissioning is to ensure that all users have the necessary knowledge to fully maximize the facility's potential in support of teaching and learning (Lackney, 2007). A1 and SL1 both provided specific examples of building-level strategies implemented to ensure school staff are equipped with the skills and understanding to use the spaces as intended. A1 noted, "We could do a better job of memorializing these understandings and creating documents that are easily accessible for future generations [due to turnover]" (ll76-78).

SL2 and SL3 echoed similar sentiments, noting that it is generally assumed that the process happens at the school level. SL2 commented that in discussions with educational leadership, the assumption is often made that "the teachers will be fine, they will get it, so I don't know if there has been a lot of emphasis on that [professional development of new design features with staff]" (*ll*79-80). SL3 added, "I think we take that part for granted" (*ll*46). "We assume that communication is happening at the school level and the faculty is using it that way" (*ll*56-58). The five participants (A1, A2, SL2, SL3, and SL4), were all in agreement that minimal to zero professional development or educational commissioning was being done to train school staff on effectively utilizing the new building design to support teaching and learning goals

aligned with 21st-century pedagogy. Table 5 provides an overview of the themes and associated participants' responses.

Table 5.

Strategies Used to Support the Onboarding of the New Building

Strategies	A1	A2	A3	A4	SL1	SL2	SL3	SL 4
Area of Growth	X	X				X	X	X
Building Led				X	X			

*****Blank spaces indicate that the topic was not noted by the participant

Interview Question 4 Summary.

This question sought to identify strategies for ensuring that school staff are equipped with the knowledge and skills to utilize the new high school design features as intended. A synthesis of participant responses indicated a clear need for improvement in this area, with an overall assumption that the training occurs at the school level. While no dominant themes emerged around specific strategies, both A4 and SL1 provided specific examples of building-led initiatives such as professional development sessions, establishing culture and climate expectations, and coaching for new staff.

Interview Question 5

What types of challenges or barriers do you encounter when designing a high school for a school division?

Two key themes emerged from participant responses to interview question five: budget constraints and stakeholder buy-in. Six participants (A1, A3, A4, SL2, SL3, and SL4) identified budget as one of the most common challenges or barriers in the design process. Additionally,

five participants (A2, A3, A4, SL1, and SL2) mentioned stakeholders buy-in as a significant challenge. These participants highlighted that stakeholders often did not fully appreciate or understand the importance of 21st-century skills and how school architecture plays in a pivotal role in advancing the school curriculum. Table 6 provides an overview of the themes and associated participants' responses.

Table 6.

Challenges or Barriers in High School Building Design

Challenges/Barriers	A1	A2	A3	A4	SL1	SL2	SL3	SL 4
Budget	X		X	X		X	X	X
Stakeholder Buy-in		X	X	X	X	X		

*****Blank spaces indicate that the topic was not noted by the participant

Budget. Six of eight participants (A1, A3, A4, SL2, SL3, and SL4) cited budget as a common challenge or barrier. A4 remarked, "Money is always a big deal" (*ll*103), adding, "We always have to be mindful of the budget because they [school divisions] are not going to find any more. When you create these collaboration spaces, the schools get a little bigger, and bigger schools cost more money" (*ll*106-108). A1 similarly noted, "One of the greatest challenges will always be for the client and the designers, is having bigger appetites than they can afford" (*ll*82-84). SL4 echoed this sentiment, stating, "We can only build what the budget will allow. There are a lot of wants that are deemed needs" (ll95-96). While A3 acknowledged budget constraints, they also emphasized, "Good design doesn't cost more than bad design, if you have 40 million dollars or 140 million dollars, we are going to do the best we can. It can be good or it can be bad, so let's make it great" (ll 213-215).

Stakeholder Buy-in. Five participants (A2, A3, A4, SL1, and SL2) pointed to stakeholder buy-in—especially regarding the impact of school architecture on teaching and learning and the importance of 21st-century skills—as a significant challenge. A3 noted, "Understanding and awareness are the biggest hurdles" (*ll*207-208), adding that "it is their [stakeholders] perception about the role of architecture in education that we never get past" (*ll*212-213). A2 also mentioned barriers to achieving stakeholder buy-in expressing the following:

> People need to get out of their own experiences to think about this building that is going to be around for 75 years. They are either comparing to spaces that they are in or that they were in, and they can't get past that to think about a 21st-century space (*ll*84-86).

A4 added, "You have to explain to them [stakeholders] in today's world, things are really changing. We have to really embrace the way students are learning, and it's different than it was when you and I went to school" (*ll*114-115). SL1 also described resistance to new design ideas, particularly around increased transparency and the use of more glass in school designs. SL stated, "There were a lot of people vehemently opposed to that idea" (ll150-151), adding that "trying to pull everyone around those ideas was certainly a challenge and one of the hardest things we had to do" (*ll*154-155).

Interview Question 5 Summary

The fifth interview question sought to identify the challenges or barriers encountered when designing a high school for a school division. Budgetary constraints were the most frequently mentioned, with participants describing difficulties in integrating all design ideas into the final building product. However, all six participants noted that collaboration allowed for the creation of cost-effective solutions that still met design and curricular goals. Participants also

spoke about stakeholder buy-in as a significant barrier when designing a new school building, as many staff, community members, and school board members lacked an understanding of 21st-century learning and the important role architecture plays in education. They often based their opinions about their own school experiences, limiting their ability to appreciate modern educational needs. Additionally, both SL3 and SL2 mentioned timelines as a challenge, particularly regarding building constraints such as permitting, environmental policies, and availability of materials, which can delay project completion.

Interview Question 6

Tell me about any additional design trends in recent school builds, and why they are a prominent focus.

A significant design trend highlighted by six of the eight participants (A1, A2, A4, SL1, SL3, and SL4) is the incorporation of flexible spaces. These spaces encompass a wide range of applications, ranging from multi-disciplinary spaces to the strategic utilization of each available area within the school building. This flexibility allows for a dynamic shift in how education is delivered, accommodating diverse learning styles and fostering collaboration, creativity, and critical thinking.

Another prominent trend, identified by A4, SL2, and SL3, focused on environmental influences in the high school building design. This includes elements such as outdoor learning spaces, sustainable building materials, and the increased use of natural light. The attention to environmental factors not only enhances the learning experience by creating a more stimulating and inviting learning and teaching environments, but also aligns with growing efforts toward sustainability and eco-conscious building practices. Table 7 provides an overview of the themes and associated participants' responses.

Table 7.

Additional High School Design Trends

Trends	A1	A2	A3	A4	SL1	SL2	SL3	SL 4
Flexible Spaces	X	X		X	X		X	X
Environmental Influences				X		X	X	

*****Blank spaces indicate that the topic was not noted by the participant

Flexible Spaces. Six of the eight participants (A1, A2, A4, SL1, SL3, and SL4) emphasized the popularity of flexible spaces in modern high school design trends. SL3 explained that "the flexibility of space allows for multiple uses as opposed to one single use" (*ll*81-82). A2 highlighted how spaces are now designed to support multi-disciplinary projects, including career and technical education. A2 also pointed out the trend of utilizing school spaces in multiple ways, noting "There is a trend to utilize every nook and cranny verse thinking about corridors to go to point a to point b, or spaces under the stairs, are [now] places students can gather" (*ll*100-102). These smaller spaces represent innovative opportunities "to provide more connections between students and create smaller groups within that space" (*ll*90-92). SL3 indicated that "extended learning areas are very popular among the design community" (*ll*107).

A key example of flexible design, shared by SL1, is the introduction of learning stairs, which they described as large staircases that double as seating for up to 200 people, ideal for town hall meetings, class gatherings, and other large events. Similarly, A4 spoke about the trend toward flexible spaces in high school design, describing the incorporation of collaboration zones, such as "student nooks off to the side where there are cubbies students can sit in" (*ll*126-127), allowing students to sit in quiet corners to focus on individual tasks.

Environmental Influences. Three participants (A4, SL2, and SL3) discussed the integration of environmental influences into current high school building designs. SL2 noted that some schools are utilizing building funds to meet certain environmental goals. SL3 pointed out that "there is a big movement to energy efficiency and the recognition of nature inside the building" (*ll*78-79). A4 noted the use of outdoor learning spaces and of "sustainable options with the building, whether you are totally a net zero energy building where you have photovoltaic panels on the roof, you want to use those features of a building as a teaching tool" (ll13-134).

Summary of Interview Question 6.

Interview question 6 sought to explore additional design trends in current high school construction. Both architects and school facility leaders identified flexible spaces as a key element intended to facilitate collaboration, multi-disciplinary learning, and the maximization of space. These flexible spaces also support the development of smaller learning communities within the larger school environment. Additionally, two school leaders and one architect highlighted the growing importance of environmental design features, which affect not only the sustainability and efficiency of school buildings, but also enhance learning experiences. In particular, environmental features emphasize the incorporation of outdoor learning spaces and the integration of nature into the building environment.

Summary of Chapter 4

Chapter 4 provided an overview of the study's purpose, research questions, and a detailed description of the participants, along with qualitative data gathered from the sample of eight study, participants, including four architects and four public school facility leaders. The study aimed to determine what changes, if any, have occurred in Virginia high school design in response to the implementation of the *Profile of a Virginia Graduate* and the 5 C's of critical

thinking, communication, collaboration, creativity, and citizenship. Additional sub-questions explored emerging trends in 21st-century school design, focusing on alignment with educational specifications, modern pedagogy, and architectural design. Participants were specifically asked to reflect on and share their experiences with how high school design has evolved before and after the adoption of the *Profile of a Virginia Graduate*.

When describing the changes that have occurred since the adoption of the *Profile of a Virginia Graduate*, both school architects and school facilities leaders noted a significant shift away from the industrial era school design model composed of single-cell classrooms with rows of desks and one teaching wall to flexible and collaborative spaces. These spaces are designed with the incorporation of moveable furniture with a variety of spaces to best meet the needs of diverse learners while supporting 21st-century pedagogy and curriculum. The use of school design spaces to support 21st-century skills through the 5 C's included the incorporation of flexible spaces, inspirational building design, and outdoor learning spaces. In addition to the design themes noted while discussing the advancement of the 5 C's, participants identified the strategic design of flexible spaces to allow for collaboration, multi-disciplinary instruction, maximization of space, and the creation of smaller learning communities within the larger building, and the incorporation of environmental influences as current trends in high school design.

Participants also shared common themes in the design process as being a collaborative between architects and school facility leaders. This process encompasses stakeholder meetings, sharing of educational specifications, and school site visits in order to design a high school that meets the needs of the school division. However, challenges and barriers arise during this process and shifts in school design may need to be made. The main challenges and barriers that

arise are budgetary constraints and stakeholder buy-in. Chapter 5 will summarize findings, present implications, suggest future studies, and provide reflections.

Chapter 5: Findings, Implications, and Recommendations for Future Research

Introduction

The purpose of this study was to explore the perceptions of four professional architects in Virginia and four local school directors of facilities regarding any changes in high school designs they've observed in response to the implementation of Virginia 5 C's—collaboration, critical thinking, creativity, communication and citizenship—as outlined in the 2016 *Profile of a Virginia Graduate*. Information from interviews conducted with the eight study participants was assessed to identify themes in 21st-century building design that align with educational design specifications, contemporary pedagogy, and architectural trends. This study also sought to determine whether the pedagogical shift towards 21st-century skills has impacted the educational specifications of new high schools, and if so, what architectural changes have been made in Virginia schools since the adoption of the *Profile of a Virginia Graduate*.

This study was guided by one primary research question: How has high school design evolved in response to the pedagogical focus on 21st-century skills, particularly following the adoption of the *Profile of a Virginia Graduate* in 2016?

Findings and Conclusions from the Research

Chapter 5 presents a discussion of the findings that emerged from the interview data. In summary, this study sought to identify if the pedagogical shift towards 21st-century skills has impacted the educational specifications when designing a new high school, and if so what architectural changes have been made in Virginia schools since the adoption of the Profile of a Virginia Graduate in 2016. Four findings emerged after an analysis of data.

Finding 1

Architects and school facilities leaders indicated that high school building designs have evolved to better support 21st-century pedagogy and the 5 C's (critical thinking, creativity, collaboration, communication, and citizenship). Those who took part in this study described a move away from the industrial-era model of school design comprising single-cell classrooms with rows of desks and one teaching wall, transitioning instead to flexible, collaborative spaces.

Five participants (A2, A3, A4, SL1, and SL4)—three architects and two school facility leaders—noted that high school designs from ten to twenty years ago reflected an industrial-era approach to education, with classrooms lining both sides of a hallway, desks arranged in rows, and teachers delivering lessons from the front of the room. SL4 described prior high school design as "a stereotypical 50-year setting, where we have a teacher in the front and rows of kids facing one teaching wall within the room." Seven participants agreed that schools designed decades ago look vastly different from the schools being designed today, which feature moveable furniture and a variety of spaces to accommodate the needs of diverse learners while supporting 21st-century teaching and curriculum.

Half of the participants mentioned using educational design specifications to communicate the design specifications of the school building, with six of the participants noting the inclusion of the *Profile of the Virginia Graduate* and/or the 5 C's in the design process. Four participants (A3, A4, SL1, SL2)—two architects and two school facility leaders—described the shift to school designs that support or reflect 21st-century pedagogy and curriculum needs. SL1 emphasized that spaces are thought about "from an instructional perspective designed specifically to allow for collaboration, for communication, and for creativity" (ll20-21).

Finding 1 is consistent with previous research highlighting increased efforts towards creating learning spaces aligned with 21st-century learning standards and a shift in learning spaces from traditional learning environments to flexible and innovative ones (Carvalho et al., 2020; Kariippanon et al., 2017; Patrix & Benade, 2018; Sigurdardottir & Hjartarson, 2011). French et al. (2022) also found that shifting educational goals towards global citizenship and skills like the 5 C's have propelled shifts in school design to support these learning goals. Additionally, Merriënboer et al. (2017) found that misalignment between educational vision and school design can impact educational quality, emphasizing the need for physical spaces that support specific learning outcomes and learning philosophies. As teaching practices have evolved to support 21st-century students, classroom environments have also shifted, replacing rows of desks and chairs with flexible furniture arrangements to enhance teaching and learning (Kariippanon et al., 2017). This shift from traditional learning design to flexible learning spaces has been found to support collaboration, engagement, student autonomy, self-regulation, and student-centered teaching practices (Kariippanon et al.).

Finding 2

Architects and school facilities leaders emphasized that variety and flexible use of school spaces are essential for meeting the diverse learning needs of 21st-century students. Recent high school designs are increasingly incorporating flexible spaces as a core feature, which facilitates collaborative learning, interdisciplinary instruction, and the creation of smaller communities within the larger school environment. This study's eight participants highlighted the shift away from single-classroom models toward more adaptable spaces that are able to maximize utility and foster a more dynamic learning environment.

As detailed in interview findings, flexible spaces encompass a broad array of design elements, ranging from multi-functional areas to the efficient use of available space within the school building. Examples of flexible learning spaces include learning stairs, collaboration spaces, individual study spaces, and technology nooks. Additionally, half of the participants, including three architects and one school facility leader (A2, A2, A3, and SL4), emphasized the importance of moveable furniture, which enhances room layout options and promotes greater teaching and learning flexibility.

Finding 2 aligns with previous research highlighting the role school design plays in supporting 21st-century learning. As instructional practices have evolved to engage today's students, so too has classroom design, moving away from rows of desks and chairs with a variety of furniture that can be arranged in various ways to facilitate teaching and learning (Kariippanon et al., 2017). The results detailed by Sigurdardottr & Hjartarson (2011) demonstrated a clear transition in building design from traditional, closed classrooms to open, flexible spaces with moveable boundaries and shared spaces. Modern schools are now envisioned as community hubs, equipped with ergonomic, mobile furniture, privacy niches, and technology-rich environments that enable distance learning.

Additional studies by Baker (2012), Cash (2012), Krueger (2018), and Nair (2019) also support the incorporation of mobile furniture and flexible-use rooms to accommodate varied lesson plans and curriculum requirements. Flexible spaces that support both large and small group activities underscore the importance of collaborative learning (Krueger, 2018). This innovative school design approach, often referred to as "learning studios," provides versatile environments that cater to a range of learning modalities (Nair, 2014). Mobile furniture provides ease of movement to create individual study, groupwork, or larger open spaces (Krueger, 2018).

In addition, flexible design spaces foster shared resources and spaces that support project-based learning and space optimization (Arsenault, 2022).

Finding 3

Architects and school facilities leaders emphasized the importance of a structured professional development process for staff in newly designed school buildings to ensure that design components and features are utilized as intended. Five of the eight participants (A1, A2, SL2, SL3, and SL4) identified this as a critical area for improvement. Currently, it is too often assumed that school leaders can independently guide their staff in adapting to the new space, although this study's participants agreed that this support is not always sufficient. As one architect, A1, noted, "We could do a better job of memorializing these understandings and creating documents that are easily accessible for future generations." Five participants (A1, A2, SL2, SL3, and SL4) agreed that professional development or educational commissioning aimed at training staff to effectively use the new building design for 21st-century teaching and learning practices is minimal.

This finding aligns with previous research suggesting the importance of purposeful preparation and professional development when transitioning staff to a new learning environment and building design. In support of this study's findings, Niemi (2020) emphasized the need for purposeful preparation, which includes incorporating teacher input in the design phase, establishing a shared vision and goals, and aligning the physical space with teachers' preferred pedagogical practices. Furthermore, a recent study confirms that building trust and fostering skills to support both teaching methods and student behavior management in open and flexible learning environments are critical for successful outcomes (Deppeler & Aikens, 2020). To achieve this, professional learning opportunities that promote the reshaping of teaching

practices alongside adjustments to school design should be both authentic and sustainable (van Merriënboer et al., 2017).

Finding 4

Architects and school facilities leaders identified budget constraints and stakeholder buy-in as barriers in designing new high schools that align with 21st-century learning needs. These challenges became apparent through responses to interview question five, confirming that budget limitations and resistance from stakeholders—including staff, community members, and school board members—represented potentially significant barriers. Many stakeholders often lack familiarity with the principles of modern educational environments and the growing importance of the 5 C's. Instead, they tend to reference their own schooling experiences, which did not emphasize the role of architecture in fostering 21st-century educational goals. Moreover, three architects and two school facilities leaders noted that stakeholders did not value or understand the importance of 21st-century and the role that school architecture plays in advancing the school curriculum. A2 and A4 noted that overcoming stakeholders' perceptions about the role of architecture in education requires ongoing efforts to illustrate how rapidly the learning landscape is evolving, and that today's students learn differently than previous generations.

Six out of eight participants (A1, A3, A4, SL2, SL3, and SL4) mentioned financial limitations as a common challenge or barrier. A1, A4, and SL4 all stressed that school districts can only build what they can afford, which restricts the scope of incorporating certain modernized school design elements such as larger, flexible spaces. Additionally, A1 noted that school divisions often aspire to achieve ambitious design goals but must scale them down due to budget limitations. However, A3 argued that good design does not inevitably cost more than bad

design, underscoring that architects and school leaders can collaborate to implement effective design solutions within budget constraints.

Finding 4 aligns with existing research on the crucial role of funding in developing educational facilities that support teaching and learning goals, as well as maintaining and upgrading existing school facilities. According to Filardo (2021), underfunding in school maintenance and capital improvements across the U.S. often results in outdated facilities, compromising students' access to suitable learning environments. These outdated schools may face issues like overcrowding, poor air quality, disorganized layouts, mold , and inadequate lighting, all of which have been linked to lower academic outcomes (Chmlelewski et al., 2023).

Additionally, this funding supports research addressing the value of involving all stakeholders in the school design process. In designing schools for tomorrow, Nair (2011), Sigurdardottir & Hjartarson (2011), and van Merriënboer et al. (2017) all emphasize that successful school design for the future depends on the inclusion of all stakeholders—school boards, staff, parents, community members, and architects—from the beginning of the design process. Baker (2012) also advocated for reflective, open feedback loops that incorporate community insights into what enhances student learning environments. In contrast, misalignment among stakeholders regarding 21st-century learning goals can create substantial obstacles in the design process, underscoring the need for ongoing collaboration to support these shared educational objectives.

Implications

In response to the findings that emerged from this study, five implications for practitioners and future studies were identified.

Implication 1

The VDOE should update the *Guidelines for School Facilities in Virginia's Public Schools* to incorporate the influence of the 5 C's—critical thinking, creativity, communication, and citizenship—on school building design to provide specific guidance to school divisions as these skills are embedded throughout the VDOE's educational guidance documents for all localities. Currently, The Virginia Department of Education (VDOE) has outlined recommendations that should be considered when planning for school facilities projects, as well as define minimum standards that all Virginia schools should meet. However, these guidelines provide minimal guidance beyond recommending that school divisions should develop a mission and vision to support educational programming goals. This recommendation aligns with Findings 1 and 2. As schools shift away from industrial-era school building designs toward more open and flexible spaces that support 21st-century learning, the VDOE's facility guidelines should reflect the pedagogical priorities outlined in the *Profile of a Virginia Graduate.* Study data suggest common themes in designing schools for the modern learner, emphasizing the 5 C's and 21st-century skills as part of many school divisions' educational specifications. Updating the guidelines would offer consistency across Virginia's public-school divisions, ensuring that new school buildings not only meet infrastructure, building code, and space utilization needs, but also support 21st- century teaching and learning as outlined in the *Profile of a Virginia Graduate.*

Implication 2

School divisions should develop collaborative teams of school division leaders and staff to develop local building specifications that consider adaptability and flexibility in school design. This recommendation is based on Finding 2. A design approach that prioritizes

flexibility would enable schools to better meet the diverse learning needs of students and support 21st-century curriculum goals. According to study participants, strategically designed flexible spaces foster collaboration, multi-disciplinary instruction, and the ability to create differentiated learning communities within the larger building. As education moves toward student-led learning, project-based activities, and inclusive learning opportunities for all students, adaptable building specifications will help schools meet curriculum goals while maximizing their building spaces and resources, allowing facilities to evolve alongside ever-changing educational needs.

Implication 3

School division leaders and architects should collaborate to provide adequate professional training on how to best utilize the new design spaces to support teaching and learning goals for school faculty. Implication 3 responds to Finding 3. Study data showed that minimal to zero professional development or educational commissioning was provided to train school staff on using new facilities to support 21st-century pedagogy. Educational commissioning—the process of training occupants on a building's design intent—ensures that staff can fully utilize the facility to enhance learning (Lackney, 2007). This training should include ongoing professional learning opportunities to ensure that the knowledge is sustained despite any staff turnover and the passage of time. Easily accessible documentation or handbooks could serve as valuable resources for current and future staff, helping to sustain knowledge of the building's design intent.

Implication 4

School divisions should advocate for state funding to renovate or replace outdated facilities. Currently, local Virginia school divisions receive 14% less state funding on average when compared to all other 50 states (JLARC, 2023). Implication 4 is informed by Finding 4.

According to data from this study, funding emerged as a key barrier to constructing new schools., with study participants nothing that school divisions often face financial constraints that limit design options. Participants also observed that modernized building designs tend to be larger and thus are costlier to construct. Despite being the second largest infrastructure sector in the U.S., elementary and secondary schools remain chronically underfunded, with most of the burden falling on local budgets. The current funding gap for school facility infrastructure in this country stands at about $85 billion due to years of chronic underfunding of maintenance and repairs (Vincent & Heming, 2021). The total replacement cost across the Commonwealth of Virginia exceeds $24 billion (VDOE, 2021). In addition, the Commonwealth of Virginia utilizes the local composite index (LCI) to determine the contribution ability of local-level government with the state paying the higher share (JLARC, 2023). This LCI formula is outdated, over 50 years old, and does not use the most updated data available to accurately and fairly determine a locality's ability to pay. This type of funding creates disparities in funding of facilities across local school divisions.

Advocating for additional funding at the state level is essential in providing local school divisions with adequate and equitable funding to support growing communities and replace aging buildings. Effective teachers, skilled administrators, and strong curriculum alone cannot compensate for the negative impact of crumbling school facilities on educational quality (Vincent & Heming).

Implication 5

Architects and school leaders should work together to educate the community on the importance of 21st-century skills and the role of school building design in supporting student achievement. This implication responds to Finding 4. According to data from this study,

stakeholders—including community members, school board members, and parents—often lack an understanding of the critical role the 5 C's play in preparing students for the global workforce.

Additionally, most stakeholders do not fully grasp the connection between building design and educational outcomes, likely because they reference their own personal histories, which can be vastly different from what today's students are experiencing. Engaging stakeholders though school board meetings, town halls, and PTA meetings, as well as including current infographics and presentations before and throughout the design process, is essential for inculcating stakeholder buy-in for designing buildings that best support 21st-century pedagogy.

Limitations of the Study

This study features several limitations that may impact the generalizability of its findings. As a qualitative case study, it was designed to investigate the perceptions of both architects and public-school leaders regarding school design changes in Virginia since the implementation of a *Profile of a Virginia Graduate.* Four key limitations associated with the methodology should be noted: (a) the willingness of respondents to speak candidly, (b) the nature of the respondent sample, (c) the data-collection instrument used, and (d) potential researcher bias.

Willingness of Respondents to Speak Openly

This study utilized semi-structured interviews for data-collection, using a set of predetermined questions that allowed for some flexibility in responses. Despite the assurance of anonymity, some participants may have been reluctant to be fully forthcoming in their responses. Additionally, respondents might have provided answers they thought the researcher wanted to hear, refrained from full disclosure, or unintentionally misrepresented details due to memory limitations or limited familiarity with the topic (Kormos & Gifford, 2014).

Respondent Sample

This study employed purposeful sampling to identify participants with enhanced knowledge of the *Profile of a Virginia Graduate* and the focus on 21st-century skills as part of many school divisions educational specifications. The perspectives of certain excluded groups whose direct learning or teaching experiences may have been helpful (notably, students and teachers) were not incorporated in this study's findings, even though their input could have provided valuable context. The exclusion of these groups was driven by sampling size considerations and a decision to focus on the two respondent groups (architects and school leaders).

Data Collection Instrument

Although the researcher's advisory committee collaborated closely in developing the interview questions, it is possible that different or additional questions could have produced further insights on modern school design and its potential. Given the evolving nature of school design and the diverse factors that influence it—notably technology integration, issues of sustainability, and flexible learning spaces—some aspects may have remained unexplored. The addition of other or different questions could have generated a more nuanced understanding of how modern design principles can address the needs of today's students, enhance educational outcomes, and adapt to future trends.

Researcher Bias

The researcher sought to remain mindful of any potential biases regarding the importance of having 21st-century school design be guided by *The Profile of a Virginia Graduate*—outlining the four domains of knowledge and competencies that high school graduates need to be successful in the workforce and as members of the global community—and the 5 C's

(communication, critical thinking, collaboration, creativity, and citizenship). Efforts were made throughout the data-collection and analysis process to maintain objectivity and impartiality to preserve the study's integrity.

Recommendations for Future Studies

This qualitative study identified key themes in 21st-century school building design and recommended actions for architects and school division leaders to align new high school buildings with modern educational needs. Insights from four architects and four school facilities leaders informed recommendations for school division leaders and architectural firms to collaborate effectively with community stakeholders and policy leaders at the state and federal levels. This collaboration would support alignment between school infrastructures and 21st-century skills as outlined in a *Profile of a Virginia Graduate*. Additionally, the study underscores the impact of school buildings on student achievement, and the need for increased funding from state- and federal-level entities.

Suggestions for additional studies into how school building design supports 21st-century learning and the 5 C's include:

- Expanding data collection to include document review of school design plans and local school division educational specifications.
- Broadening the focus to include elementary and secondary school buildings.
- Constructing a study that examines how specific design features in high schools influence teaching and learning.
- Exploring a comparative study between 21st-century high schools and modern workplaces to assess employee efficacy and preparedness.

Conclusion

The purpose of this qualitative study was to explore the perspectives of Virginia architects and local school directors of facilities regarding changes (if any) that have occurred in Virginia public high school designs in response to the implementation of the 5 Cs (collaboration, critical thinking, creativity, communication and citizenship), as outlined in the *Profile of a Virginia Graduate*. Interviews conducted with four architects from three different firms and four local public school facility leaders from different school divisions revealed that high school designs are shifting from the traditional industrial-age model of single classrooms with rows along a corridor to open, flexible spaces with mobile furniture. This transformation reflects changes in educational pedagogy that support 21st-century skills as described in the *Profile of a Virginia Graduate*. However, to fully realize the potential of these new designs, school leaders and staff need more professional learning opportunities regarding effective building utilization.

Collaboration with stakeholders to communicate the influence of building design on academic achievement, coupled with the role of 21st-century skills in preparing students for the global workforce, are essential in gaining community buy-in and advocating for adequate funding. The alignment between 21st-century pedagogy, building design, and funding will ultimately create learning environments that support all students as future members of a global society.

Reflections

Educational trends will likely continue to be influenced by political and social changes, as well as a growing understanding of what is needed to support a diverse population of students in a rapidly changing world. As technology connects people globally, students require not only a strong academic foundation but also requires them to develop strengths in skills such as

communication, collaboration, critical thinking, creativity and global citizenship in order to be successful beyond high school. This research study enabled architects and school facility leaders to discuss the impact of inspiring, sustainable, and updated school infrastructure in supporting the academic, social-emotional, mental and physical wellbeing of high school students.

Educators are working hard to meet the diverse learning needs of students, while also fulfilling federal, state and local curricular expectations to prepare students for the future workforce. However, due to significant funding deficits across the country, many schools are over 40 years old, with failing infrastructure—overcrowded spaces, poor air quality, and limited technology access—which adversely impacts student achievement. Local school divisions cannot continue to "do more with less;" they need a shift in mindset and advocacy for increased funding at the state and federal levels.

It is crucial to engage all stakeholders in this effort by building awareness of the importance of teaching 21st-century skills, the impact of building design on learning, advocating for public school funding, and innovating school design approaches. Collaboration among community members, educators, parents, school board members, architects, and federal, state and local leaders is essential for enhancing the educational experience and providing optimal learning environments for all students.

References

Alexander, D., & Lewis, L. (2014). *Condition of America's public school facilities: 2012-13* (NCES 2014-022). U.S. Department of Education, National Center for Educational Statistics. https://nces.ed.gov/pubs2014/2014022.pdf

Arsenault, P. J. (2022). Updated school design in a post-pandemic world. *Architectural Record*, 1–10. https://continuingeducation.bnpmedia.com/pdf/courses/L314C2925.pdf

Baker, L. (2012, January). *A history of school design and its indoor environmental standards, 1900 to today*. National Clearinghouse for Educational Facilities. http://www.ncef.org/pubs/greenschoolshistory.pdf

Battelle for Kids. (2019). *Framework for 21st century learning definitions*. https://static.battelleforkids.org/documents/p21/p21_framework_definitionsbfk.pdf

Benade, L. (2017). Is the classroom obsolete in the twenty-first century? *Educational Philosophy and Theory*, *49*(8), 796–807. https://doi.org/10.1080/00131857.2016.1269631

Carvalho, L., Nicholson, T., Yeoman, P., & Thibaut, P. (2020). Space matters: Framing the New Zealand learning landscape. *Learning Environments Research*, *23*(3), 307–329. https://doi.org/10.1007/s10984-020-09311-4

Cash, C. S. (2012). Learning in 21st century schools: Toward school buildings that promote learning, ensure safety, and protect the environment.

Chmlelewski, E., Jauregul, H., O'Donnell, S., Levine, B., Gioconda, K., & Kruse, L. (2023, December). Addressing a multi-billion dollar challenge: Advancing knowledge of how high-quality school environments can positively affect educational outcomes. *Perkins Eastman*.

Commonwealth Learning Partnership. (2020). *The Virginia 5 C's*. https://www.commonwealthlearningpartnership.org/virginia-5-c%E2%80%99s

Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches.* (V. Knight, Ed.; 4th ed.). Sage Publications, Inc.

Creswell, J. W., & Poth, C. N. (2018). Qualitative inquiry and research design: Choosing among five approaches (4th ed.). Sage.

Darian-Smith, K., & Willis, J. (Eds.). (2017). *Designing schools: Space, place and pedagogy*. Routledge.

Deppeler, J., & Aikens, K. (2020). Responsible innovation in school design: A systematic review. *Journal of Responsible Innovation*, *9*(3), 573–597. https://doi.org/10.1080/23299460.2020.1809782

Earthman, G. I. (2019). Planning educational facilities: What educators need to know (5th ed.). Rowman & Littlefield.

Filardo, M. (2021). *2021 state of our schools: America's PK-12 public school facilities*. National Council of School Facilities. www.stateofourschools2021.org

French, R., Mahat, M., Kvan, T., & Imms, W. (2022). Viewing the transition to innovative learning environments through the lens of the Burke-Litwin model for organizational performance and change. *Journal of Educational Change*, *23*(1), 115–130. https://doi.org/10.1007/s10833-021-09431-5

Goodyear, P., Carvalho, L., & Yeoman, P. (2021). Activity-centered analysis and design (ACAD): Core purposes, distinctive qualities and current developments. *Educational Technology Research and Development*, *69*(2), 445–464. https://doi.org/10.1007/s11423-020-09926-7

Howell, J., Greer, H., Brown, J. (2023). Report to the governor and the General Assembly of Virginia: Virginia's K-12 funding formula. https://jlarc.virginia.gov/pdfs/reports/Rpt575.pdf

International Society for Technology in Education. (2021). *ISTE standards: Students*. ISTE.

Jerald, C. D. (2009). *Defining a 21st century education*. Center for Public Education. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=0252e811a5dee8948eb052a1281bbc3486087503

Kariippanon, K. E., Cliff, D. P., Lancaster, S. L., Okely, A. D., & Parrish, A. M. (2018). Perceived interplay between flexible learning spaces and teaching, learning, and student wellbeing. *Learning Environments Research, 21*(3), 301–320. https://doi.org/10.1007/s10984-017-9254-9

Kormos, C., & Gifford, R. (2014). The validity of self-report measures of proenvironmental behavior: A meta-analytic review. *Journal of Environmental Psychology, 40*, 359-371.

Krueger, J. (2018, August 24). Designing 21st century classrooms: 6 top considerations. HMC Architects. https://hmcarchitects.com/news/designing-the-21st-century-classroom-6-top-considerations-2018-08-24/

Lackney, J. (2007). Directory case studies articles awards program language of school design membership e-newsletter blog events about contact home educational commissioning TM educating educators to optimize their school facility for teaching and learning.

Lafortune, J., & Schonholzer, D. (2017). *Does new school construction impact student test scores and attendance*? California Policy Lab. Retrieved from https://capolicylab.org

Maxwell, J. A. (2013). Qualitative research design: An interactive approach (3rd ed.). SAGE.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.

Nair, P. (2011, July 29). The classroom is obsolete: It's time for something new. *Education Week*. https://www.edweek.org/education/the-classroom-is-obsolete-its-time-for-something-new/2011/07

Nair, P. (2014). Blueprint for tomorrow: Redesigning schools for student-centered learning. Harvard Education Press.

Nair, P., Doctori, R. Z., & Elmore, R. F. (2019). *Learning by design: Live, play, engage, create* (P. Sampson, Ed.). Education Design International.

National Council on School Facilities. (2019a, August 16). Beaverton School District, OR, educational specifications - Elementary Schools 2014. https://www.facilitiescouncil.org/plan-examples/category/education+specifications#:~:text=An%20Educational%20Specification%20is%20a,A%20new%20or%20modernized%20school.

National Council on School Facilities. (2019b, August 16). *Prince George's County Public Schools, MD, educational specifications - Elementary Schools 2015*. https://www.facilitiescouncil.org/plan-examples/2019/8/16/prince-georges-county-public-schools-md-educational-specifications-elementary-schools-2015

Neilson, C. A., & Zimmerman, S. D. (2014). The effect of school construction on test scores, school enrollment, and home prices. *Journal of Public Economics*, *120,* 18–31. https://doi.org/10.1016/j.jpubeco.2014.08.002

Niemi, K. (2021). The best guess for the future? Teachers' adaptation to open and flexible learning environments in Finland. *Education Inquiry*, *12*(3), 282-300 https://doi.org/10.1080/20004508.2020.1816371

OECD. (2018). *Improving learning spaces together: OECD school user guide and survey*. OECD. www.oecd.org/education/innovation-education/centreforeffectivelearningenvironmentscele/

Partnership for 21st Century Skills Ohio Department of Education. (2016). *21st-century skills-core content integration*. www.P21.org

Patrix, M., & Benade, L. (2018). Beyond the building: Reconceptualising learning environments: A literature review. *Teachers' Work*, *15*(1), 10-19. https://doi.org/10.24135/teacherswork.v15i1.241

Pearlman, B. (2010). Designing new learning environments to support 21st-century skills. In J. Bellanca & R. Brandt (Eds.), *21st century skills: Rethinking how students learn* (pp. 117–147). Solution Tree Press.

Reed, S.S., Mullen, C.A., Boyles, E.T. (2021). Bringing problem-based learning to elementary schools to benefit children's readiness for a global world. In: Mullen, C.A. (eds) *Handbook of Social Justice Interventions in Education*. Springer International Handbooks of Education. Springer, Cham. https://doi.org/10.1007/978-3-030-29553-0_128-2

Reinius, H., Korhonen, T., & Hakkarainen, K. (2021). The design of learning spaces matters: Perceived impact of the deskless school on learning and teaching. *Learning Environments Research*, *24*(3), 339–354. https://doi.org/10.1007/s10984-020-09345-8

Sigurdardottir, A. K., & Hjartarson, T. (2011). *School buildings for the 21st century: Some features of new school buildings in Iceland*. *CEPS Journal 1*(2), 25-43. DOI: 10.25656/01:6090

Snyder, G. R. (2020). Updating school designs 2020: A review of the literature. *Educational Viewpoints: The Journal of New Jersey Principals and Supervisors Association*, Spring, 74–76.

Standard 4. Student Achievement and Graduation Requirements. (2016). Virginia Law. https://law.lis.virginia.gov/vacodeupdates/title22.1/section22.1-253.13:4/

Szpytma, C., & Szpytma, M. (2019). Model of 21st-century physical learning environment (MoPLE21). *Thinking Skills and Creativity*, 34, 100591. https://doi.org/10.1016/j.tsc.2019.100591

Tanner, C. K. (2009). Effects of school design on student outcomes. *Journal of Educational Administration, 47*(3), 381–399. https://doi.org/10.1108/09578230910955809

United States Environmental Protection Agency. (2023, September 26). Take action to improve indoor air quality in schools. https://www.epa.gov/iaq-schools/take-action-improve-indoor-air-quality-schools

van Merriënboer, J. J. G., McKenney, S., Cullinan, D., & Heuer, J. (2017). Aligning pedagogy with physical learning spaces. *European Journal of Education*, 52(3), 253–267. https://doi.org/10.1111/ejed.12225

Vincent, J., & Heming, A. (2021). 2021 State of our schools: America's PK-12 public school facilities. www.stateofourschools2021.org

Virginia Department of Education. (2021). *Guidelines for school facilities in Virginia's public schools*.

https://www.doe.virginia.gov/home/showpublisheddocument/38810/638064315916330000

Virginia Department of Education. (2022). *Profile of a Virginia Graduate*. Retrieved October 19, 2024, from https://www.doe.virginia.gov/parents-students/for-students/graduation/policy-initiatives/profile-of-a-virginia-graduate

Virginia Department of Education. (2021). *Needs and conditions of Virginia school buildings*. https://studiesvirginiageneralassembly.s3.amazonaws.com/meeting_docs/documents/000/000/979/original/Needs_and_Conditions_of_Virginia_School_Buildings_6.3.21.pdf?1622733329

Willson, A., & Winebrenner, P. (2017, November 1). Learning stairs: The new student-centered space. *Spaces4Learning-Impacting K-12 & Higher-Education Environments*. https://spaces4learning.com/articles/2017/11/01/learning-stairs.aspx

Appendix A.

Interview Questions

Research Question(s)	Interview Questions
RQ1: How has high school design evolved in response to the pedagogical focus on 21st-century skills, particularly following the adoption of the *Profile of a Virginia Graduate* in 2016?	1. What changes have you seen evolve in the design process of school buildings since you started as an architect? 1a. What differences are you finding when designing schools in 2024 compared to designing schools 10 years ago? 2. a. What information is provided by a school division to best meet their high school building needs? 2. b. Do school divisions mention the Profile of a Virginia Graduate or the 5 C's 2c. What input do architects have on design features? 4. How have the 5 C's informed the design of elementary schools? 5. How do you use school design to advance the 5 C's- communication, collaboration, critical thinking, creativity and citizenship 6. What kinds of challenges or barriers do you encounter when designing a school for a locality?
RQ1a- Considering the statewide adoptions of the Profile of a Virginia Graduate which includes the 5 C's (collaboration, critical thinking, creativity, communication and citizenship), what changes in philosophy and educational specifications have been observed? RQ1b- How are post-Profile designs different from pre-Profile designs?	

Appendix B.

CITI Program Certificate

CITI PROGRAM

Completion Date 24-Jan-2023
Expiration Date 24-Jan-2026
Record ID 46044781

This is to certify that:

Robin Accetta

Not valid for renewal of certification through CME.

Has completed the following CITI Program course:

Social & Behavioral Research
(Curriculum Group)
Social & Behavioral Research
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Virginia Polytechnic Institute & State University (Virginia Tech)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w47786fbc-c8c8-4ab7-9547-0cb2850379e0-46044781

Appendix C.

Interview Protocol and Questions

Thank you for agreeing to participate in my research study entitled "Perceptions of Public High School Design Changes in Virginia Since the Implementation of the Profile of a Virginia Graduate."

Before I begin recording, please take a moment and change your name to:

- Architect (number)
- Local Facilities Director (number)
- State Operations Director (number)

Your participation in this interview serves as your consent for your responses to be used in my research study. All data collected are confidential, and all information provided during this interview will be kept confidential. When the results of this study are shared, no identifying information will be revealed about the participants or the school division or architectural firm in which they represent. If at any time during this interview you do not wish to answer a question or no longer wish to continue with the interview, please state that at any time.

Participation in this study represents minimum risks to the interviewee. There are no compensatory benefits for participation in this interview. However, during the interview you may generate ideas or knowledge that may benefit you in your role in supporting school facility design work.

The purpose of this qualitative study was to identify perceptions of Virginia architects, and local level school directors of facilities regarding what changes, if any, have occurred in Virginia high school designs in response to the implementation of Virginia 5 C's, collaboration, critical thinking, creativity, communication and citizenship, as outlined in the Profile of a

Virginia Graduate. Furthermore, information will be gathered to identify themes in 21st century building design as they align with educational design specifications, 21st century pedagogy, and architectural design.

Do you acknowledge the purpose, potential risks, and benefits and agree to participate in the study by completing the interview?

Interview Questions for the Semi-Structured Interview:

1. What changes have you seen evolve in the design process of school buildings since you started as an architect?

a. What differences Are you finding when designing schools in 2024 compared to designing schools 10 years ago?

2. What is an overview of a new school design process from beginning to end?

a. What information is provided to you from a school division to best help you meet their building needs? Or depending on role
b. what information do you provide to an architectural firm?

3. What input do architects have on design features?

4. How have the 5 C's informed the design of elementary schools?

5. How do you use school design to advance the 5 C's- communication, collaboration, critical thinking, creativity and citizenship

6. What kinds of challenges or barriers do you encounter when designing a school for a locality?

This concludes the interview.

This concludes the interview. After this interview is transcribed, you will be sent a copy of the transcription. If there are any changes that need to be made to your responses, please provide those back to me via email within 7 days of receipt of the transcription.

Thank you for participating in this research study.

Optional Prompts as Needed…

· Tell me more about that…

· Give me an example of that…

Appendix D.

Information for Participation in a Research Study

Information Sheet for Participation in a Research Study

Principal Investigator: **Robin Accetta Riley**
IRB# TBD
Title of Study: Perceptions of Public K-12 School Design Changes in Virginia Since the Implementation of a Profile of a Virginia Graduate

My name is Robin Accetta Riley . I am a graduate student at Virginia Tech, and I am conducting this research as part of my course work. You are invited to participate in a research study. This form includes information about the study and contact information if you have any questions.

WHAT SHOULD I KNOW?

If you decide to participate in this study, you will complete a brief five question demographic survey and if selected, participate in a one-on-one interview. You are permitted to participate in the survey and opt out of the interview should you so choose. The questions asked in the interview will focus on your experience in designing new K-12 schools across the Commonwealth of Virginia. Interviews will be held via Zoom. The interviews will be recorded and transcribed via Zoom and audio recorded as a backup. The transcriptions via Zoom will be crosschecked by the researcher to ensure accuracy. The survey should take approximately 2 minutes to complete, and the interview should take approximately 30 - 45 minutes of your time.

I do not anticipate any risks from completing this study. You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so

CONFIDENTIALITY

We will do our best to protect the confidentiality of the information we gather from you, but we cannot guarantee 100% confidentiality. All information received during the survey and the interviews will be kept confidential, and your identity will not be revealed in the dissertation when reporting the findings of the study. Any data collected during this research study will be kept confidential by the researcher. Your interview will be audio recorded via Zoom and a digital audio recording program will be used as a back-up. The interview will be transcribed via Zoom, and the researcher will crosscheck the transcription for accuracy. The participant will also have an opportunity to crosscheck the participant's responses for accuracy. Once the survey transcription of the interview is sent to the participant, the participant will have one week to review and submit any desired changes to the researcher. The researcher will code the transcripts using a pseudonym (false name) for the participant. The recordings and transcriptions will be uploaded to a secure password-protected computer in the researcher's office and uploaded to the Virginia Tech google drive which has a two-factor log-in. The recordings and transcriptions will be stored until successful completion of the researcher's dissertation

WHO CAN I TALK TO?

If you have any questions or concerns about the research, please feel free to contact Robin Accetta Riley (raccetta@vt.edu). You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research participant, contact the Virginia Tech HRPP Office at 540-231-3732 (irb@vt.edu).

Please print out a copy of this information sheet for your records.

If you would like to participate in this research study, please click here:

Confidential Interest Form

Thank you for your time!

If you have any questions or concerns about the research, please feel free to contact Robin Accetta Riley (raccetta@vt.edu). You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research participant, contact the Virginia Tech HRPP Office at 540-231-3732 (irb@vt.edu).

Please print out a copy of this information sheet for your records.

If you would like to participate in this research study, please click here:

Confidential Interest Form

Thank you for your time!