A Case Study in Well Being

Implementing Mental Health-Focused Design in Existing Public High Schools

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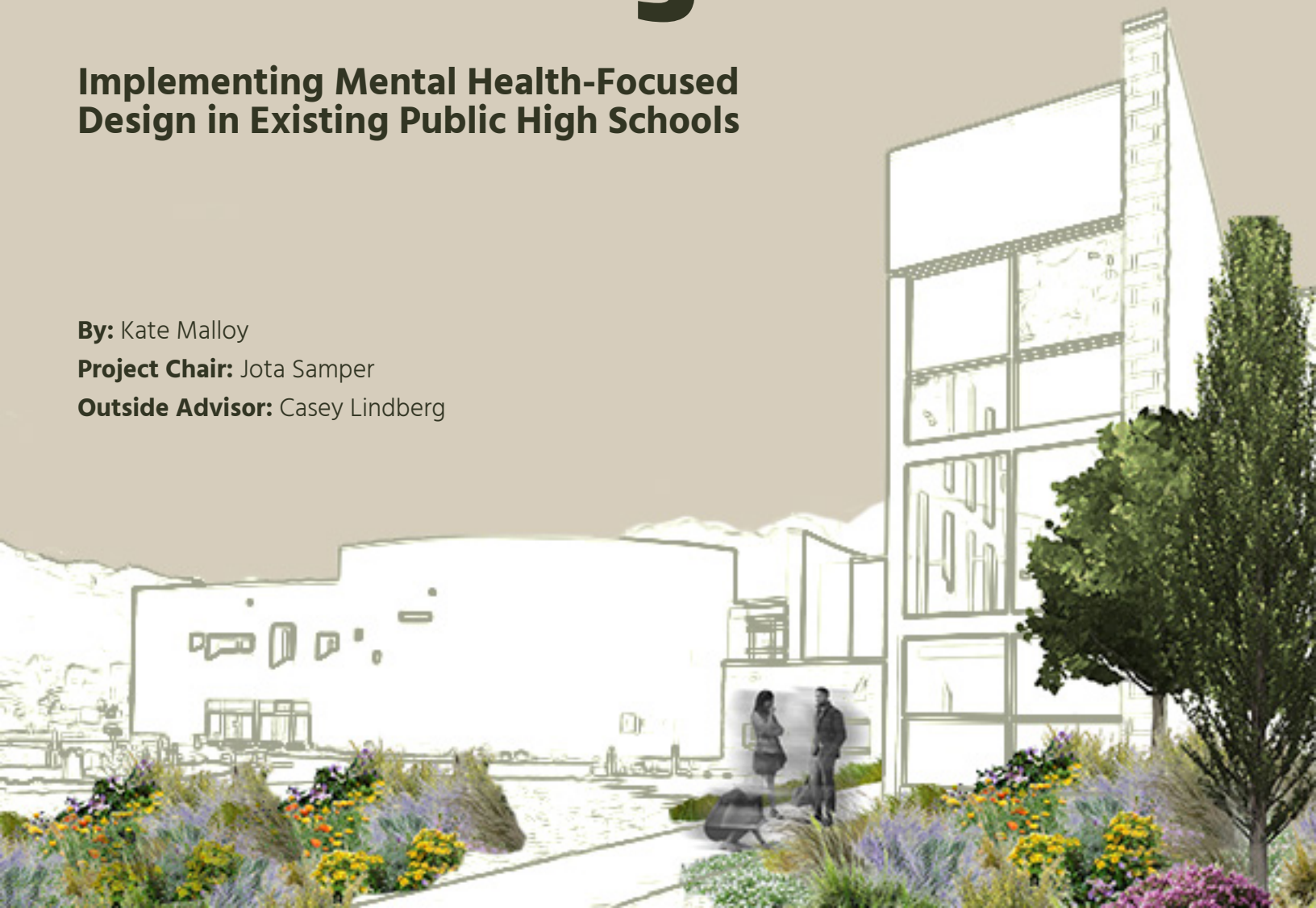

This thesis is dedicated to my amazing emotional support team without whom this project would not have been possible. Thank you to my amazing advisors, Jota Samper, Casey Lindberg, and Nate Jones who helped me to develop an understanding of academic research and writing. Thank you to my mom for spending countless hours proofreading every draft before I submitted it, and for encouraging me along the way. Thank you to my dad for providing emotional support and encouragement. Thank you to my sister who was able to give me a students perspective on school design, and help with some last minute measurements. Lastly, Thank you to my amazing friends who supported me and encouraged me along the way. I owe the completion of this project to all of you.

Abstract

High school students in the United States spend approximately 1,195 hours in school per year ("Schools and Staffing Survey (SASS)," n.d.). According to a 2023 CDC study, over 40% of high school students report persistent feelings of sadness or hopelessness highlighting their vulnerability to mental health challenges (Abrams 2023). Scholars have found that children's unrestricted access to social media, has increased the potential for high school students to the risk of high school students for mental health-related issues (Verlenden 2024). Much research has found that changes in the physical infrastructure of schools can improve mental health (Raniti et al. 2022).

However, 74% of public high school facilities in the U.S. have not undergone additions or renovations since before 2010 (de la Rosa 2024). It is more important than ever that these buildings are updated to support the unique mental wellbeing needs of modern student populations. Understanding the gap between best practices and existing educational infrastructure this research addresses the question: How can simple, scalable remodeling solutions, developed using theories from environmental psychology, be leveraged to better support the needs of students at already existing public high schools in the U.S.? To explore this, from a sample of all Coloradan high Schools this research selects Glenwood Springs High School as a case study to demonstrate how existing public schools can be evaluated to determine areas within the school where the current design fails to meet students' mental health needs, and how those areas can be improved through targeted design interventions.

From my research I was able to identify five key design variables whose qualities were informed by theories of Environmental Psychology and Neuroarchitecture. These design variables are natural materials, acoustic quality, natural and artificial lighting, flexible and open learning spaces, and views of/access to green spaces. Each of these criteria targets a specific aspect of mental health. For example, increased natural lighting has been proven to elevate serotonin levels, which can enhance mood and focus (Canazei et al. 2017), I elaborated on how each design variable impacts mental health and explored practical methods for applying these principles to school design. By implementing strategies such as incorporating reclaimed beetle kill pine from local timber yards and improving acoustic quality through soft paneling, I was able to enhance the school environment while maintaining the objective of targeted small-scale interventions. In the final design, I proposed scalable improvements in each of the five categories and explained how each strategy could be adapted to different learning environments.

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01
Introduction

How does the built environment affect the minds of those who inhabit it?

The spaces where students learn shape their experiences. High school students spend thousands of hours inside school buildings—spaces that profoundly influence their mental health, well-being, and ability to thrive. Yet, many schools across the U.S. are outdated, failing to support the needs of modern students. This research explores how small-scale, evidence-based design interventions can improve student well-being without requiring full reconstruction.

According to a survey by the National Center for Education Statistics (NCES), high school students in the United States spend approximately 1,195 hours in school per year ("Schools and Staffing Survey (SASS)," n.d.). The school building is the second most significant building in which students spend their time, which means that the design of the building is foundational to student success. Public school infrastructure across the U.S. is currently outdated, with a recent study by the NCES reporting that the average construction year of instructional buildings in the U.S. is 1975 (De la Rosa 2024). There have been several advancements in school design since that time, with many newly built school facilities designed to focus on the needs of the modern student. Unfortunately, many schools either cannot justify or do not have the funding to build new schools or conduct large-scale remodel projects to incorporate these design advancements. Because the physical environment of school infrastructure has been proven to affect the mental health of students, this outdated infrastructure has significant implications for student wellbeing.

High school students are one of the most at-risk populations in the U.S. for mental health related issues. Recent studies show that students reported a 40% increase in persistent feelings of sadness, hopelessness, and suicidal thoughts over the past ten years. This trend has been exacerbated by the rise of social media use (Abrams 2023). According to the World Health Organization, adolescent mental health issues have been classified as a global crisis, with one in seven ten-to-nineteen-year-olds experiencing some kind of mental disorder ("Mental Health of Adolescents," n.d.). By focusing on theories of design that prioritize mental health, I have developed design strategies that can be implemented at a small scale to benefit student wellbeing.

Many theories explore the relationship between mental health and the quality of the built environment. The primary field of study I focused on in this project is Environmental Psychology . Environmental Psychology suggests that certain aspects of the built environment can directly affect mental health and wellbeing. Research has shown that elements such as natural lighting, natural materials, and views of nature can reduce stress levels, increase serotonin levels in the brain, and increase stress recovery time (Küller and Lindsten 1992; Yin et al. 2020; Matsuoka 2010; McCormick 2017).

Through my research, I identified five key variables to shape my design solutions: natural and artificial lighting, natural materials, acoustic quality, flexible and open learning spaces, and views of / access to green space. With these elements as a foundation, I will answer the following question: How can design principles from Environmental Psychology be applied to create scalable renovation strategies that effectively and affordably improve student mental health and wellbeing?

This project was structured into three sections. First, I examined the theoretical frameworks of Environmental Psychology and other relevant design strategies such as Neuroarchitecture to inform my research on the relationship between mental health and the built environment. This research included an in-depth exploration of how the five design variables I identified impact student wellbeing. Next, I analyzed the current state of high school infrastructure in the U.S. with a specific focus on outdated design and limitations that schools face in conducting large-scale renovations. At this phase, I also selected a school to use as a hypothetical example for how these design strategies could be implemented and developed a scale on which to rate the school based on the five design variables. The final step was to propose a series of small-scale renovation strategies that align with the principle informed by Environmental Psychology to improve student mental health. I focused on creating design interventions that are both minimally impactful to the current infrastructure and feasible for a wide variety of schools. By utilizing my rating scale and applying similar design solutions, schools can create a healthier, more supportive environment for students without requiring complete reconstruction.

02

Literature Review

High school environments significantly impact student mental health, yet many schools are ill-equipped to support students' well-being. Over 40% of high schoolers experience persistent sadness, and most U.S. public high schools were built before 2010, leaving outdated infrastructures that contribute to anxiety and depression. This review integrates environmental psychology and neuroarchitecture—drawing on theories like Stimulus, Control, and Behavioral Situational Theory—to show how factors such as lighting, materials, acoustics, flexible layouts, and access to nature can be reimagined through scalable, evidence-based design interventions to create healthier, more supportive learning environments.

Framing the Problem

High school students are the most at-risk population for mental health-related issues (Verlenden 2024). According to the CDC, over 40% of high school students report persistent feelings of sadness or hopelessness, compared to 25% of middle school students, highlighting their vulnerability to mental health challenges (Abrams 2023). 74% of public high school facilities in the U.S. have not undergone additions or replacements since before 2010 (de la Rosa 2024) which indicates that the majority of public high school facilities in the U.S. were designed without consideration for the unique mental wellbeing needs of modern student populations. Research by Raniti et al. found that poorly maintained school environments—characterized by outdated facilities and inadequate lighting—are linked to higher rates of anxiety and depression among students (Raniti et al. 2022). The goal for my study was to explore the implications of enhancing existing learning environments by incorporating insights on how spatial design can support high school students' mental health. I incorporated key theoretical frameworks from environmental psychology such as Behavioral Situational Theory, Control Theory, and Stimulus Theory to create a design that positively effects the physical and emotional health of high school students in the U.S.

History of Public-School Design in the United States

The average age of public school facilities in the U.S. is 75 years old (de la Rosa 2024), which means that the average school building in the U.S. was constructed in 1949. From the 1950s to the 1970s there was a surge in school construction to accommodate the baby boom generation; design emphasized functionality and cost-effectiveness over aesthetics, often resulting in plain unadorned structures (Baker 2012). Postwar schools increasingly began to utilize steel framing and materials such as glass and concrete (Ogata 2008). During this time period, classroom design was standardized to support uniform teaching methods, the predominant philosophy of the time (Baker 2012). Economic constraints of the 1970s to 1980s led to cost-cutting measures as well as new building techniques that used less expensive materials like cinder block and prefabricated elements (Baker 2012). Moving into the 1990s, and continuing until present day, there has been a growing emphasis on sustainability in school design with a shift in focus to sustainable and locally sourced materials to reduce environmental impacts (M. Chawla 2024). Educational philosophies over the last 30 years have increasingly supported the integration of technology and the use of flexible learning spaces(Ghajargar and Bardzell 2019). However, since many schools were designed in an era when cost and uniformity were the standard, many students do not experience the benefits of modern design strategies.

Environmental Psychology - Theoretical Frameworks

Environmental psychology is an interdisciplinary field that draws from both psychology and environmental design to inform the study of the relationship between humans and the built environment. Beginning in the 1920s, environmental psychologists investigated the effects of noise, heat, and lighting on work performance and employee wellbeing. Over time, this research expanded to look at other environments, including educational settings (Zhijun 2024). Within environmental psychology, there are many theories; for my research, I focused on three theoretical frameworks that have specific applications to educational environments: Stimulus Theory, Control Theory, and Behavioral Situational Theory. I selected these three theories due to their prominence in the field of educational architecture. One of the most relevant theories for understanding how the built environment influences student behavior and wellbeing is the Stimulus Theory, which explores how environmental factors affect human responses.

Stimulus Theory

Stimulus theory, also known as the Stimulus-Organism-Response (S-O-R) paradigm, is a theory of environmental psychology that

was originally developed by Mehrabian and Russell in 1974. The S-O-R paradigm suggests that a person's internal feelings and responses are guided by stimuli from the environment. The processing of these stimuli can be either conscious or subconscious and involves perceptions and interpretations that shape the person's emotions and decisions (Hochreiter, Benedetto, and Loesch 2023). This framework is particularly useful for understanding how specific environmental factors within educational settings influence student behavior and performance.

The S-O-R paradigm illustrates how environmental factors like poor lighting can negatively affect students. In this case, the stimulus is poor lighting which increases student stress levels and diminishes their ability to focus. This leads to negative responses such as disengagement, decreased participation, and lower academic performance. While some studies have applied the S-O-R paradigm to explain students' growing preference for e-learning environments, research specifically focusing on in-person school settings remains limited (Hochreiter, Benedetto, and Loesch 2023). In the context of school design, natural light can act as a positive stimulus. Studies show that classrooms with abundant daylight enhance students' mood and focus by aligning with their natural circadian rhythms (Wen et al. 2024). Conversely, dim or harsh artificial lighting may negatively affect mood and learning outcomes. Understanding how environmental stimuli influences students' emotional and cognitive responses provided me with valuable insights for designing learning environments that promote wellbeing and academic success.

Control Theory

Control theory is a foundational concept in Environmental Psychology. It was first introduced by William T. Powers in his book, "Behavior: The Control of Perception", published in 1973. The theory explains human behavior as a continuous process in which individuals strive to control their environment to align it with their desired goals and values (Powers 1994). To better understand how this process operates, control theory identifies three fundamental concepts that explain how individuals perceive and regulate their environment. The first is perceptions, which refers to how individuals perceive, interpret, and understand their environment. The second is reference values, or the desired states or goals that people strive to achieve or maintain. The third and most integral concept is the feedback loop, a dynamic system in which individuals monitor their perceptions, compare them to their reference values, and adjust their behavior accordingly to reduce discrepancies. Theorists that support control theory suggest that when individuals are not able to adjust their behavior or perceive control in a situation, this leads to discomfort and difficulty regulating emotions (Revesman and Perlmuter 1981). These concepts are particularly relevant in educational environments, where students continuously interact and attempt to regulate their surroundings to support learning and focus.

In a classroom setting, control theory can be observed in how students respond to environmental challenges. For example, due to poor insulation or a lack of noise control, a student may perceive excessive noise, leading to distraction. To regain focus and realign with their reference goal of concentration, the student might attempt to move to a quieter part of the room or utilize noise-cancelling headphones as a behavioral adjustment. However, in an environment that lacks such resources, the student may be unable to realign with their reference goal, potentially leading to decreased learning retention, and other related issues. In using control theory to inform school design, I seek to create environments that support students' ability to manage their surroundings, ultimately enhancing both emotional wellbeing and academic performance.

Behavioral Situational Theory

Behavioral situational theory offers valuable insight into how the structure of physical and social environments establishes expectations that guide human behavior within space. This theory originates from Roger Barker's book "Behavior Settings Theory", first published in 1968. Barker posited that environments are composed of

consistent, unchanging patterns between users and the built environment (Barker 1968). He referred to these patterns as "behavior settings," which combine the physical design of spaces with social norms that subconsciously influence behavior.

Examples of behavior settings in school design include libraries, which feature quiet zones, individual desks, and acoustic design elements that naturally promote behaviors such as reading and studying. Similarly, classroom layouts can shape different behaviors: desk arrangements might encourage group work or focus students' attention on the board, while cafeterias foster social interaction and more playful activities (Kounin and Sherman 1979). The structure of the built environment provides subtle yet powerful social cues to students, influencing their behavior and reinforcing expectations. By understanding and applying behavioral situational theory, educators and designers can create learning environments that promote positive behaviors and support students' academic and social development.

Neuroarchitecture

Neuroarchitecture is a discipline that merges key concepts from architecture and psychology to create environments designed to enhance users' mental and physical health, wellbeing, and enjoyment of place (Abbas et al. 2024). The integration of these disciplines began at the end of the 20th century, coinciding with advancements in neuroscience and brain imaging technologies. These tools have enabled researchers to measure how the built environment affects brain function and emotional responses, providing an empirical basis for design decisions (Higuera-Trujillo, Llinares, and Macagno 2021).

The goal of neuroarchitecture is to bridge the gap between neuroscience and architectural design to create environments that promote positive cognitive and emotional states. Key principles include sensory integration, which examines how users engage their senses in spaces such as through light, acoustics, and texture—to influence mood and focus. Another principle is neuroplasticity, which leverages the brain's ability to adapt and reorganize in response to environmental stimuli. The third key principle is emotional design, which seeks to create spaces that elicit positive emotions such as comfort, security, and inspiration through natural forms, biophilic design, and aesthetic harmony (Coburn, Vartanian, and Chatterjee 2017).

In school design, these principles can be applied in various ways. For instance, sensory integration might involve classrooms designed with abundant natural light and calming acoustics to support focus and reduce stress (Wen et al. 2024). Neuroplasticity could be encouraged through adaptable classroom layouts that allow students to modify their workspaces, catering to the brain's ability to reorganize in response to environmental changes and fostering a more personalized learning experience (Higuera-Trujillo, Llinares, and Macagno 2021). Emotional design in educational environments may include the use of calming textures and natural materials to evoke feelings of comfort and security, supporting students' emotional wellbeing (Coburn, Vartanian, and Chatterjee 2017).

While much of the existing research in neuroarchitecture focuses on single-family housing and healthcare facilities, educational spaces provide a relatively new area of exploration. I aim to address this gap in literature by connecting students' needs for educational environments that support mental health with healthcare design principles rooted in neuroarchitecture. For example, hospitals designed with neuroarchitecture principles often feature rooms with abundant natural light, views of greenery, and calming acoustic treatments to reduce patient stress levels and enhance mood—goals that closely align with improving mental health outcomes (Ulrich 1984). My design seeks to combine the practices of neuroarchitecture with theories from environmental psychology to create educational spaces that positively impact the physical and emotional health of high school students in the U.S.

Application of Theories of Wellbeing in Design

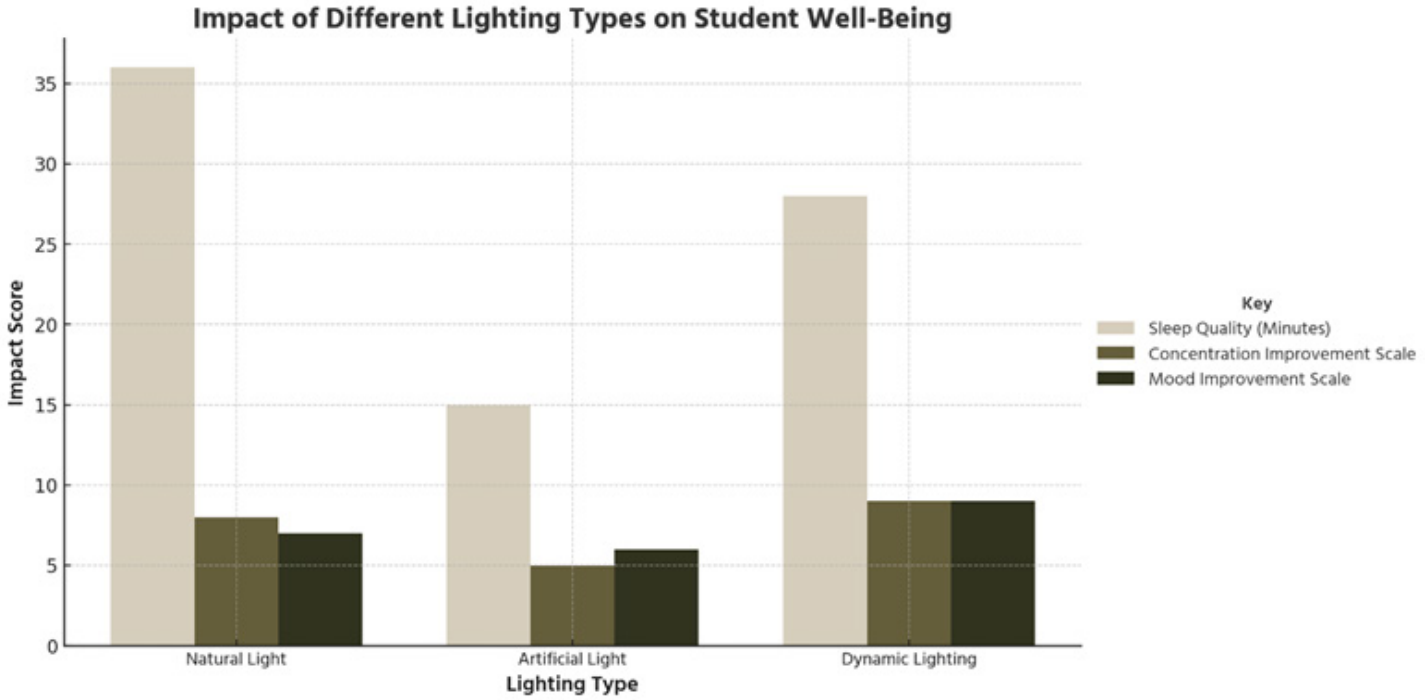
By applying theories that promote wellbeing to the built environment, I was able to translate core principles from environmental psychology and neuroarchitecture into actionable design variables. These design variables serve as a guideline for school renovations with the goal of enhancing student wellbeing and academic performance; they were selected through a comprehensive literature review, focusing on the most frequently cited design elements in these fields, and were paired down into five categories: natural and artificial lighting, natural materials, flexible and open learning spaces, views of and access to green space, and acoustic quality. These factors represent the conditions of the built environment that have the greatest impact on students' mental health and wellbeing according to evidence based in related literature.

Natural and Artificial Light

The amount and quality of light in the learning environment has been proven to have a significant impact on student wellbeing. Research shows that students in primarily naturally-lit classrooms get an additional 36 minutes of sleep per night compared to their peers (Boubekri et al. 2020). Exposure to daylight has also been proven to decrease stress levels, support healthy circadian rhythms, and improve concentration (Küller and Lindsten 1992). Additionally, exposure to natural light has been linked to an increase in student movement and physical activity by approximately 11.2 minutes per day (Aggio et al. 2015). Light intensity, measured in lux plays a key role in these outcomes. For instance, in workplace settings, a minimum of 500 lux is typically required to ensure sufficient illumination for productivity (Zhang et al. 2020), 1,000 lux is considered optimal (Vimalanathan and Ramesh Babu 2014). This indicates the importance of appropriate lighting levels in learning environments as well. In contrast, a lack of natural light coupled with poorly designed artificial lighting has been proven to negatively affect mental health and student performance in school. In this project, I use lux as the unit of measure to determine if the school is well lit to align with the studies done by Zhang et al., and Vimalanathan and Ramesh Babu. Based on these impacts, the intentional design of lighting in school environments is essential for creating a supportive and nurturing learning environment.

While natural lighting has many positive effects on students, it also poses some challenges that must be taken into consideration while designing. Some examples of challenges that daylight creates include increased glare, visual discomfort, and uneven lighting distribution. There are many design strategies that can help to minimize these effects ranging in scale from the physical positioning of classrooms on site during the original design phase to selecting light-colored paints and finishes to better reflect sunlight within the spaces (Leslie 2004). Many small scale solutions to improve daylighting in schools are also relatively cost effective. One example of this is installing light shelves, which are horizontal surfaces installed near windows above eye level. They have any extremely reflective upper surface that reflects light onto the ceiling and creates a more even distribution of natural light while also allowing light to permeate further into the building (Berardi and Anaraki 2016). To minimize glare and visual discomfort, strategies such as exterior shading devices like louvers and pergolas are a good option that control the direct sunlight exposure while still allowing light to enter. Though these strategies can significantly enhance the benefits of natural light, daylighting alone is not enough to address the lighting needs of an educational environment. This is particularly evident during overcast days and for interior spaces that have limited daylight access. Artificial lighting is necessary to ensure that the learning environment is well lit and supports ideal learning conditions.

Keeping classroom spaces well-lit is crucial to encourage focus and productivity in the learning environment. Well-designed lighting systems can help supplement daylighting on overcast days and during evenings to ensure that the spaces maintain consistent levels of illumination while the building is occupied. The use of artificial lighting systems that simulate natural light has been proven to improve concentration and cognitive alertness,

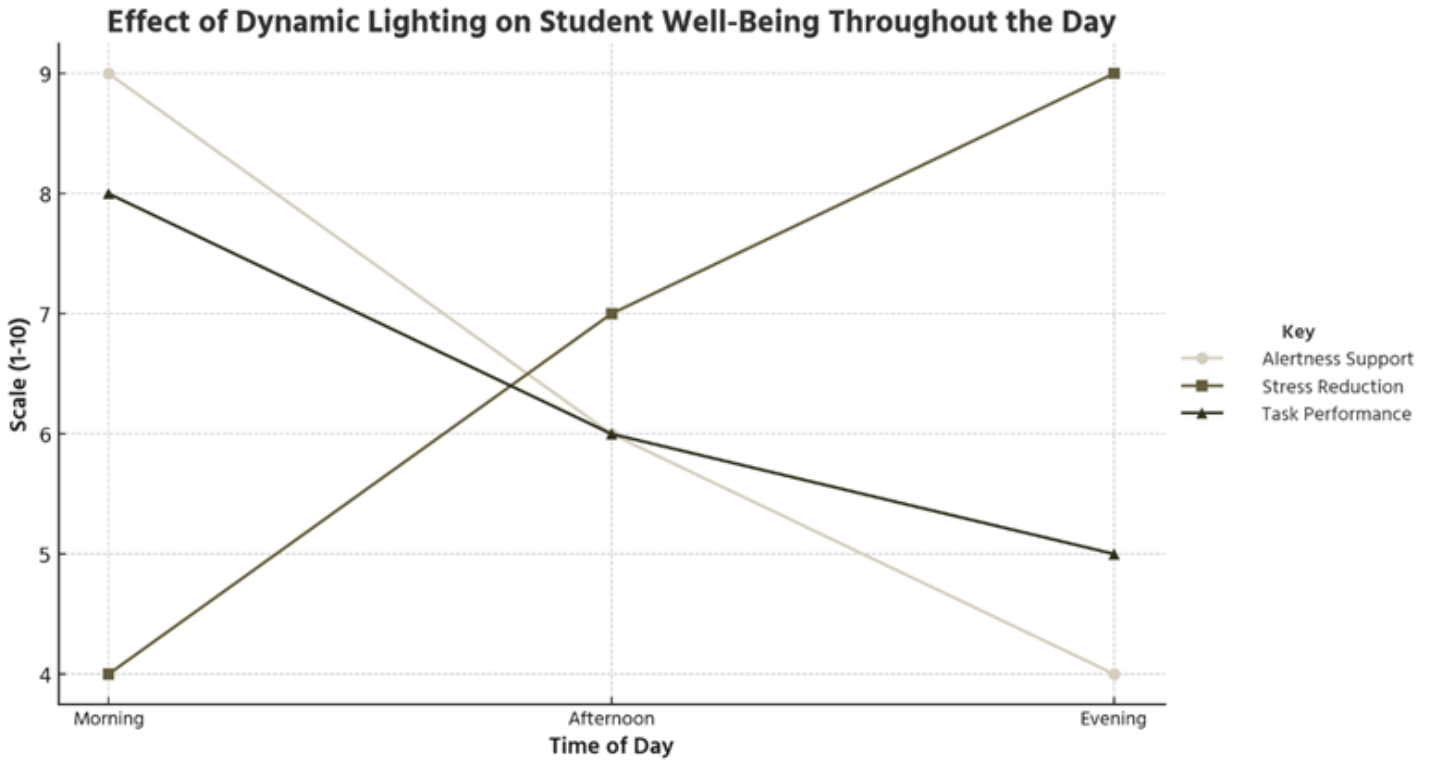


Source: (Boubekri et al. 2020; Küller and Lindsten 1992; Mott et al. 2012; Hansen et al. 2018; Zhang et al. 2020)

as well as to improve sleep quality by maintaining healthy circadian rhythms (Mott et al. 2012).

There are two main types of artificial lighting: LED lighting and fluorescent lighting. LED stands for "light emitting diode"; such fixtures create light by passing an electric current through a semiconductor material and emitting photons. LED lights are typically highly energy efficient and free from hazardous materials such as mercury, which makes them more environmentally friendly (U.S. Department of Energy, n.d.) Fluorescent lamps generate light by passing an electric current through mercury vapor, which emits ultraviolet (UV) light. Fluorescent lamps are less efficient than LEDs and have a shorter life span (U.S. Department of Energy 2024). LED lights are the preferred lighting for educational environments as studies have suggested that LED lighting contributes to task performance, visual comfort, and alertness of students in both computer-based and paper-based activities (Kazemi et al. 2018).

There are many effects of brightness and color temperature of artificial lighting. One study found that while warm-toned, low intensity artificial lighting was conducive to reducing aggression and restlessness, boosting pro-social behavior and feelings of relaxation, and supporting students with special needs, it also has a negative impact on academic performance (Hansen et al. 2018). It is important for artificial lighting to be dynamic to support the varied needs of students during the day. Dynamic lighting systems adjust the brightness and color temperature throughout the day to mimic natural light patterns (Zhang et al. 2020). These systems have been proven to improve student sleep quality, mood, focus, motivation, and concentration. They also can be tailored to support various educational needs by adjusting brightness and temperature for different tasks. For example, cooler, high-intensity lighting can be used during morning lessons to boost alertness, concentration, and cognitive performance, while during the afternoon, warmer, lower-intensity lighting can create a calming environment to reduce student stress (Hansen et al. 2018; Zhang et al. 2020).



Source: (Boubekri et al. 2020; Küller and Lindsten 1992; Mott et al. 2012; Hansen et al. 2018; Zhang et al. 2020)

Lighting has been proven to significantly affect student wellbeing by influencing sleep patterns, concentration, mood, and physical activity. Natural lighting in particular supports student circadian rhythms and reduces stress. Well-designed artificial lighting can enhance cognitive performance and emotional regulation. One crucial small scale remodel option is to replace current existing lighting with dynamic artificial lighting to create a hybrid lighting environment. Strategically placed light shelves and exterior shading devices such as louvres can be used to enhance energy efficiency and reduce student discomfort while maximizing the benefits of daylighting. By incorporating these strategies, schools can create environments that boost student performance and support the wellbeing of students.

Natural Materials

Use of natural materials has been correlated with a reduction in stress and anxiety. Many researchers attribute this effect to people's inherent biological connection to nature, commonly referred to as the biophilia hypothesis. The hypothesis suggests that there is an emotional dimension to the connection between humans and nature (Gaekwad et al. 2022). One prominent theory in environmental psychology that supports the use of natural materials in learning environments is Attention Restoration Theory (ART). This theory states that intense or prolonged focus can lead to mental fatigue; however, through contact with nature, directed attention capabilities can be restored (Liu et al. 2018). The biophilia hypothesis and ART both support the integration of natural materials into school environments to enhance students' mental health and wellbeing.

Edward Osborne Wilson initially introduced the biophilia hypothesis in 1984. As a biologist, naturalist, ecologist, and entomologist, Wilson proposed that humans have a subconscious tendency to seek out connections with nature and other forms of life. He suggested that this tendency comes from our evolutionary history because early human survival depended on close contact with natural environments (Edward O. Wilson 1984). The concept of biophilia began influencing architecture in the 1990s when scholars such as Stephen Kellert and architects like William Browning made significant contributions to the field and expanded on Wilson's biophilia hypothesis. They focused specifically on integrating

natural elements like materials, lighting, and spatial layouts into design to promote wellbeing (Kellert and Calabrese 2015). More recently, a study measured participants' heart rate, blood pressure, and self-reported anxiety in residential settings. The findings revealed that spaces with a higher concentration of natural materials, such as wood, stone, and natural fibers led to a reduced heart rate, lower blood pressure, and decreased anxiety (Huntsman and Bulaj 2022). Similarly, other studies have found that incorporating natural materials can reduce stress and anxiety, enhance mood, and create calming environments (Kotradyova et al. 2019; Watchman, Potvin, and Demers 2017). These findings underscore the importance of integrating biophilic principles into educational architecture.

Incorporating natural materials into the built environment has proven to positively impact student wellbeing and learning outcomes. There are many ways to integrate natural materials into school design; wood is the most widely used and versatile option. Wood can be incorporated into the educational environment through flooring, wall treatments, partition walls, and furniture (Ghaziani, Lemon, and Atmodiwirjo 2021). Research has demonstrated that wood in interior spaces contributes to stress reduction and fosters a sense of warmth and comfort—qualities that many educational environments currently lack (Kotradyova et al. 2019). Another strategy for integrating natural materials is implementing living elements such as plants and green walls. Studies indicate that incorporating living elements into learning spaces creates a visual connection to nature that promotes relaxation and stress reduction among students (Gray and Downie 2024). In addition, research has linked the presence of living elements in educational environments to improved air quality as well as enhanced wellbeing (Ribeiro, Santana, and Oliver 2024). Sustainable materials such as bamboo and cork also offer mental health benefits such as increase in dopamine and serotonin while also reducing a school's carbon footprint and serving as a practical tool for environmental education among students (Browning and Determan 2024). According to one study, the optimal percentage of coverage of interior spaces in natural materials is 45%; enough to reap the benefits discussed above without becoming overwhelming or inconvenient to maintain (Watchman, Potvin, and Demers 2017). I used this percentage as a benchmark to test if spaces in the school contain enough natural materials to positively benefit students and will break down the percentage into two categories: Walls, Floor, and Ceiling (WFC) coverage, and Furniture. By enhancing spaces with natural elements, schools can create healthier, more engaging learning environments.

The use of natural materials in educational architecture has been proven to reduce stress and anxiety, promote a sense of calm, and a connection to nature. However, there are certain factors to take into consideration when designing natural materials in high-traffic environments such as schools. One key concern is cost; natural materials often have a higher initial cost which can eliminate them from consideration by school boards planning remodels. However, investing in natural materials often can save money long-term by reducing energy consumption and lowering maintenance costs (Browning and Determan 2024). Another common concern is maintenance; some natural materials require specific maintenance strategies to ensure their durability. Strategic implementation of these materials, however, can mitigate maintenance challenges. For example, soft wood, or wood flooring may not be appropriate in a high traffic area, but wood partitions or green walls can maintain the aesthetic and benefit of natural materials while reducing the risk of damage. Thoughtful material selection and placement, with a focus on long-term benefits, can help schools effectively integrate natural materials to enhance both student wellbeing and the functionality of the learning environment.

Flexible and Open Learning Spaces

Flexible and open learning spaces are defined as adaptable and dynamic environments that allow students and teachers to adjust the environment to fit specific learning and instructional needs (K. E. Kariippanon et al. 2018). Some examples of how this would physically look include modular moveable furniture, zoned learning environments, and indoor-outdoor

spaces (Bai et al. 2024; Larose et al. 2024). Learning environments that have embraced flexible layouts are sometimes called Active Learning Classrooms (ALCs). One study analyzing student engagement in ALCs found that they had a positive impact on students learning engagement and wellbeing by encouraging less sedentary time during the school day (Sánchez-López et al. 2025). A similar study found that flexible learning spaces encourage active breaks and active lessons which increase physical activity among students (Larose et al. 2024). Flexible learning spaces also allow students to more easily align with their reference goals according to control theory which posits that doing so increases emotional regulation (Revesman and Perlmuter 1981).

There are many benefits to flexible layouts including increased collaboration and autonomy, support for diverse learning styles, and reduced stress for students. According to one study done on flexible and open learning environments, the spaces encourage higher levels of interaction and collaboration among students in comparison to traditional classrooms (K. E. Kariippanon et al. 2018). The same study also found that adaptable environments allowed students to take a more active role in their learning process and enabled more group activities as well as collaborative learning experiences. All these factors not only foster academic success but also promote social skills (Katharina Kariippanon et al. 2024). Another study done by the University of Illinois found that flexible learning spaces are more inclusive, especially for students with special needs, due to the ability to create breakout areas and reconfigurable layouts that allow students to customize the environment to suit their individual needs (Gracyalny and Hurtienne 2023). The sense of control that students feel in being able to customize their learning environment has also been proven to decrease stress anxiety by creating a sense of more personal space (Sánchez-López et al. 2025).

There are two main design adjustments that can transform a learning environment from fixed into flexible and open, the most well-known approach is to include modular and moveable furniture. This genre of furniture includes adjustable seating, standing desks, and modular tables and seating (Bluteau, Aubenas, and Dufour 2022). A common way to increase open learning space in a school is to integrate zones. Designated learning zones create spaces for different types of learning such as creative hubs, collaboration zones, and quiet study areas. Schools that implemented this strategy saw additional student movement and engagement as opposed to schools that only incorporated modular and moveable furniture (Aggio et al. 2015).

While incorporating flexible and open learning spaces may seem straightforward, there are some challenges that schools should take into consideration. Some potential issues include increased noise, student distraction (Rands and Gansemer-Topf 2017). By considering these potential difficulties while designing the issues can be mitigated for example sound absorbing materials such as soft acoustic panels and carpets can be used to dampen noise, and in more focused zones flexible partitions can be used to divide the space and provide further acoustic control (Karjalainen et al. 2020). To minimize unnecessary student distraction in more public learning spaces, moveable partitions can also serve as dividers to create smaller enclosed spaces for private study (Rands and Gansemer-Topf 2017). Integration of flexible and open learning environments in schools can support increased socialization, and ownership over the environment as well as decrease in anxiety.

Views of / Access to Green space

Exposure to green space for young people is incredibly crucial; it has many known benefits including enhanced mental health and resilience (L. Chawla et al. 2014), and increased opportunity for physical activity (Barton et al. 2015). The term “green space” has various definitions, including “urban parks and wetlands that comprise some vegetation” and “small urban parks, including public parks, street verges, cemeteries, and sports grounds” (Taylor and Hochuli 2017). For this research, I have chosen to use the second definition. The inclusion of green space is essential in school design; it is the greatest design factor

that encourages students to get outside and to be active.

Beyond simply providing opportunities for physical activity, green space plays a significant role in cognitive restoration and emotional regulation, aligning with the principles of Attention Restoration Theory (ART). Experiencing nature has the potential to restore direct attention capabilities which means reducing the likelihood that students will experience burnout. Other positive benefits of increasing student exposure to green space through the lens of ART are an increase in concentration and a decrease in irritability, distractibility, impulsivity, antisocial behavior, accidents, and stress (Matsuoka 2010). ART suggests that nature helps people recover from mental fatigue by offering four key qualities: being away, extent, fascination, and compatibility (Kaplan and Kaplan 1989). Nature helps students feel like they are stepping away from the school environment which gives them a mental break (being away). These settings are most restorative when they are large and immersive, allowing students to explore and feel fully engaged (extent). Once in nature, students' attention will be captured by many different stimuli, like watching grass move in the wind or birds flying. This becomes even more beneficial if students can interact with the environment (fascination). Lastly, being outside in nature automatically supports students' need for rest and mental refreshment (Matsuoka 2010). Based on these criteria, it is evident that green space that is merely a patch of turf and a tree, will not have as many positive restorative powers as green space that contains natural plantings, garden spaces, and a variety of native trees that can capture students' attention while also providing visual intrigue. To maximize these cognitive and psychological benefits, green spaces should be designed with diverse plantings and interactive elements that captivate students' attention and encourage immersive experiences.

While integrating green space into school environments offers many benefits for student wellbeing, it can also present challenges that need to be addressed through thoughtful design and strategic budgeting. Budget limitations can make integrating large scale green space overhauls in areas without pre-existing green space challenging. Native plantings are more cost efficient over time but initial cost for pre-established plants can be high compared to seeding which requires multiple growing seasons to establish full cover (Dollhopf et al. 2008). While native plantings in green space require less maintenance than grass, tasks such as watering, pruning, and pest management are still necessary. This provides a great opportunity for students to be involved in caring for the natural environment but needs to be addressed even when students are not present. Another important consideration is making sure that students with disabilities have safe and accessible ways to interact with the environment, such as with raised beds and accessible pathways. Potential design strategies include community garden spaces, where each homeroom has a designated plot, enclosed courtyards or raised beds with native plantings for schools with limited land, and rooftop gardens for schools in urban settings. By prioritizing cost effective and accessible design strategies, students can have more constructive access to green space at school that enhances their wellbeing, encourages environmental stewardship, and creates lasting educational and community benefits.

Acoustic Quality

Acoustic quality refers to how sound behaves in the learning environment. The primary focus of acoustic quality levels are background noise levels, reverberation time – also known as echo – and speech clarity. A space with good acoustic quality typically has low levels of background noise and optimal reverberation, when these factors combine, they produce an acoustic environment that enables students to clearly hear the teacher, and other classmates (Shield and Dockrell 2024). The acoustic quality of the learning environment is directly related to the stimulus theory. Noise is an environmental stimulus; too much noise can act as an overstimulating stressor. In a classroom environment excessive noise has been shown to overload students' learning capacity and increase stress (Norlander, Moås, and Archer 2024).

The acoustic environment has been proven to have many benefits on student mental health and wellbeing. One survey of Austrian schools reported that students who were frequently exposed to higher levels of ambient noise in the learning environment showed worse mental health scores, and more behavioral problems than students in quieter environments (Lercher et al. 2002). This survey suggested that noise contributes to psychological strain in children. A similar study done with Finnish students showed that children in classrooms with poor acoustic quality reported not feeling at ease, experiencing less enjoyment and lower happiness while at school (Astolfi et al. 2019). A study done by Karjalainen et al. determined that for the optimal learning environment ambient noise while a classroom is unoccupied should not exceed 35 dB(a), and that the optimal ranger for reverberation is 0.45 RT60 to 0.6 RT60 (Karjalainen et al. 2020)

Some examples of design strategies that reduce noise include soft finishes and furnishings, minimizing obstacles between the speaker and the listener, and breaking up large spaces when possible. One primary goal of acoustic control is to reduce the amount of noise in the room. Strategies for reducing noise levels include using soft finishes such as acoustic ceiling tiles, wall panels, and carpeting, as well as strategically placing noisy portable equipment such as printers and projectors to minimize the impact on students (Kristiansen et al. 2016). Another goal of acoustic control is to enhance speech clarity, some design strategies that can be taken to accomplish this include rearranging classroom layouts to minimize the distance and number of obstacles between the speaker and the listener (A Castro-Martínez et al. 2016). The last strategy for acoustic control is to reduce reverberation in the room, this can also be done by incorporating soft materials such as acoustic tiles and carpeting. Another strategy however, is to break up larger open spaces by including bookcases or soft curtains to split up the space (Shield and Dockrell 2024)

The main challenge of acoustic control is to balance the desire for flexible and open learning spaces with acoustic levels that are conducive to learning environments. Many studies have found that poorly planned open learning environments lead to significantly lower academic progress over time in comparison with peers in standard enclosed classrooms (Rance 2023). By introducing lots of soft materials and being mindful of the three main aspects of acoustic control: quantity of noise, reverberation, and enhanced speech, schools can create mindful flexible learning environments that support students' needs while also encouraging learning and socialization.

Rationale for Design

While there are numerous studies on the application of theories such as control theory and stimulus theory to understand how high school students perceive their educational environments (Manca et al. 2020; Hochreiter, Benedetto, and Loesch 2023), there is a lack of design solutions that address schools with limited resources for large-scale remodels. Many existing studies focus on specific environmental features rather than offering a holistic approach that integrates ideas from environmental psychology and neuroarchitecture into accessible and scalable design strategies for schools. Through my design, I aim to integrate these concepts to propose scalable, evidence-based strategies that enhance student mental health and academic performance. By understanding how the built environment impacts student wellbeing through the lens of environmental psychology and applying these insights to design, I have developed innovative, flexible solutions that can be adapted to schools across the country. This process has allowed me to address the central question: How can design principles from Environmental Psychology be applied to create scalable renovation strategies that effectively and affordably improve student mental health and wellbeing?

03

Research Methods

This chapter outlines the research approach used to examine how school design impacts student mental health. A mixed-methods strategy combines site observations, spatial analysis, and literature review. Primary data includes field notes, photographs, and architectural assessments of Glenwood Springs High School, while secondary sources provide a theoretical foundation in neuroarchitecture and environmental psychology. Comparative case studies further inform the feasibility and impact of design interventions.

Investigation Process

My research was divided into three main phases: Phase One—Case Selection, Phase Two—Evaluation, and Phase Three—Design. I employed a mixed-methods case study approach, incorporating elements of Research through Design (RtD) to explore how the five variables I selected could be addressed through renovation to improve student mental health. I chose this combination of methods because it allowed for an in-depth understanding of the school's needs and demonstrated how the variables could hypothetically be applied to future school remodels.

To collect data to inform my design process, I used several strategies, including site visits, informal interviews with students and staff, and environmental measurements taken with both a lux meter app and a decibel meter app. In the methods phase, I first outlined the steps taken to select the case study for my redesign, then I explained how I evaluated the existing school based on the five design variables. Finally, I outlined the design process and the strategies I employed to improve the school.

Interviews

The interview process I used was informal. I began by speaking with some of the staff and educators at the school. In these interviews we talked through their routine at the school, and the different spaces they most frequently used. I asked them how they felt in those spaces at different times of day as well as any observations they had about student behavior in different areas of the school. Student participants were identified using the snowball sampling method. I began by speaking to one student I had a previous connection with, and expanded to other students who attend the school base on peer referrals. This allowed me to have a diverse perspective of the student experience while also maintaining accessibility and time constraints. During these discussions, I created sketches and took notes about common frustrations. These conversations and sketches informed a collage concept of renderings for each design strategy. These collages, in turn, facilitated further dialogue with students and educators to gauge their opinions on current design solutions. For the purpose of this study all participants have been kept anonymous for ethical purposes.

Variable Selection

After conducting my preliminary interviews I then spent some time developing my five variables. In order to do this I first conducted a comprehensive review of relevant literature and recorded the frequency of the appearance of common design terms. I also reviewed Enriched Environments to Support Social and Emotional Learning: A Visual Design Guide (Mantooth et al. 2024), which is an interior design guide that also prioritizes mental health in public schools but focuses on larger scale remodel and new build projects.

I then compared the variables discussed in the design guide as well as those from the review of literature that I conducted, to select my five variables. I focused specifically on environmental factors that have been shown to improve mental health and well being, those that have the most significant impact on adolescents, and the ones that are best incorporated through small interventions. Some example of other commonly discussed variables that did not meet these criteria include: thermal comfort, and air quality. After conducting this process I ultimately selected acoustic quality, natural materials, natural and artificial lighting, flexible and open learning spaces, and views of and access to green space as the five variables to focus on for this project. These variables are a combination of terms that were widely discussed in relevant literature and show the most promising results in improving student mental health and well being, while also being able to be achieved through smaller design interventions.

Case Selection

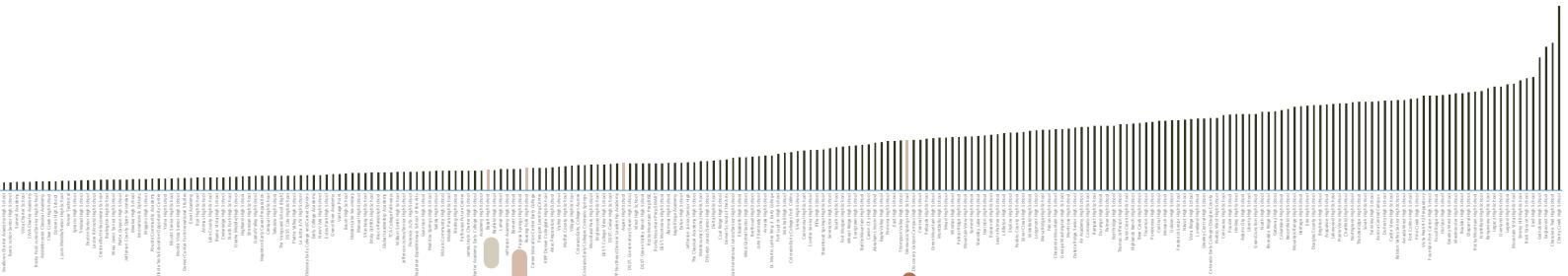
Case study selection was a critical part of my research. To explore how scalable design interventions can improve student mental health, I selected a representative high school to exemplify how the variables I selected could be used to analyze currently existing infrastructure and inform the remodel process.

The first step in my process was to select the school that would be the focus of my research. I began by looking at a spreadsheet created by the Colorado Department of Education that lists statistics about every school in Colorado, including student population data (Colorado Department of Education 2025). I filtered the data so that it contained only information about high schools, then removed any school that contained more students in Pre-K through 8th grade than those in 9th through 12th grade and any schools that identified themselves as an "E" school, online, or virtual school. In the end, 359 schools remained . I sorted every school from least to most students and created the graphic you see to the right.

Basalt High School

- **Number of Students:** 417
- **Location:** Basalt, CO
- **Materials:** Metal, concrete, brick, and curtain walls
- **Remodeled in:** 2018

Selection of Case Study Schools Filtering from all Colorado High Schools



Roaring Fork High School

- **Number of Students:** 455
- Location: Carbondale, CO
- **Materials:** Stone, Plaster, concrete, brick, and curtain walls
- **Remodeled in:** 2014

Aspen High School

- **Number of Students:** 560
- Location: Aspen, CO
- **Materials:** Metal, concrete, brick, and curtain walls
- **Remodeled in:** 2024

Glenwood Springs High School

- **Number of Students:** 1038
- Location: Glenwood Springs, CO
- **Materials:** Cinder block, concrete, brick, and curtain walls
- **Remodeled in:** 2006

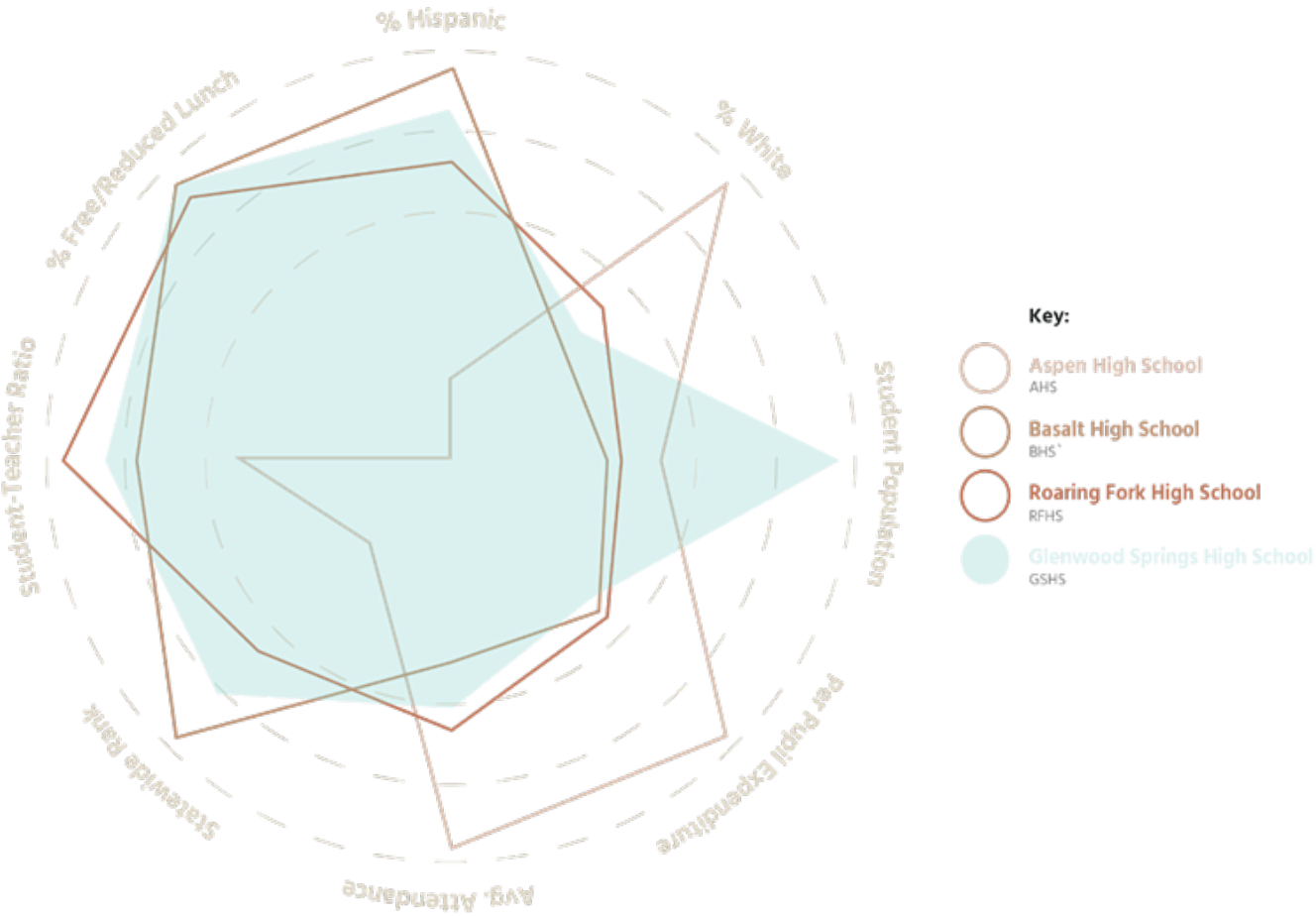
Source: Colorado Department of Education 2023-2024 Pupil Membership by School and Grade Excel

As I considered the average physical setting of a Colorado school, I found that the majority of schools in Colorado are in rural districts; in fact, the state includes 178 school districts, 146 of which are deemed rural ("COE - Public School Enrollment," n.d.). Rural areas near affluent resort towns such as the Eagle River Valley and Vail, the Uncompahgre Valley and Telluride, and the Roaring Fork Valley and Aspen share a unique economic environment where demand for attainable, low-income housing for resort town employees, in these areas with high real estate values, pushes development increasingly further from employment opportunities. Schools in these areas vary widely in quality due to the economic gradients created by these conditions.

After determining that the Roaring Fork Valley was the focus of the study, I did more research into economic demographics for the valley. The median annual income in Glenwood Springs in 2024 was $69,728; median income increases in each town moving up the valley towards Aspen, where the median income in the same year was $92,911 (US Census Bureau, n.d.). While the Roaring Fork Valley includes just four incorporated towns, there are six public high schools, Glenwood Springs High School, Yampah Mountain High School, Roaring Fork High School, Bridges High School, Basalt High School, and Aspen High School. I eliminated Bridges High School and Yampah Mountain High School because they are not traditional public schools and therefore are not representative of an average school.

To select a subject school from the four remaining, I delved into each school's unique construction and demographic composition. I reviewed each school's demographic information and found that the school which best represented the economic diversity of the area is Glenwood Springs High School (GSHS), as represented in the chart below:

Selection of Primary Case Study School



Source: (SchoolDigger 2024; Colorado Department of Education 2024; U.S. News & World Report 2024)

To create this chart, I assigned a value between 1 and 100 based on the demographic information in each category of the chart for each school to identify which school represented the most diverse student body. then calculated the area created by each school's "footprint" in the chart to determine which had the largest economic and demographic diversity. As is evident from the chart, Glenwood Springs High School (GSHS) had the most diverse student population.

GSHS, built in its current location in 1953 (Soncarty 2002), was constructed primarily from concrete, brick, and cinderblocks. The school underwent an extensive remodel in the early 2000s that was completed in 2008. As with initial construction, materials of choice for this stage were concrete and cinderblock, Fortunately, the renovation brought large windows throughout the school, including those for interior facing classrooms that were comprised of glass walls facing interior hallways. Notably, the glass walls were frosted in 2020 due to student safety concerns (Graff 2005).

Evaluation

To evaluate the school, I developed units of measure to determine how the school is currently meeting the needs of the students based on design variables I identified in the literature review. I then made my first visit to the site to analyze the school. I began my visit by walking around the school with an administrative staff member and conducted an informal interview to discuss how he felt the current spaces were utilized to identify areas for improvement. Based on this informal interview, I then selected five spaces in the school that were underutilized or could be adjusted to better serve their purpose. Each of these spaces also acted as a typology that represented an example of how these design strategies could be applied to the school at large, as well as to other schools. The five spaces I chose for this project were a classroom, the library, the main hallway, the lobby, and the lunchroom.

Next, I developed a matrix to rank the current school design on how specific design elements in educational environments influence student wellbeing and performance. I developed my strategy for measuring these criteria using resources I had readily available. An example of how I developed the measurements is the Natural and Artificial Lighting variable . Multiple studies highlight the range of acceptable light brightness in learning environments to be between 500 and 1000 lux. In these studies, they typically use physical lux meters, however because I did not have access to a lux meter, I downloaded a lux meter app and used that to take measurements. The goal of these adjustments is to make it so that these analysis techniques are accessible to anyone wanting to propose improvements to a school environment including but not limited to teachers, staff members, school board members etc. The evaluation section is split into sub-sections regarding each of the five variables. Each sub section will explain what the unit of measurement is, and how I developed it. The table below highlights the metrics I used for each of the variables.

Data Analysis Metrics

Design Variable	***Unit of Measurement***	***Acceptable Range***
Natural and Artificial Lighting	Lux and Kelvins	Lx: (500-1000) K: (3500-4500)
Acoustic Quality	A-Weighted Decibels	dB(A): (35 and below)
Flexible and Open Learning Spaces	Number of uses of a space	(2 – 5+)
Natural Materials	% of Coverage (3 Variables)	(45% Organic Coverage)
Views of / Access to Greenspace	Views of Natural Planting	(yes or no)

Source: (Vimalanathan and Ramesh Babu 2014; Boubekri et al. 2020; Karjalainen et al. 2020; Watchman, Potvin, and Demers 2017; K. E. Kariippanon et al. 2018)

There are some limitations to the accuracy of the measurements that come with using smart phone apps such as the lux and decibel meters as the tools of measurement for this process. For example each phone may have slightly different measurements due to different camera and microphone hardware. These measurements will not be as precise as if they were made using an actual lux meter, or decibel meter to record the same readings however, they can provide enough information about the space to understand if there is an initial problem that should be further investigated. The goal of using these apps was to provide tools that are accessible to the general public to provide more opportunities for people to analyze and critique their environments to have a deeper understanding of the impacts.

Natural and Artificial Lighting

Natural and artificial light is typically measured in two ways, either by brightness, measured in lux (Zhang et al. 2020), or by temperature, measured in kelvins. (Vimalanathan and Ramesh Babu 2014). Whereas the range of brightness that is optimal for student mental health and performance, the range that properly lights a space without causing glare or visual discomfort, is between 500lx and 1000lx, (Zhang et al. 2020), the ideal range of correlated color temperature (CCT) is between 3500k and 4500k, considered a neutral white light that doesn't create too much visual strain or disrupt the circadian rhythm (Vimalanathan and Ramesh Babu 2014). In this study, I based my measurements on studies done by Zhang et al., and Vimalanathan and Ramesh Babu and looked at both brightness and temperature to verify that spaces were properly lit. To ensure that this mode of measurement was accessible to as many people as possible, I chose to use a popular photography smart phone app called Light Meter that can measure both temperature and brightness as the tool of measurement. Looking at the quality of artificial and natural lighting in space, I observed and recorded the primary light source for each space, and what time each measurement was taken, then recorded the brightness and temperature of each space. To do this, I aimed the camera to capture as much of each space in the field of view as possible and recorded this information, as well as the time that each measurement was taken, on the table below.

Acoustic Quality

Acoustic quality can be measured in multiple ways; I chose to focus on studies that measured acoustic quality in decibels and A-weighted decibels. Decibels are a raw measure of sound intensity that does not account for human hearing while A-weighted decibels are adjusted to more accurately represent how human ears perceive sound. One study by the World Health Organization utilized sound level meters strategically positioned to measure noise levels over a 24-hour period. Observers were assigned to meters to monitor and document where the noises originated from within each subject room. The study identified two categories of sound: human-generated sounds and mechanical sounds (Naef et al. 2022). While the scope of this research did not include monitoring over a 24-hour period or monitoring multiple spaces at once, I was able to identify that a large majority of noises in school spaces were human-generated. According to the World Health organization, classroom noise during lessons should not exceed 35 dB(a) (Naef et al. 2022). I used this as a baseline to determine which areas were most in need of added acoustic control. To take these measurements, I used a decibel meter app to record measurements in A-weighted decibels and measured each space during its most activated time, such as a classroom during class time and a hall during passing period.

Flexible and Open Learning Spaces

Flexible and open learning spaces require more subjective metrics compared to some of the other variables in this study such as natural lighting. Many studies in this field focus more on measuring the effects of these spaces and less on determining what defines a flexible and open learning space. While the definitions are loose, I decided to choose the one set out by Kariippanon et al. which highlights a learning space where traditional and rigid furniture layouts are replaced with a variety of adjustable furniture configurations, where the

spaces are specifically meant to facilitate two or more uses, with five or more uses being optimal (Katharine Kariippanon et al., n.d.). To determine how flexible the environment at GSHS was currently, I conducted informal interviews with students and teachers and asked them to name how many ways they have seen each room be utilized.

Natural Materials

There are many ways to measure the inclusion of natural materials in design. For this research, I selected a study by Watchman et al., where researchers created three virtual reality environments that had varying percentages of surfaces in a space covered by natural materials. They put people into the virtual environments and measured participants' heartrates and blood pressure and concluded that 45% of surface coverage was the optimal quantity of natural materials that reduced stress in the participants, while still being easy to maintain (Watchman, Potvin, and Demers 2017) . I divided the "surface coverage" variable into three categories to facilitate environmental assessment: structure, furniture, and plants . These variables were assessed by the percentage of each that contained natural materials, then adding that number together to get the result for each room. Additionally, I took photos in each room to have material to reference as the project developed.

Views of / Access to Green Space

According to the ART theory developed by Kaplan and Kaplan, which suggests that nature helps people recover from mental fatigue by offering four key qualities: being away, extent, fascination, and compatibility, a access to green space is most impactful when students can interact with it and feel like they are stepping away from the school environment (Kaplan and Kaplan 1989). This effect is amplified when the green space includes native plantings. In fact, one study stated that perceived biodiversity was a facet of green space that supports improved mental health (Matsuoka 2010). For this project, I wanted to focus on native plantings specifically because they typically offer a more affordable strategy that requires less maintenance than traditional lawns and non-native plants. To measure students' exposure to native plantings from inside the school, I recorded any windows that had views of native plantings and made note of which outdoor areas were most and least utilized by students utilized.

After developing evaluation metrics, I visited the school for a second time to take record proper measurements, take photos and conduct more informal interviews. During the visit, I spoke with the superintendent and obtained architectural plans of the school. I then recorded data for the existing school and, based on my measurements, selected a design variable to focus on to improve each space. At this point, I began the design phase of my project.

Design

The objective of the design phase was to develop hypothetical remodel strategies that help schools better support their students' mental health and wellbeing. Given the fact that students and teachers utilize these environments daily, I specifically wanted to prioritize understanding what current users need to ensure that my proposed designs were grounded in students' lived experiences.

Building on the interviews, I translated the collage concepts into more detailed 3D models of the spaces in a design software called Rhino , then used these models to explore spatial relationships, materials, and implementation challenges. With each space, my goal was to balance functionality, aesthetics, and feasibility.

In the final design stage, I created collage renderings of each of the modeled spaces, creating visual narratives to represent my final design strategies. These renderings served as a bridge between the research and the design; they help communicate some of the more complex theoretical premises to the layperson and provide solutions in a compelling and accessible format.

04
Results

To understand the impact of the current school design on student wellbeing, I collected and analyzed data regarding the five key design variables I created and how they contribute to the mental wellbeing of current students. To that end, I present the data gathered through site visits, including qualitative feedback from current students and staff and environmental assessments of lighting and acoustic quality. By examining this data, I was able to determine which space needed the most help from each of my five design variables. These findings served as the basis for my design strategies.

1. Natural and Artificial Lighting

The first criteria I reviewed was natural lighting. Studies show that natural lighting improves sleep quality and enhances emotional regulation and wellbeing (Küller and Lindsten 1992). In more recently remodeled buildings, the lighting quality is often pleasant, though at times it can be excessive or even unpleasant. For instance, at Glenwood Springs High School, east-facing clerestory windows cause glare in the morning hours, forcing students to wear sunglasses indoors, which disrupts the learning environment. My measurements of the environmental qualities were taken on February 19th, at which time the sun's angle did not produce glare for students in class. However, through discussion with staff and students, I was able to gain a broader understanding of specific lighting conditions, like the clerestory glare.

When conducting informal interviews, students often mentioned that the lighting was too dim in the afternoon, while teachers noted that natural lighting led to inconsistent lighting levels. One teacher stated, "The windows let in so much light in the mornings that students have to wear sunglasses when looking at the board." When measuring spaces, I noted that most areas indeed received ample natural lighting during the afternoon, though the classroom I measured was considerably more dimly lit than the rest of the school because the teacher had drawn the blinds on all the windows to minimize the glare from the clerestory windows.

Natural and Artificial Lighting Measurements

Spaces	Time	Light Level (Lux)	Color Temperature (Kelvins)
Classroom	1:06PM	354	4490
Library	1:04PM	1265	4400
Main Hallway	1:00PM	1065	4700
Lobby	12:59AM	1487	4100
Lunchroom	1:07PM	1364	4800

Source: Data collected through Lux Meter app during site visit.

In the table above reveals results from the lux meter app. Cells that contain data outside of the acceptable ranges, as determined by my literature review, are highlighted. According to Zhang et al., the optimal range for light level in a space is between 500lx and 1000lx (Zhang et al. 2020). According to Vimalanathan and Ramesh Babu, the ideal range of correlated color temperature (CCT) is between 3500k and 4500k (Vimalanathan and Ramesh Babu 2014). Based on these measurements, I identified that classrooms are the space that require the most improvement of natural and artificial lighting.

There are many ways that classroom lighting could be improved. Light filtering window treatments, such as automatic shades to control glare and heat while maintaining the benefits of natural lighting when appropriate, offer a low-scale design intervention. A medium scale one could look like replacement of current artificial lighting with lighting that simulates sunlight; these lights are often called "happy lights" due to their ability to positively affect circadian rhythms. Large-scale interventions could look like readjusting window placement or reorienting classrooms to maximize lighting in the winter and filter excess light in the summer, which would also encourage added passive heating and cooling elements. For this project, I chose to design the medium-scale intervention to exemplify how lighting can be used in a functional and aesthetic way.

2. Acoustic Quality

Next, I reviewed the acoustic quality of the spaces. Studies have shown that good acoustic quality can reduce teacher burnout and increase student feelings of safety and enjoyment in the school environment (Astolfi et al. 2019; Karjalainen et al. 2020). Acoustic quality can often be a problem in schools, especially those built with common materials such as concrete and cinderblock as well as those that lack proper insulation. For this research, I wanted to measure each space in GSHS during the most active times and took each classroom measurement during a class period. Library sounds were measured during study hall, the main hallway during a passing period, the lobby after school, and the lunchroom during a lunch period.

A common theme about sound in informal interviews with students and teachers reflected what the research indicated; walls lacked insulation sufficient to dampen noise to prevent student distraction. Multiple teachers had stories of times where they heard fights breaking out in the bathrooms, or students dragging water bottles across a railing, creating loud metal clanging noises. Students reported hearing full conversations from hallways or the next classroom over. One unexpected result was that in recent years, the lunchroom had become less utilized. GSHS allows off campus lunch, and, post COVID, so many students take advantage of this allowance that the lunchroom was much quieter than I expected, however it still exceeded the acceptable range. The table below shows the results of my measurements with the decibel meter app.

The Natural and Artificial Lighting Measurements table reveals results from the lux meter app. Cells that contain data outside of the acceptable ranges, as determined by my literature review, are highlighted. According to Zhang et al., the optimal range for light level in a space is between 500lx and 1000lx (Zhang et al. 2020). According to Vimalanathan and Ramesh Babu, the ideal range of correlated color temperature (CCT) is between 3500k and 4500k (Vimalanathan and Ramesh Babu 2014). Based on these measurements, I identified that classrooms are the space that require the most improvement of natural and artificial lighting.

Measured Noise Levels

Spaces	Acoustic Levels (dB(A))
Classroom	50
Library	41
Main Hallway	70
Lobby	55
Lunchroom	45

Source: Data collected through decibel app during site visit.

The table above reveals that all rooms measured above the accepted range as determined by my literature review. According to Karjalainen et al., the optimal acoustic range for learning environments should not exceed 35 dB(a). Of these, because the main hallway, clearly the loudest observed, is adjacent to almost every classroom, I selected it as my subject to improve acoustic quality.

The main hallway has a lot of potential for improvement through design. One small-scale design strategy to minimize noise is to install soft paneling to dampen noise and create visual interest through the use of custom colorful panels,

or panels with intriguing shapes. These panels also offer a student-led project where Art and Science classes could work together to create acoustic panels out of fast fashion waste to learn about the environmental impacts of fast fashion that also produces a benefit to the school. Having their work displayed in this fashion might also lead to an increase in ownership over the environment for students. A medium-scale design solution involves replacing current metal railings and existing study space furniture in the hallways with soft furnishings and acoustic paneled railings to further dampen noise. A large-scale design solution could be a remodel that addresses wall insulation and redesigns the hall space with advanced acoustic materials to maximize sound insulation. For this project I have chosen to design the small-scale intervention, to explore how the hallway could be transformed in an interesting and functional way using colorful acoustic panels.

3. Flexible and Open Learning Spaces

Next, I reviewed the flexibility of each space. Research has shown that flexible learning spaces encourage active breaks and active lessons which increase physical activity among students (Larose et al. 2024) and also allow students to increase emotional regulation (Revesman and Perlmuter 1981). Many schools built before the 2000s do not take into consideration flexible and open learning spaces, as the use of such spaces has only begun to take hold in the pedagogical structure of public schools in the U.S. in their current form in the 21st century due to the rise in project-based learning and STEM education. The GSHS remodel in the early 2000s included many flex spaces and breakout rooms for students, including one room between each classroom in the main wings of the building. However, due to an increase in student population numbers, the school is over capacity, and the flex spaces have been converted into teacher offices.

When conducting informal interviews, I found that some teachers remember the initial design intention for the flex rooms and wish they could still be utilized in the same way. Teachers also mentioned that with the school at capacity, it is not possible to revert these spaces to their intended use; many classrooms are shared between multiple teachers, so they need spaces to do private, individual work. I discovered, however, that there are many spaces that are currently underutilized. During these informal interviews, I asked students and teachers to identify as many ways as possible that each space could be used. I compiled the resulting answers in the table below.

Flexible and Open Learning Space Uses

Spaces	*Use One*	*Use Two*	*Use Three*	*Use Four*	*Use Five*
Classroom	Class	Office			
Library	Study hall	Free period			
Main Hallway	Circulation	Group work			
Lobby	Event reception	Science demonstration	After school hangout	Extended gym	Community gathering
Lunchroom	Lunchroom	PT conferences	Event space		

Source: Data collected through informal interviews during site visit.

I recorded every use mentioned in my informal interviews in the Flexible and Open Learning Space uses table. I found it interesting how many things the lobby has been used for, considering it is the entrance to the school and often functions as a community center as well. Many people come to the school to see the plays in the auditorium adjacent to the lobby. Based on my observations, and because the classroom, library, and main hall all have two main uses and have already served as the subject for other design interventions, I selected the library as the subject of my redesign.

There are many possible design strategies for improving the flexibility of a space like the library. A small-scale design intervention could be to re-zone the current layout and designate spaces specifically for silent study, collaboration, technology, and lounge. With this, the library could transform into a multi-functional learning hub. In

a medium-scale design, space could be zoned the same as the small-scale intervention, then re-furnished with modular furniture and partitions to give the space a modern and engaging vibe while still maintaining the multi-functional effect. A large-scale solution could be a complete redesign of the library and other under-utilized spaces across the school to create a string of connected learning hubs that serve the student population at large. For my design, I chose to expand upon the medium-scale design strategy to really explore how modular furniture could be utilized to transform a space.

4. Natural Materials

Natural materials and textures can reduce stress and anxiety, enhance mood, and create calming environments (Kotradyova et al. 2019; Watchman, Potvin, and Demers 2017). Unfortunately, due to cost constraints, many schools, including Glenwood Springs High School, rely on industrial materials like concrete and cinderblock. While the school has a significant amount of glass, the building is constructed almost entirely from concrete, and cinderblock and there is a severe lack of natural materials in the school. In fact, every space I observed in the school was almost completely devoid of natural materials.

Surprisingly, when conducting my informal interviews, natural materials were never mentioned without prompting. When I asked how students and teachers felt about them, they did not feel strongly either way, though many people cited the windows, and views of nearby trees, to be calming. The table below reflects my objective findings about natural materials on the school campus. For my design, I chose to expand upon the medium-scale design strategy to really explore how modular furniture could be utilized to transform a space.

Presence of Natural Materials in the Environment

Spaces	Structure	Furniture	Total
Classroom	0%	0%	0%
Library	0%	19%	9.5%
Main Hallway	0%	0%	0%
Lobby	0%	100%	50%
Lunchroom	0%	0%	0%

Source: Data collected through observation by author during site visit.

As you can see, the physical construction of the school building does not contain any natural materials. However, there are some natural materials in the furniture selection, and the building does have many potted plants that the students take care of. According to one study, the optimal percentage of coverage of interior spaces in natural materials is 45%; enough to reap the benefits discussed above without becoming overwhelming or inconvenient to maintain (Watchman, Potvin, and Demers 2017).

I calculated the total average percentage of the three categories I laid out in the table above to determine the total percentage coverage of the interior spaces and found the percentage of coverage for the furniture category by counting the number of furniture items in the room that were made of natural materials and then dividing that number by the total number of furniture pieces in the room. Based on this data, I chose to use the lunchroom as the subject for my redesign process.

The lunchroom could be redesigned in many ways. The smallest-scale design strategy would be to install plants in the lunchroom to increase natural elements in the space. In a medium-scale intervention, elements such as reclaimed wood, or beetle-kill timber could be incorporated to align with the local environment and serve as an example of environmentally friendly construction practices for the students. At a large scale, biophilic design principles could be used to integrate natural materials into the architectural elements to provide a comprehensive redesign of the lunchroom to better suit the needs of the school while incorporating lots of natural materials. For this design, I am choosing the large-scale remodel option to exemplify how a large-scale remodel can increase the positive impact for students and include more aesthetic elements as well.

5. Views and Access to Green space

Access to green space has been proven to support stress recovery and mental wellbeing (Matsuoka 2010). However, despite its beautiful natural location, this school fails to integrate its natural surroundings effectively. While the school has a fairly large plot of land, much of the green space is just grass, and even that is underutilized by students. While experiencing nature has the potential to restore direct attention capabilities, which means reducing the likelihood that students will experience burnout (Matsuoka 2010), this correlation does not have as strong of an effect when the student is experiencing groomed lawns.

During my informal interviews, I found that the most used grassy spaces are the sports field and the field to the west of the lunchroom and that the green spaces between each classroom wing, as well as the green space to the south of the school, are not typically utilized. Students and teachers agreed during the interviews that more native flora and fauna on site would be an aesthetic improvement. Students are more likely to use outdoor areas when they have a clear purpose rather than being simply open lawns. Accordingly, the most effective green-space intervention involves adding native planting gardens between classroom wings, improving aesthetics, reducing maintenance costs, and providing hands-on ecological learning. These plantings can be introduced incrementally—small, medium, or large—based on available resources. Overall, analyzing five key design variables allowed the author to pinpoint improvement opportunities and propose scalable solutions that enhance student mental health and well-being in any school setting.

Green Space Usage Frequency and Student Engagement

Greenspace Location	*Primary Use*	*Usage Frequency (High/Medium/Low)*	*Student Engagement*
Sports Fields	Athletic events, PE classes	High	Organized use, sometimes used by the community outside of sports
Lawn west of Lunchroom	Lunch breaks, informal gatherings	Medium	Used occasionally for socializing and gathering
Greenspaces between wings	Unused	Low	Minimal seating and interactive features, often shaded
Lawns south of school	Fire alarm evacuation zones	Low	Typically, only used for fire alarm evacuations, exposed to parking lot

Source: Data collected through informal interviews during site visit.

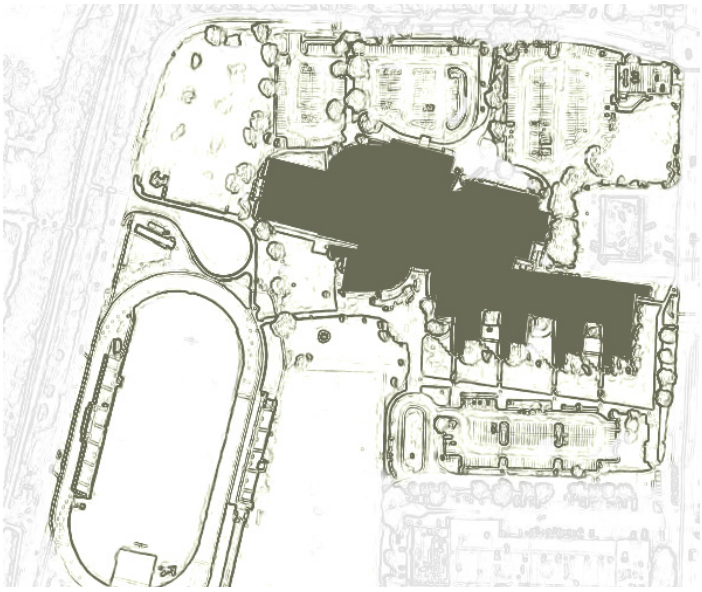
05
Design

This chapter outlines the research approach used to examine how school design impacts student mental health. A mixed-methods strategy combines site observations, spatial analysis, and literature review. Primary data includes field notes, photographs, and architectural assessments of Glenwood Springs High School, while secondary sources provide a theoretical foundation in neuroarchitecture and environmental psychology. Comparative case studies further inform the feasibility and impact of design interventions.

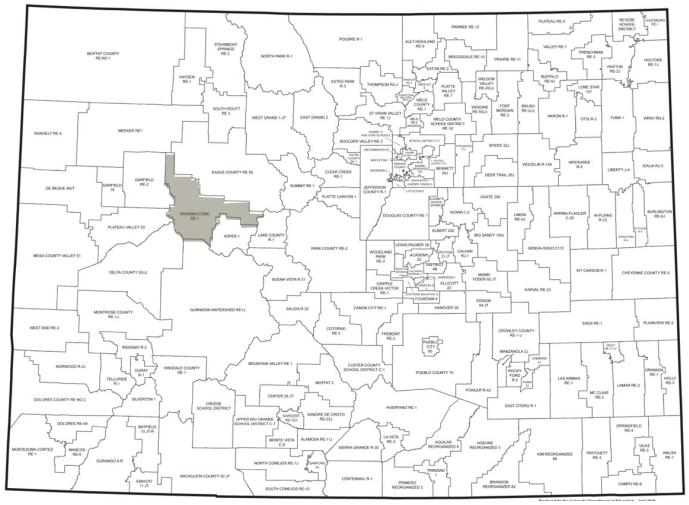
Site Overview

Site: Glenwood Springs High School
Constructed: 1953
Remodeled: 2006
Square Footage: 134,000 sqft
Student Population: 1,016 (as of 2024)
School District: Roaring Fork Valley RE-1

Site Plan



School District Map of Colorado



First Floor Plan

Call-outs

1. Lunchroom

- Lacks natural elements (mimic organic coverage)
- Layouts: Rigid setup; need flexible seating

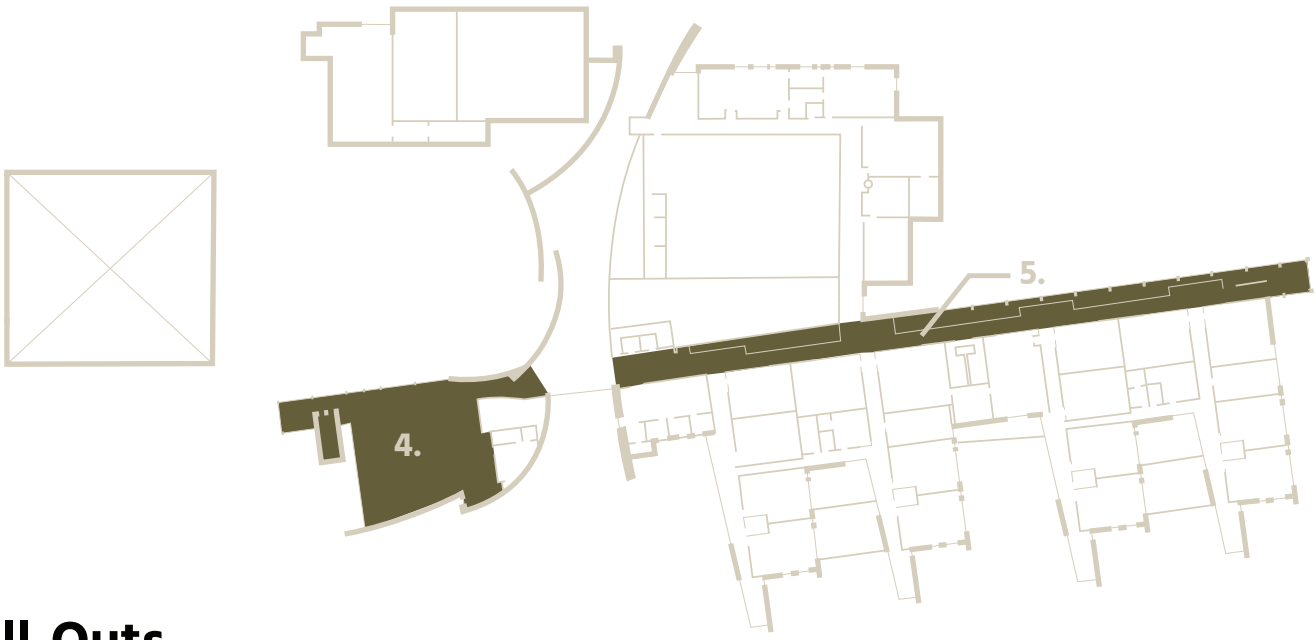
2. Classroom

- Lighting: 354 lux (below 500-1,000 target); drawn blinds limit natural light

3. Courtyard

- Green Space: Currently mainly hardscape with no native plantings

Second Floor Plan



Call-Outs

4. Library

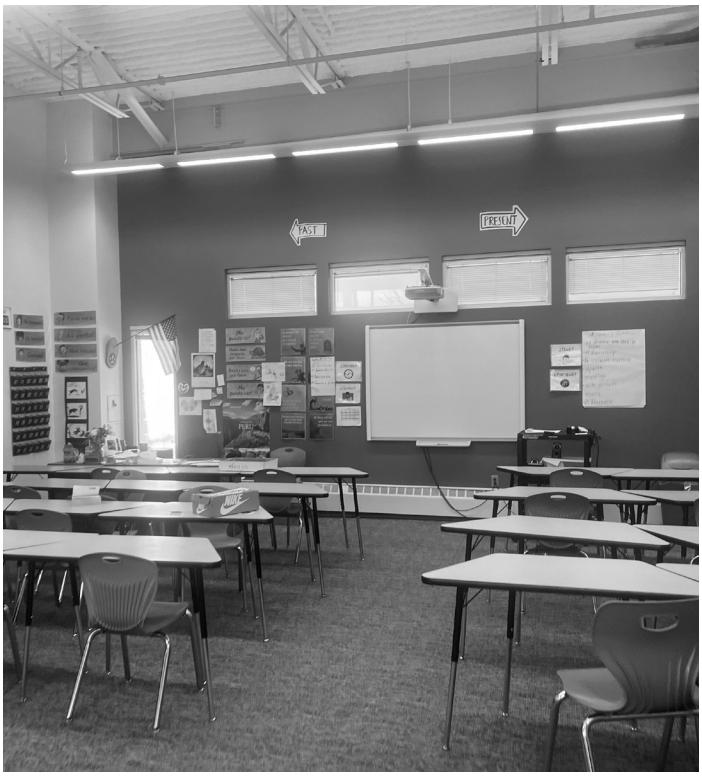
- Layout: Underutilized for multi-use; opportunity to introduce zones

5. Hallway

- Acoustics: High noise levels, 70dB(a) which exceeds the optimal acoustic range for educational environments.

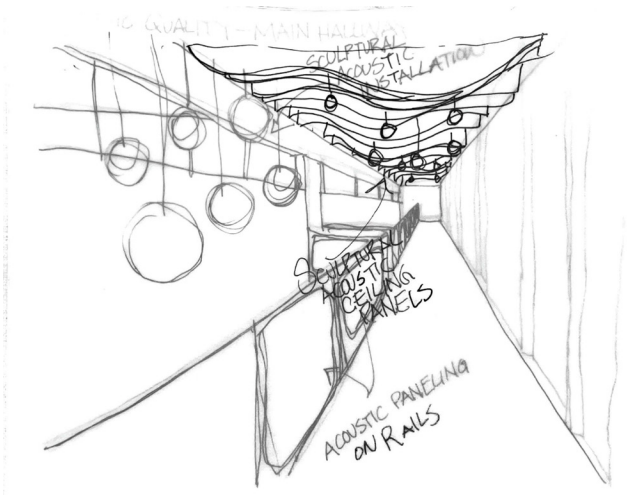
Natural Lighting

Existing Photo

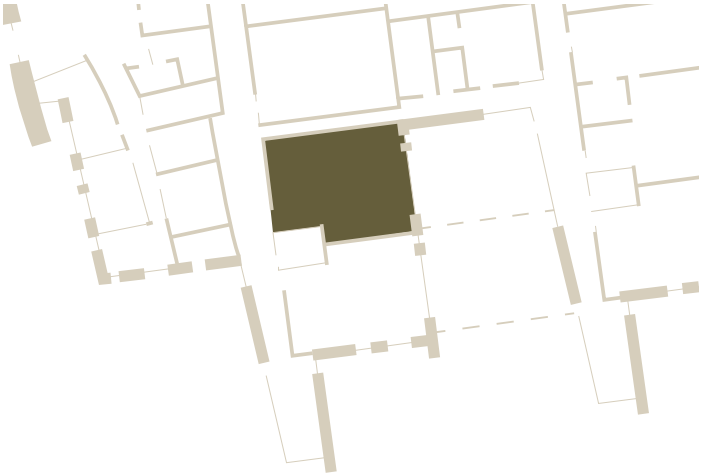


Source: Image taken by the author.

Sketches



Key Plan



Step One - Site Analysis:

While assessing the classroom's lighting, I noticed that the upper clerestory windows, despite flooding the room with natural light, create a harsh glare that renders them almost unusable. On top of that, the linear lights at the front of the room don't provide enough illumination on cloudy days or in the evening, leaving parts of the space dim and inconsistent.

Step Two - Design:

To address these issues, I developed a sculptural lighting solution—my version of "happy lights"—that adjusts both brightness and color temperature throughout the day. This intervention not only aims to balance the overall light levels and reduce glare, but it also introduces a visually engaging element that transforms the space into a more dynamic and inviting environment.

Step Three - Results:

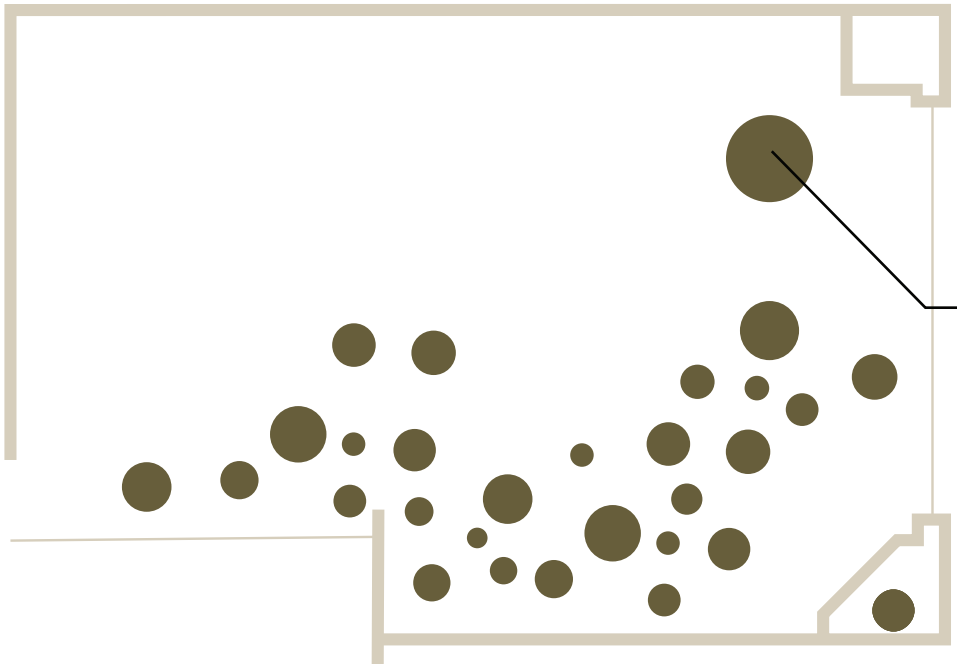
My research indicates that dynamic lighting systems like this affords students with alertness, comfort, and alignment with their circadian rythms.. I believe that by integrating this adaptive lighting approach, the space will become more comfortable for students, reducing eye strain and creating an environment that supports improved focus and overall well-being.

Sculptural Lights

Paper Lights:
Less expensive, Less durable.

Ceramic Lights:
More expensive, More durable.

Plan



Sculptural Lighting

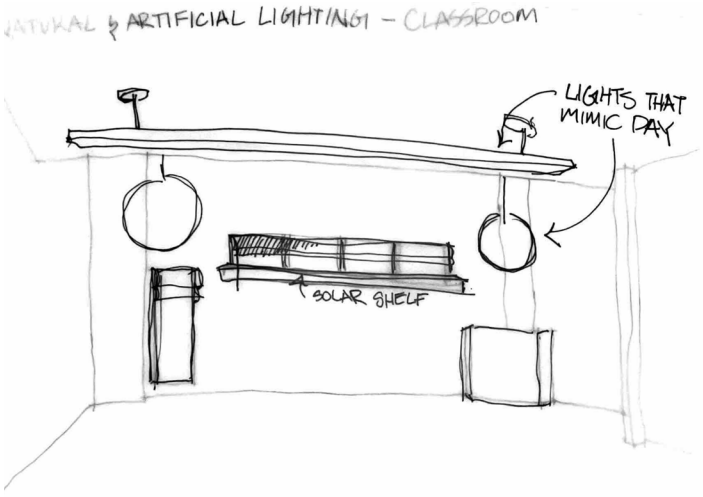
A mix of different sized lights to mimic daylight in the classroom

Acoustic Quality

Existing Photo

Source: Image taken by the author.

Sketches



Key Plan

Step One - Site Analysis:

While assessing the hallway's acoustic quality, I noticed that the space is dominated by harsh, reverberant noise due to a lack of soft, sound-absorbing materials. The hallway consistently measures around 70 dB(A)—far exceeding the recommended 35 dB(A) for learning environments—and this excessive noise spills over into adjacent classrooms, creating distractions during class time.

Step Two - Design:

To tackle this issue, I designed a series of targeted interventions that focus on integrating soft materials to absorb sound. My approach includes installing custom, colorful acoustic panels along the walls and replacing hard railings with softer, more absorbent finishes. This design not only aims to lower noise levels but also adds a visually engaging element to the hallway, transforming it into a more inviting and calming pathway.

Step Three - Results:

My research indicated that incorporating soft, acoustic materials in high-traffic areas affords students with cal, quiet, and focus, and significantly reduce ambient noise and improve speech clarity. By bringing the noise levels closer to the recommended range, these interventions to minimize disruptions in adjacent classrooms, ultimately creating a more conducive environment for both teaching and learning.

Sculptural Acoustic Panel Materials

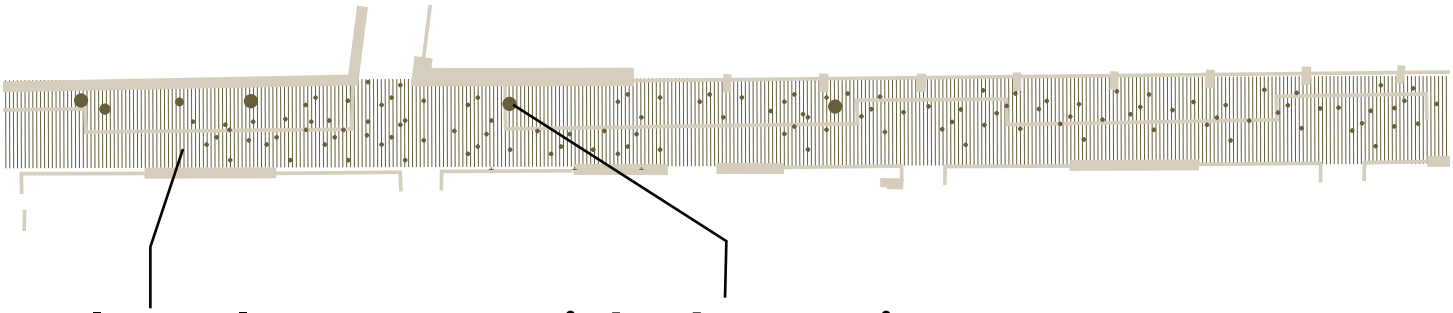
Premade Panels

Premade panels have tested sound absorption, can be more durable, and can often be easier to install.

Handmade Panels

Handmade panels are more environmentally friendly and can foster student involvement and education about environmental stewardship through a collaborative project.

Plan



Sculptural Acoustic Panels

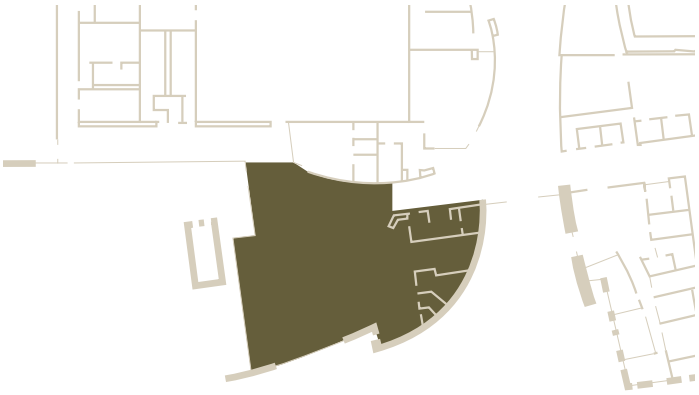
Parametric panel design that could be made from recycled materials or premade acoustic panels.

Light / Acoustic Sculpture

A mix of lighting and acoustic orbs at different scales hang from the ceiling to add increased acoustic dampening as well as better lighting and added visual intrigue

Flexible and Open Learning Spaces

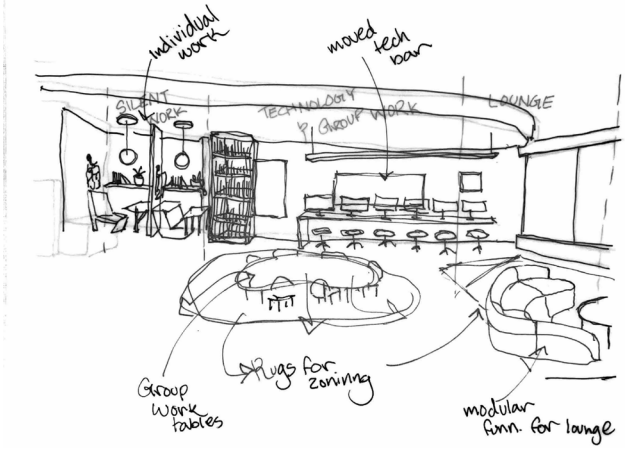
Key Plan



Existing Photo

Source: Image taken by the author.

Sketches



Step One - Site Analysis:

While analyzing the library, I noticed that its layout is extremely rigid. The fixed furniture arrangement leaves little room for movement, and many students expressed discomfort with rearranging the space. This inflexibility limits both individual study and collaborative work, making it difficult for students to adapt the area to their needs.

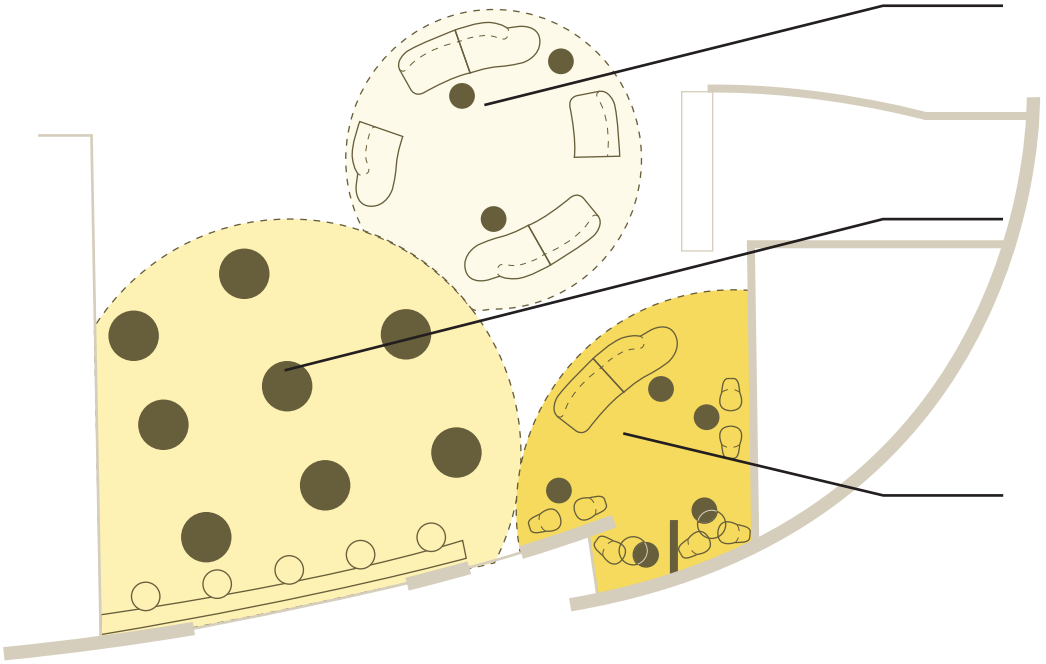
Step Two - Design:

To address this issue, I developed a strategy to create zoned spaces within the library using modular furniture. By introducing versatile seating and workstations that can be easily reconfigured, the library can transform into a dynamic environment that encourages both independent study and group collaboration. Additionally, incorporating movable curtains to clearly delineate these zones offers further flexibility and reinforces the new spatial organization.

Step Three - Results:

My research indicates that modular furniture affords students collaboration, autonomy, and choice. Zoned spaces afford different modes of study such as solo, group, and tech-enabled. These interventions will not only make the library more functional and inviting but will also foster a sense of ownership and well-being among students, ultimately contributing to improved academic outcomes.

Plan



Lounge Zone

Contains module couches, and small movable tables.

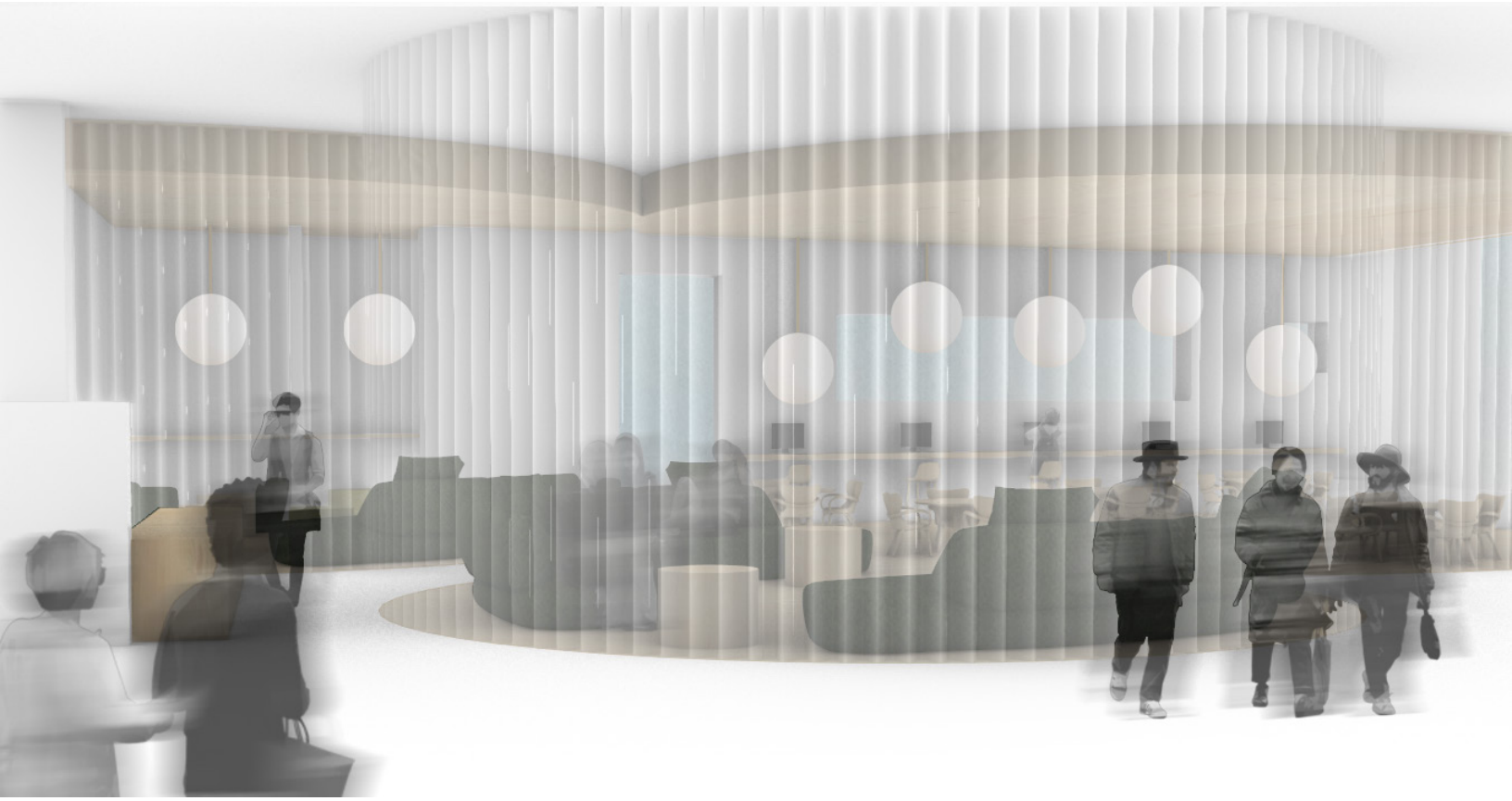
Group Zone

Larger tables for group work and updated tech zone.

Individual Zone

Smaller more private work zones with individual and duo work areas.

Curtains Divider Rendering

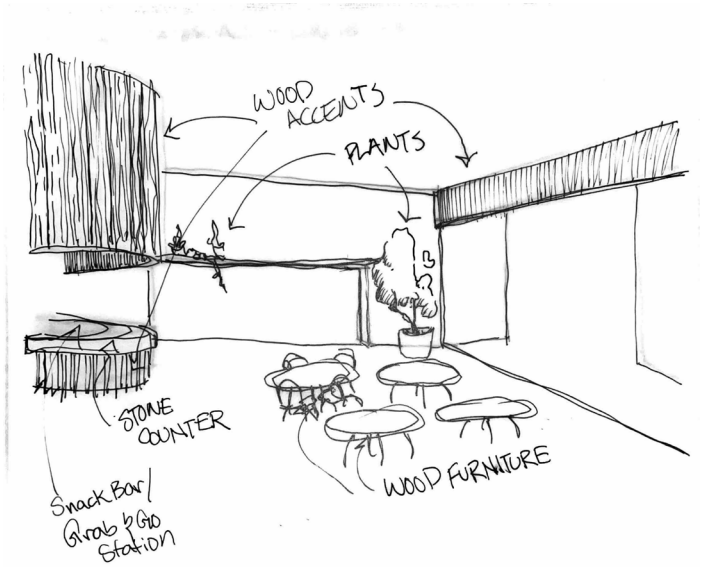


Natural Materials

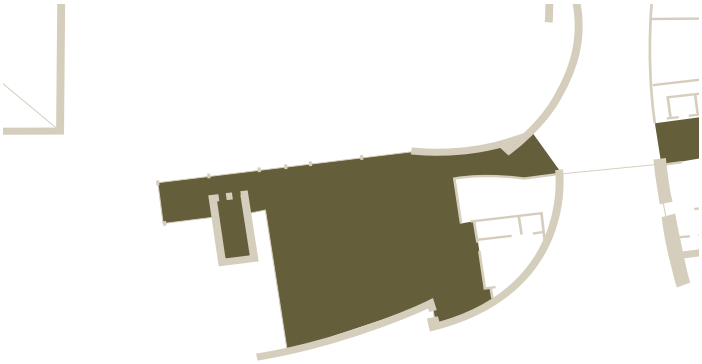
Existing Photo

Source: Image taken by the author.

Sketches



Key Plan



Step One - Site Analysis:

While conducting site visits, I learned from both students and staff that the lunchroom has seen a serious decline in usage post-COVID. The space feels uninviting and underutilized, with fewer students hanging out outside of the standard lunch period. This decline is concerning since the lunchroom has the potential to serve as a dynamic social hub that supports casual learning and relaxation throughout the day.

Step Two - Design:

To address this issue, I decided to update the lunchroom with natural materials to create a warmer and more inviting atmosphere. My design strategy includes reimagining the serving station into a more efficient, grab-and-go format, making it easier for students to access breakfast and snacks as well as lunch. Incorporating elements such as reclaimed wood, greenery, and natural textures will not only improve functionality but also infuse the space with a calming, biophilic quality that encourages students to linger and interact.

Step Three - Results:

My research suggests that integrating natural materials into interior spaces affords students a sense of warmth, calm, and natural connection which can contribute to a more engaging and comfortable environment. By transforming the lunchroom with these natural elements I anticipate that students will be more inclined to use the space throughout the day. This intervention should foster a stronger sense of community, encouraging informal interactions and supporting overall student well-being.

Wooden Slats

Inspiration

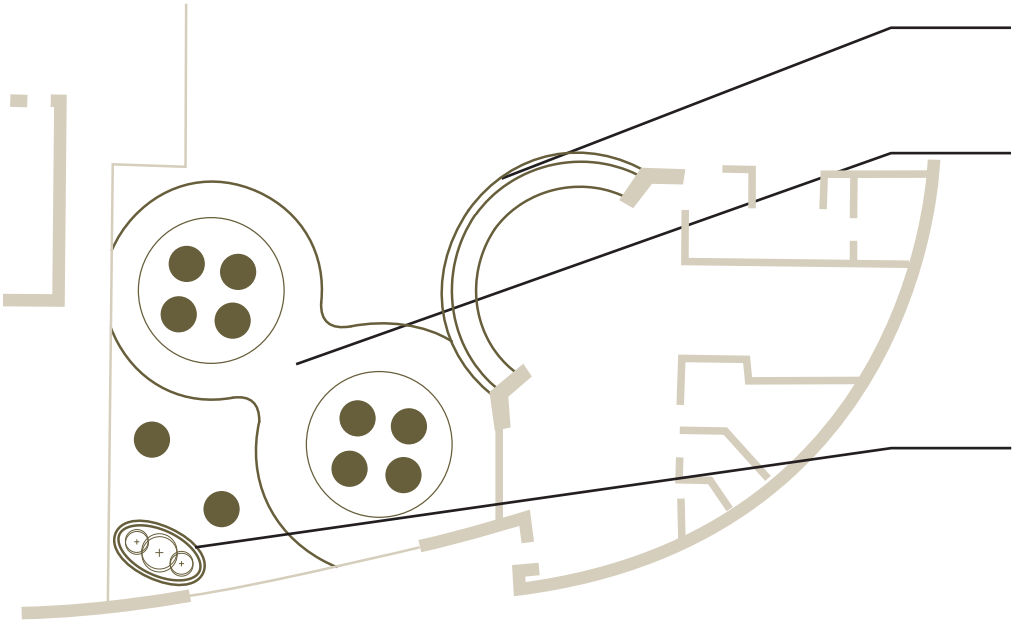
I really wanted to incorporate transparency through slat walls to suggest a division of space between the dining and study areas. I found this image of an organic slat wall that is used as a divider between a living space and a circulation space that inspired my design.

Possible Wood Options

Beetle kill pine harvested from local trees.

Reclaimed wood from local demolition projects

Plan



Grab & Go

Introduced wooden slats at updated lunch grab & go.

Zoned Dining

Zoned dining with wooden slat sculpture, furniture and floor divider.

Planter

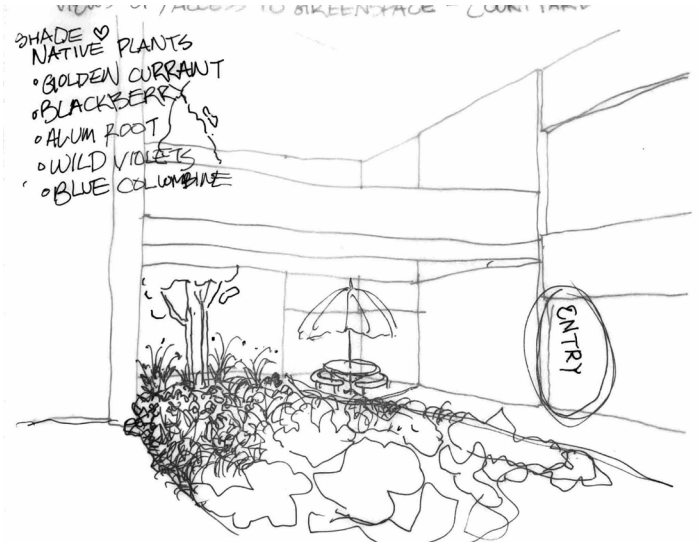
Bringing native plants from green space variable into the interior.

Views of / Access to Green Space

Existing Photo

Source: Image taken by the author.

Sketches



Key Plan

Step One - Site Analysis:

While evaluating the school's outdoor areas, I noticed that although the green space is expansive, it consists mostly of monotonous lawn. While areas like the sports field and the lawn west of the lunchroom see moderate use, the spaces between the classroom wings and to the south of the school remain largely unused. This underutilization is a concern, as these areas have the potential to serve as restorative environments if designed with care.

Step Two - Design:

To transform these underutilized areas, I propose integrating native flora, dedicated seating, and interactive design elements. By creating small, defined garden zones and seating clusters, the space can become a welcoming retreat that invites relaxation and social interaction. This approach would not only enhance the visual appeal of the greenspace but also provide varied environments that support both quiet reflection and collaborative learning.

Step Three - Results:

My research indicates that integrating natural elements and seating areas affords students a place for reflection, stress relief, and play. More frequent use of these spaces can improve cognitive function and create a stronger sense of community. By re imagining the green space of the school with native plantings and interactive elements, I anticipate that the school environment will become more inviting, fostering greater connection to nature and enhancing the overall well-being of students.

Native Plant Examples

Downy Serviceberry

Thrives in partial shade, produces edible berries that attract birds and pollinators, and changes color in the fall.

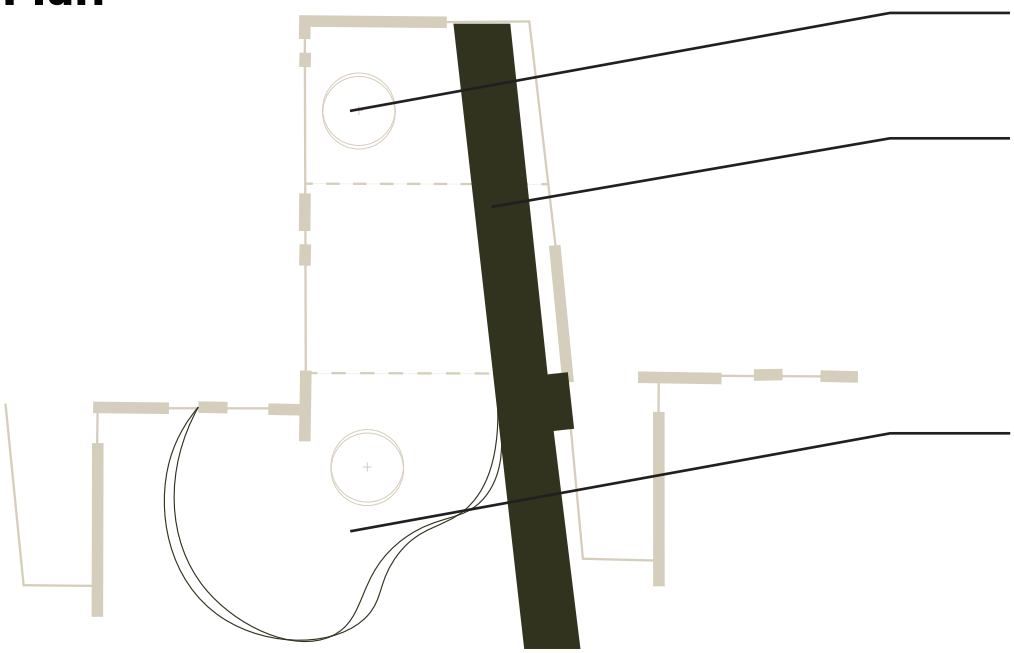
Parry's Primrose

Thrives in partial shade and most soils typical to Colorado woodlands. Produces delicate pink flowers, and attracts pollinators.

Sandberg Bluegrass

Native cool-season grass that performs well in partial shade. Aids in soil stabilization and erosion control.

Plan



Existing Trees

Narrowed Path

Making space for the introduction of native plants.

Native Planter

Introduction of shade plants native to Colorado.

06
Conclusions

This chapter outlines the research approach used to examine how school design impacts student mental health. A mixed-methods strategy combines site observations, spatial analysis, and literature review. Primary data includes field notes, photographs, and architectural assessments of Glenwood Springs High School, while secondary sources provide a theoretical foundation in neuroarchitecture and environmental psychology. Comparative case studies further inform the feasibility and impact of design interventions.

The goal of this project was to develop a framework of scalable design strategies that schools can implement to improve student mental health and wellbeing. At the beginning, I posed the question: How can design principles from Environmental Psychology be applied to create scalable renovation strategies that effectively and affordably improve student mental health and wellbeing? Through the course of this research, I explained how the five design variables I selected can positively and negatively influence student mental health and wellbeing and, by selecting a case study school, I was able to exemplify how different scale design strategies could be implemented into the learning environment of any school to increase the positive impact the environment has on students.

Glenwood Springs High School, a typical cinderblock and concrete construction high school built in the 1960s and remodeled in the early 2000s, served as the subject school. It, like many other schools built and remodeled around the same time, faces problems with overcrowding, lack of natural materials, unpredictable natural lighting levels, and problems with acoustic insulation. While not all U.S. public schools share the same lay out, they are constructed with the same pedagogical principles in mind and, as such, contain many of the same typologies as GSHS, including structured classroom layouts, large hallways for circulation, gathering spaces, lawns, lunchrooms and libraries. Due to these similarities in typology, it is valid to assume that design strategies addressing any one variable can be applied more broadly to other schools by following the guidelines laid out in the results section of this paper.

It is important to recognize the concerns schools may face when considering these improvements. Starting at the very first step, it is often difficult for schools to find the funding for large scale remodel projects, which is why each of the five variables has a small-scale, which translates to low-cost, design strategy. For example, in the natural materials category, merely ensuring that most rooms have at least a few plants in them can increase certain positive benefits. Likewise, arranging existing furniture in a library into a zoned layout and allowing students to rearrange whenever necessary to make spaces for different types of study benefits student wellbeing and encourages more ownership of the environment. Notably, as design interventions increase in scale, the benefits also increase; school boards and administrators have an opportunity to allocate or secure funding to improve spaces for students. In terms of implementation, timing remodels so that they are minimally impactful to students during learning hours, which means typically implementing strategies during the summer, is the best course of action. Another potential concern is regulatory and bureaucratic hurdles. Schools must comply with extensive construction regulations and building codes, as well as safety guidelines which may limit the scope of renovations and increase costs. Additionally, teachers, staff, and potentially students may resist changes to the environment that alter their established teaching routines. Overall, by keeping teachers, staff, students and communities' members informed about the changes being made and what the benefits are, schools can maintain transparency and help ease the transition.

Through the course of this project I sought to create design strategies that schools can use to affectively and affordable improve their surroundings to support student mental health and well being. While I do think that I was able to present strong concepts that hypothetically would improve student well being, there is certainly room for more research specifically regarding practical applications surrounding funding, and exploring real world effects on students with these implementations. I hope to pursue these areas of study further in the future. I think that the framework that I have provided is an extremely valuable resource that can be used as a preliminary evaluation of the existing environment of the school, and can also be used by advocates in developing proposals for improvement projects. However I would recommend further more professional testing with higher quality measurement devices if these projects were to be seriously proposed. Overall this project provides a great framework for initial evaluation and design ideation, and with a little more in-depth analysis the variables I developed, and the interventions I proposed could lead to a robust and restorative

school environment.

My project shows that design principles from environmental psychology can be applied to school design by evaluating existing environments with five key variables. Drawing on interdisciplinary research, I developed hypothetical solutions at various scales—visualized through collaged renderings—that illustrate how targeted interventions like incorporating natural materials or improving artificial lighting can enhance student and teacher well-being. Future research could measure the long-term impact of these strategies on mental health, investigate neuroarchitecture in schools, or compare approaches across different architectural contexts.

By implementing design changes based on these five variables schools across the U.S. can make significant improvements to their environment without unreasonable funding requirements. Meeting the optimal ranges outline in this project have been shown to have measurable effects on serotonin production, sleep schedule, as well as stress reduction; all of which are factors that have been proven to increase mental health. It has been shown that students with better mental health, and a stronger sense of place have better attendance and learning retention.

07
Bibliography

This chapter outlines the research approach used to examine how school design impacts student mental health. A mixed-methods strategy combines site observations, spatial analysis, and literature review. Primary data includes field notes, photographs, and architectural assessments of Glenwood Springs High School, while secondary sources provide a theoretical foundation in neuroarchitecture and environmental psychology. Comparative case studies further inform the feasibility and impact of design interventions.

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