# North Dakota State University
## Graduate School

**Title**

Building Blocks Towards New Education

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The Supervisory Committee certifies that this *thesis* complies with North Dakota State

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**MASTER OF ARCHITECTURE**

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BUILDING BLOCKS TOWARDS NEW EDUCATION


A Thesis
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**ABSTRACT**

The purpose of this research is to look at the effects digital technologies have had on education and explore ways educational facilities can react to these new technologies in the form of how we look at learning spaces. The goal with this thesis is not for it to be a guide but rather as a point of inspiration for educational facilities and designers. With the advancing development of digital technology, educational facilities are tasked with adapting to a society that has digital technology deeply ingrained in it. Educators and designers have a great opportunity to reevaluate our learning spaces and react to how digital technology might affect students learning. In the end, I used the words inclusive, exclusive, and circulation to identify and use of the space and populated\adjusted the area using a kit of parts.

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# 1. INTRODUCTION

We are living in a time where digital technology is advancing at an incredible speed. The permeation of digital technology into our everyday lives has only recently occurred within the past few decades. Even today, it seems as though there is some new technological breakthrough with each passing year (*This Timeline Charts the Fast Pace of Tech Transformation across Centuries*, 2023). Not only that but cutting-edge technology is trickling down into the consumer markets much faster than it has ever been before. Virtually everyone has access to extremely powerful tools that most people would not have thought possible just several decades ago. Technologies like smart phones, computers, tablets, digital home assistants, artificial intelligence, and so much more. Our day-to-day environments are inundated with these technologies to the point that a lot of people would be lost without them. Of these people, a large number of these consumers are children.

## 1.1. Problem Statement

Children today have access to all these technologies, and parents today have the monumental task of raising these kids with the world at their fingertips. But not just parents, the education system also has to adapt to these advancing technologies in order to keep up with the times. Schools are tasked with the adoption of these new technologies so that they do not feel outdated in order to give children the education they deserve. On the flip side, we have children who are sponges when it comes to learning. And they have access to the internet which includes the largest databases in the world, right at their fingertips. The education system has this immense task of both adapting and adopting to the rapid advancement of digital technology.

### 1.1.1. Research Question

With the rapid development of digital technology, how can schools adapt to the effects digital technology has had on education?

## 1.2. Objectives

The purpose of this research is to look at the effects digital technologies has had on education and explore ways schools can react to these new technologies in the form of how we look at learning spaces. My goal with this thesis is not for it to be a guide but rather as a point of inspiration for educational facilities and designers. This is a very well researched area and I do not think I have the authority to offer guidelines to educators and designers to design learning spaces in a certain way. My goal is to inspire people to look at our learning spaces and ask, "what else can we do here, how can we improve this space"; not just tell them "this is what needs to be done".

My research objectives include:

- Studying what impact digital technology has had on education.

- Identifying trends in classroom designs.

- Proposing a possible method to design new learning environments with the effects of technology in mind.

## 2. BACKGROUND

How has digital technology impacted education? What steps have already been taken to address technology within the classroom? What are the current trends in classroom design? These were the main questions I was asking myself in researching how digital technology has affected education and classroom designs. The effects of digital technology can be seen in many aspects of education as a whole and will play a large part in how designers and educators can approach learning space design.

Firstly, we need to define what digital technology is and what it might include. I'm going to use Marc Berman's definition from Programming Insider which he states that "digital technology refers to electronic tools, devices, and systems that process, transmit and store data in binary form."(2021) Essentially, devices like smartphones, computers, laptops, tablets, projects, smartboards, and all kinds of other electronics. With digital technology, it would be almost impossible to not include the internet and everything that comes with it. However, it is not the main focus of research but should still be noted as social media has had a monumental impact on every aspect of life. Here we will be looking at the possibilities that digital technology can offer to change the design of learning spaces.

### 2.1. Project Issues

### 2.1.1. Digital technology's impact on education

"Digital technologies have made a paradigm shift in the entire education system. It is not only a knowledge provider but also a co-creator of information, a mentor, and an assessor. Technological improvements in education have made life easier for students." (Haleem et al., 2022)

Haleem, Javaid, Qadri, and Suman provide an extensive article compiling applications digital technology has in education. Their journal article titled *Understanding the Role of Digital Technologies in Education: a Review* lists 34 different applications digital technology has in education, including descriptions and multiple references for each. A few I want to highlight are:

- Creating Inclusive learning environments

- Developing teamwork and communication skills

- Flexible education

- Students gain self-learning abilities

- Dynamic learning

This article goes to show how impactful digital technology can be in education. It is no secret that digital technology is extremely versatile. So, why not take advantage of this and better integrate it into our education? With how common electronics are now with the youth, kids' attention span and interests is a great place to look to encourage engagement with the learning material. Better integration of digital technology will also allow educators to better equip students for the future and its uncertainties (Haleem et al., 2022).

In another article titled *The Architecture of Ideal Learning Environments,* Emelina Minero talks about how devices like projects, screens, and sound systems not needing to stay in the classroom but instead, integrating these technologies in other places like hallways, common spaces, and cafeterias. In addition, they allow students access to the network anywhere on the campus, which includes outdoor spaces. She writes "The effects can be subversive in all the right ways, reducing students' dependence on the teacher, promoting peer-to-peer collaboration, and widening the sphere of learning from the confines of the classroom to the whole school

grounds." (2018) This goes to show how technology is starting to evolve not just in the classroom but other areas of the school as well.

### 2.1.2. Trends in classroom design

By far, the most common trend in classroom design is flexibility. Classrooms and learning spaces are being more and more flexible for students' needs (Wierman, 2016). This can be seen in the types of furniture used in classrooms (NorvaNivel, 2017) or by extending education beyond the classroom into other areas of the school (Minero, 2018).

Embracing technology is also a trend in looking at classrooms differently. Technology has the power to foster engagement, inclusivity for different learners, and allows for more interactivity (Davies et al., 2013; Long, n.d.; Wierman, 2016).

## 2.2. Project Type

This thesis will attempt to address this the research question through a kit of parts. Lot of research has been done on what learning spaces could and should look like going forward. One of the main inspirations for my proposal is Fargo Public School and their process to implement a Self-Directed Learning Academy in the city. However, I want to create a method that allows for flexibility for designers and educators. In that sense, this method of design could be retrofitted into existing architecture and existing educational facilities. Giving more definition to learning spaces and creating a visual kit of parts is my approach to inspiring a different way of looking at our learning spaces.

## 3. METHODOLOGY

My approach to answering my research question is to use qualitative research based on the information I have gathered from when investigating my project issues. That information will inform my reasoning for my proposal to a new method of design for learning spaces. It will help me create definitions for spaces and inform how to use the kit of parts.

### 3.1. Fargo Public Schools and Self-Directed Learning Academy

Early on in my research, I came across a Fargo Forum article talking about a process to pass a Self-Directed Learning Academy for Fargo Public Schools. It mentioned implementing "a new Self-Directed Academy, a program allowing students to use technology to master concepts at their own pace." (Huebner, 2024) This seemed like an interesting concept to explore and research. So, I began to look into the concept of self-directed learning academies. The Montessori method of education was something that I came across in my research, but I did not fully adopt the idea as I wanted to keep my solution more flexible.

Fargo Public School's self-directed learning academy is an attempt to create a program that embraces the idea of giving more agency to the students. By doing so, it is the hope that students will be encouraged and more engaged in their learning. There is a big emphasis on allowing students to work at their own pace, achieved through flexible learning apps and technology (Gandhi et al., n.d.).

I also got the opportunity to interview Dr. Gandhi and Dr. Grosz (the superintendent and the associate superintendent respectively) of Fargo Public Schools and inquire about what, why and how they are going to implement the learning academy. They also provided a document detailing their research and possible plans for implementing the academy. Their plans for the

learning space also align with current trends in classroom design; that being, open and flexible

learning spaces to accommodate for different learners and teaching styles (Gandhi et al., n.d.).

### 3.2. Project location

This research also led me to figuring out where I would want my site to be located for

this project. Given that I wanted to keep this project local to me, I kept my project in Fargo, ND.

After talking with Dr. Gandhi and Dr. Grosz, I gained some insight into researching where I

could possibly implement the design method I was developing. The Fargo Public School website

had lots of resources to public meetings and discussions about the Fargo public school system

and after taking a look, I decided on using the Roosevelt Elementary School as my project

location based on the building being historical in age and being a centrally located school.

### 3.3. Case Study

Rosan Bosch Studio was a firm I came across while researching learning spaces and

classroom design. They are leaders and innovators of design for learning environments, boasting

awards such as International Design Awards, an Architizer Award, an INSIDE Award, and

others. This was a great case study to look into as they have had a long history with pushing

design of learning spaces in education but also in the workforce. They provide a little bit of

insight into how they go about designing these spaces on their website.

Rosan Bosch has an article on their website describing their approach to design titled

*Learning Spaces Need to Enable and Motivate Every Learner*. As humans, we all have a unique

way of learning things, this article highlights the need to notice and accommodate different ways

of learning. Rosan Bosch bases their design on six principles that take common types of learning

and synthesizes it into metaphorical terms that aims to frame the terms in a very approachable

way for both designers and non-designers.

These are the six principles:

- Mountain top

- Cave

- Campfire

- Watering hole

- Hands-on

- Movement

Rosan Bosch's way of framing these terms make them relatable in a way that allows others to visualize how that particular principle may look visually. For example, the 'cave' principle can be easily tied to a very intimate and sheltered space of learning for someone (Rosan Bosch Studio, 2019). This approach to describing space in an easy and understandable way is something I hope to translate into my project.

## 4. RESULTS

### 4.1. Analyze and plan.

In my final results I take the 2nd floor of Roosevelt Elementary School and create three different iterations of what that space could look like. I only redesigned the second floor to show the simplicity of the project and that implementing this method does not require a full redesign of the entire building. But the first step to implementing my kits of parts is to analyze and plan the space in question.

For this portion of the method, I want to label spaces with three different terms. Inclusive, exclusive, and circulation. By keeping the labels to a low quantity, I hope for it to be simple but meaningful enough to help define what a space could potentially be. This also allows for flexibility by not boxing spaces into a very specific use case.
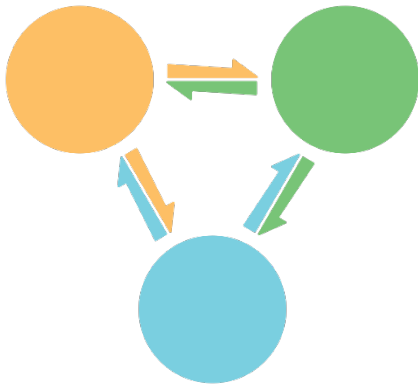
### 4.1.1. Inclusive



**Figure 1.** Inclusive Symbol

> "[Spaces that] accommodate different activities without relegating them into the distinct spatial divisions of rooms with doors... No matter where you are in the space you feel included with what is going on." (Platt, 2005)

I got this term from Christopher Platt's journal article titled *The Inhabited Perimeter and the Inclusive Room*. In his article, this definition was in the context of designing a residential home, but it works perfectly in the context of an educational space as well. Inclusive, Platt's definition, and the literal definition all describe my intention of the space extremely well. Inclusive spaces have a back and forth that happens between it and its surroundings.

These spaces are also accommodating for special needs students as they provide a variety of different ways to learn. This creates an opportunity to explore accessible solutions to learning using technology. This can open the door for self-help robotic assistants if students don't want to talk to the teacher or if the teachers are spread thin with help.
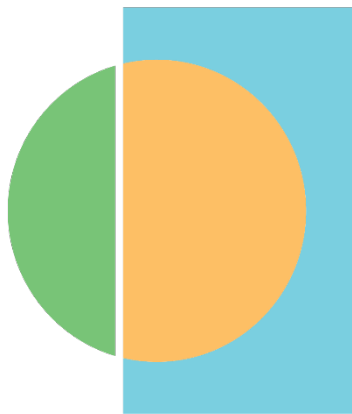
### 4.1.2. Exclusive



**Figure 2.** Exclusive Symbol

The idea behind exclusive spaces are to provide an area for students to get away from busyness and allow for a more focused space of learning. This could include breakout spaces, study nooks, or even the traditional classroom. One thing to note is to being careful not to isolate these spaces completely. Maybe you separate the space visually using a partition wall or you separate the spaces auditory but leave glass walls or windows to keep it connected visually. This allows for exclusive spaces to still have a connection to the spaces surrounding it.
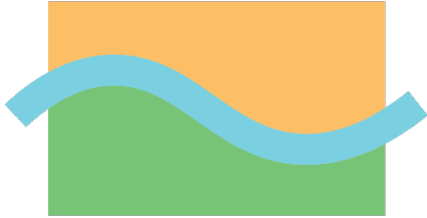
### 4.1.3. Circulation



**Figure 3.** Circulation Symbol

Circulation is important to the design of learning spaces as it not only directs traffic but also provides many design opportunities. This is a space that everyone will use and will walk through. Here, you have the opportunity to see others and be seen by others. By directing traffic, it can dictate the structure of an open floor room or frame students' view while getting from one place to another. The different possibilities the circulation provide are important to how that space may function.
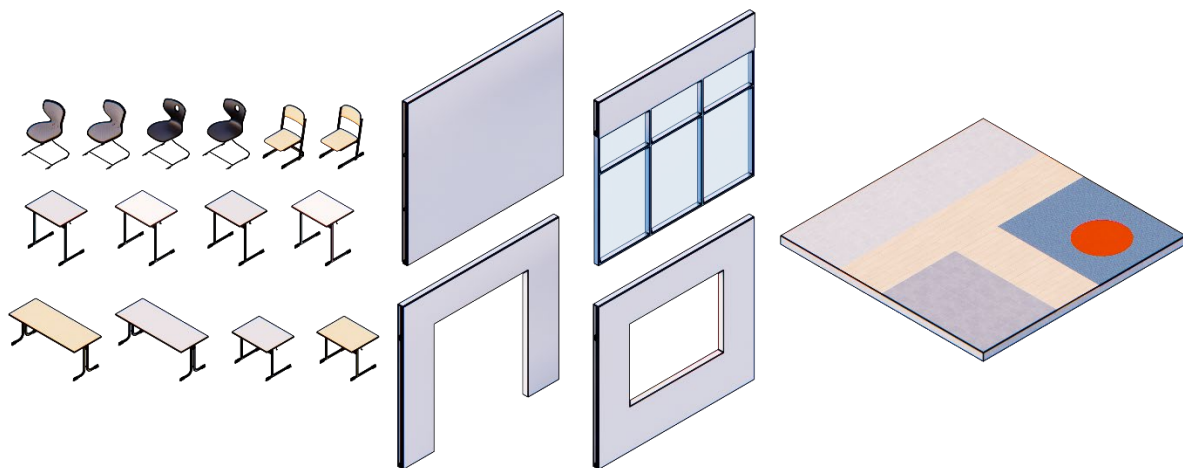
## 4.2. Kit of parts


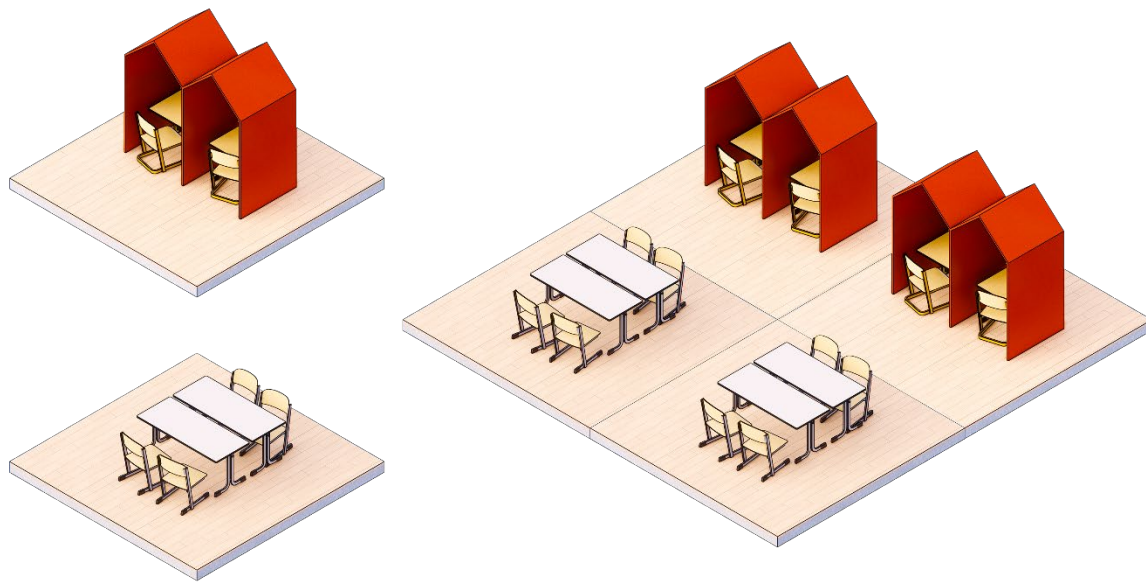
**Figure 4.** Kit of Parts

**Figure 5.** Example Spaces

The kit of parts is a way for designers and non-designers to visualize a space and organize it. Quick iterations using the kit of part allow for a flexible workflow and a way to visualize different options for what a learning space could look like.

## 4.3. Roosevelt 2ⁿᵈ Floor Redesign

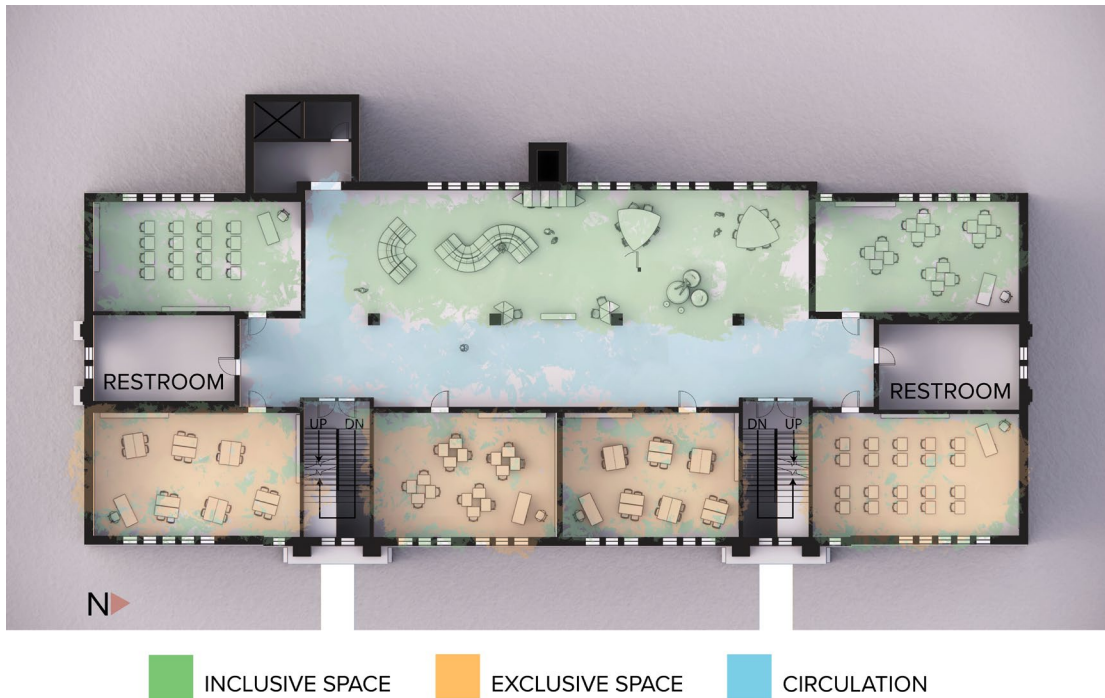### 4.4. Floor Plans



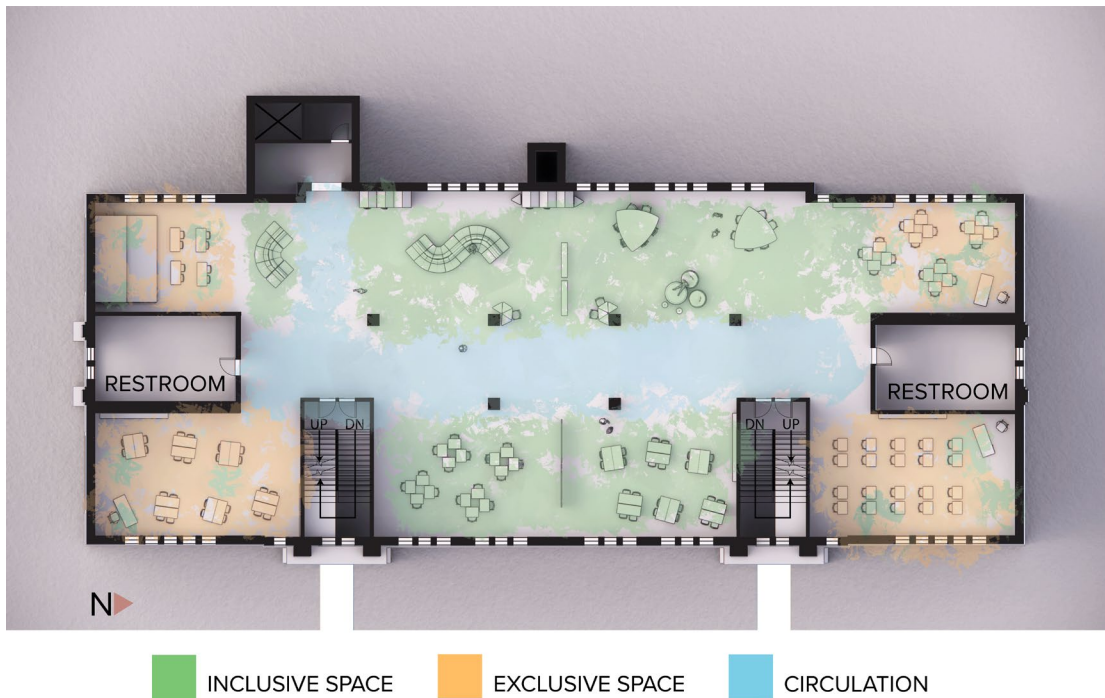**Figure 6.** Original Layout Floor Plan
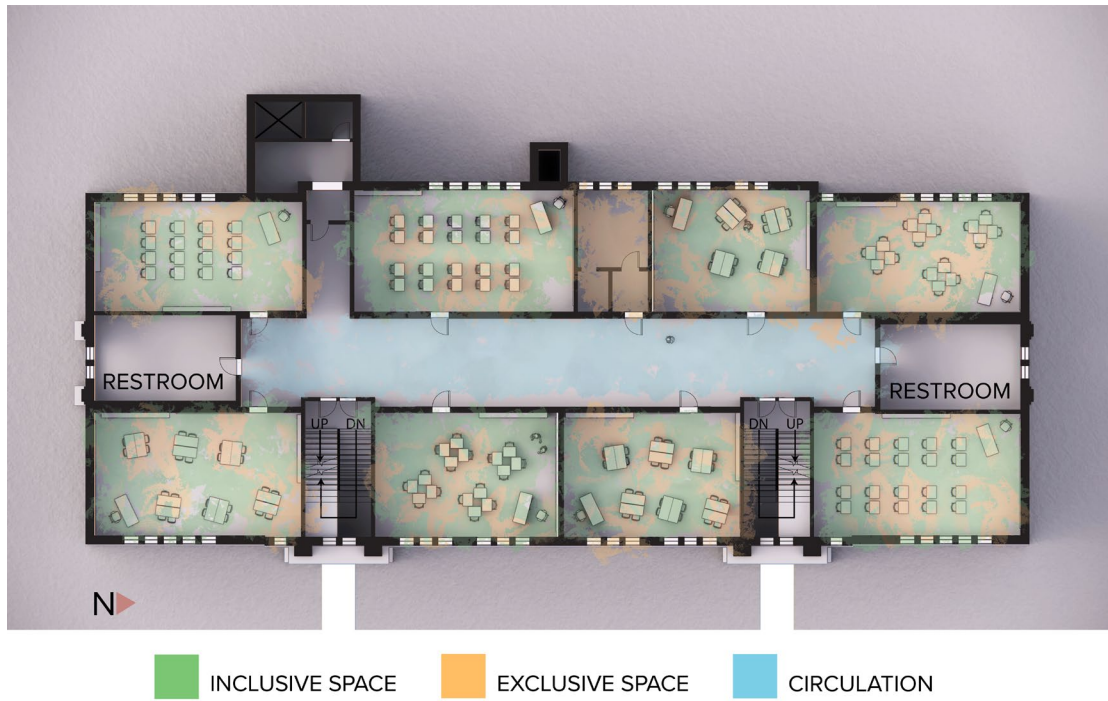


**Figure 7.** Semi-Open Layout Floor Plan

**Figure 8.** Open Layout Floor Plan

## 4.5. Isometric Views



**Figure 9.** Original Isometric View

**Figure 10.** Semi-Open Isometric View



**Figure 11.** Open Isometric View

## 4.6. Renderings



**Figure 12.** Original Floor Rendering



**Figure 13.** Semi-Open Floor Rendering

**Figure 14.** Open Floor Rendering

## 4.7. Conclusion

As I mentioned in the introduction, there is a lot of research done in this area. There is a lot of research out there and it is very easy to get sidetracked and go down a rabbit hole that does not pertain to your original research. That being said, this also means that there are other ways and angles to tackle this research question.

My hope with this research is that it is a starting point or a point of inspiration to anyone who takes time out of their day to read my research. We are on the cusp of a potential shift in the education system. Whenever there is talk about schools, I always hear how there needs to be change. The challenge is what direction this change is going to take, but what's inevitable is technology playing a significant role in that direction.

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# APPENDIX

## A. INTERVIEW NOTES

### A.1. Prepared Questions for Interview with Dr. Gandhi and Dr. Grosz

- Gandhi brought forth the idea, how did you come across the idea?

- To both, what's the vision of what this academy would look like?

- I understand that this academy is targeted for students that are "further away from educational justice" and students who are "not currently benefitting from the system." Can you elaborate on what that means?

- As a follow-up, I read that there was going to be some meetings with kids and their families to learn about their "learner profile" and, to my understanding, that this profile is what would be used to determine if the kid would benefit from this type of academy and fit some criteria. If you can share info about it, how did those meetings go? Can you elaborate about this "learner profile".

- In the article, it said that teachers would more or less take a "mentors" role in this academy. Can you elaborate on that?

- Something I find important in schools is student interaction. Of course, in a traditional school setting, there's interaction through classmates, teachers, extracurricular, and even something as simple as lunchtime. What kind of change do you see in student interaction in an academy like this? Student-student? Student-mentor?

- Will there be interaction between the K-8 and high school students?

- As I understand it, generally high school is a pathway that prepares students for college. Of course, there are resources for students to learn about vocational studies

like shop class or a maker's space. Would this academy also serve students interested in vocational studies? And what kind of facilities would be needed to accommodate these students?

- K-12 school, I understand that they'll still be divided into Elementary, Middle, and High school. There was a little bit of information shared about how each would operate. Is this still accurate?

- It was said that South High would accommodate the S-DA, is this still true? If possible, can you share more about how South High would accommodate the academy? Or the physical location of the building?

- New Construction?

- Renovation?

- As a follow-up, how would the academy interact with South High? Would the high school students be allowed to participate in the extracurricular activities there?

- How do you envision this new type of classroom for each grade level?

- What kind of facilities would be needed in this kind of academy?

- Maker's space, shop classroom, lunchrooms, teacher's lounge, etc.

### A.2. After Interview Notes and Reflection

The facility that they are currently developing is a space that will accommodate students that are opted into the program. Students will be given control over their education and will be allowed more independence. Even so, teachers will still have a vital role in instructing the students. Rather than the teacher directly instructing the students, teachers will be there to guide them. "Mentor" and "coach" are both descriptors given to their new roles they need to fill. Additionally, teachers will be responsible for a "team of students" and multiple teachers will be

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assigned to this team. Workspaces will be flexible and adaptable for the students. A designated start and end time will still be present for the school day. Extracurricular activities will still be available to the students as after-school activities. Students are given more agency over how to proceed with their education. "Educational Justice" extends to students who are affected by outside sources that affect their school life. Under the traditional system, students who are affected by some outside source will be behind and no longer in line with their peers. Creating a disparity between them and their education, which the system has left them behind; having them need to catch up. The idea is for this school to allow students to work at their own pace.