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The Effects of the Fab Lab Learning Environment of Students with Mental Health Diagnosis

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Submission Statement

Doctoral Capstone Project Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Education (EdD) in Education

Administration and Leadership

California University of Pennsylvania

August 2020

California University of Pennsylvania

School of Graduate Studies and Research

California University of Pennsylvania

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Acknowledgements

I dedicate this to my mother, the late Marilyn Martin. She has always been – and will continue to be my rock. I love you mom. Her wish for me before she left us was for me to do this, and every time I wanted to quit, I thought of her. To my children, Baylee and Logan; let this be an example that you can do anything if you put your mind to it…Love you both. To Chris Sefcheck and Tammy Mandich; thanks for all of the late-night texts and encouragement to get me through this. You two are special people. Dr. Todd Keruskin, you pushed me to limits I've never been, and I thank you for being you. To my external advisor and friend, Dr. William Henderson; thanks for all of your guidance. To Dr. Kristin Szewczyk, thanks for stepping-in when I needed someone to keep me focused. You saw me through the finish line. To all of my colleagues at Intermediate Unit 1; what an awesome bunch of people to work with. To the late, great Tom Knight; my mentor, my colleague, my friend. Not a day goes by that I don't think about you, Doc. You're the reason I got this far in the first place. Thanks for taking a chance on me. And finally, to a third grade Colonial student named Robert, who caught my eye one day and pushed me to begin working on this study. He may never know it, but Robert may have shifted the future culture and pathways in which we educate students with mental health diagnoses.

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Glossary

Adjustment Disorder (AD) - A group of symptoms, such as stress, feeling sad or hopeless, and physical symptoms that can occur after you go through a stressful life event.

Attention Deficit Hyperactivity Disorder (ADHD) - Any of a range of behavioral disorders occurring primarily in children, including such symptoms as poor concentration, hyperactivity, and impulsivity.

Bipolar Disorder - A mental condition marked by alternating periods of elation and depression.

Comprehensive Therapeutic Support – An academic/therapeutic program for students with mental health diagnosis. The program requires 15-hours of social work service per week.

Conduct Disorder (CD) - A range of antisocial types of behavior displayed in childhood or adolescence.

Dessert projects - A short, intellectually-light project served up after the teacher covers the content of a unit in the usual way - from a "main course" project, in which the project *is* the unit.

Fab Lab - A Fab lab is a small-scale workshop offering digital Fabrication. A Fab lab is typically equipped with an array of flexible computer-controlled tools that cover several different length scales and various materials, with the aim to make "almost anything".

General Anxiety Disorder (GAD) - Excessive, exaggerated anxiety and worry about everyday life events with no obvious reasons for worry.

Intermediate Units – Educational service agencies located in the commonwealth of Pennsylvania to support designated districts.

Mental Health – A person's condition with regard to their psychological and emotional well-being.

Makerspace - A place in which people with shared interests, especially in computing or technology, can gather to work on projects while sharing ideas, equipment, and knowledge. Makerspaces include technology that communicates with machinery for design and innovation.

Obsessive Compulsive Disorder (OCD) - A personality disorder characterized by excessive orderliness, perfectionism, attention to details, and a need for control in relating to others.

Oppositional Defiance Disorder (ODD) - A childhood disorder that is defined by a pattern of hostile, disobedient, and defiant behaviors directed at adults or other authority figures.

Post-Traumatic Stress Disorder (PTSD) - A condition of persistent mental and emotional stress occurring as a result of injury or severe psychological shock, typically involving disturbance of sleep and constant vivid recall of the experience, with dulled responses to others and to the outside world.

Project-Based Learning (PBL) - A student-centered pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real-world challenges and problems.

Social Anxiety Disorder - A chronic mental health condition in which social interactions cause irrational anxiety.

STEM - A curriculum based on the idea of educating students on four specific disciplines – science, technology, engineering, and mathematics – in an interdisciplinary and applied approach.

Trauma - A deeply distressing or disturbing experience.

Schizophrenia - A long-term mental disorder of a type involving a breakdown in the relation between thought, emotion, and behavior, leading to faulty perception, inappropriate actions and feelings, withdrawal from reality and personal relationships into fantasy and delusion, and a sense of mental fragmentation.

"World-Wide" Fab Network - An open, creative community of Fabricators, artists, scientists, engineers, educators, students, amateurs and professionals located in more than 100 countries and 1,750 Fab Labs across the globe.

Abstract

For years, students with mental health diagnoses have encountered many barriers in their respective education programs. Teachers and other professionals have been unsure and unaware of many of the successful strategies to engage these students in learning and providing essential skills for success in life. All too often, medication has become the primary way to alter behaviors and symptoms of students who suffer from mental health issues.

This study focuses on a group of students who have at least one mental health diagnosis. Through reviews of literature, a historical timeline is presented on strategies provided to these students, as well as a definition and overview of many of the common types of mental health diagnoses. Students are observed in both the traditional classroom environment and the Fab Lab. The purpose of this study is to determine if student behaviors, attendance, and mental health symptoms can be minimized and altered in the Fab Lab setting which could promote more learning opportunities. The study also includes analyzing teacher and social worker perceptions on both learning environments.

Chapter 1; Introduction

In early public education, woodshops, metal shops, print shops, and home economics instruction areas were very common in a high-school design. These courses were taught individually, and, in many cases, these were popular electives for students to take. In these courses, students learned how to cut and carve wood and metal; how to graphically design something and transfer to another surface; and how to sew, craft, and weave. Students that participated in these courses usually weren't on a college track, but instead were interested in learning a trade.

In 1917, the Smith-Hughes Act authorized federal funding for schools to begin vocational education programs. From the onset of these programs, students who were destined to be laborers were moved into vocational ed. Prior to this act, only "privileged" or college-bound students attended high school. With the rise of factories in the United States, the vocational/technical schools housed students who traditionally did not perform well academically and were destined to be blue-collar workers in factories. There was truly a segregation based upon academic performance.

Unfortunately, this segregation would continue for years to come as students who underachieved in the classroom and/or had behavioral issues were shipped to the vocational/technical schools. The alternative to this were for these students to participate in shop classes at the student's respective high school. This certainly didn't bode well for the reputation of these specialized schools and classes. That is, until the age of design and Fabrication came at the turn of the 21st century.

Fabrication Labs originated from the Massachusetts Institute of Technology (MIT) and was the conduit to converge analog equipment to digital technology. These

labs contain all aspects of traditional learning shops, with the addition of technology that provides precision in project completion. In Fab Labs, students – regardless of academic achievement – can excel individually and/or working in groups to complete projects. 3-D printers, laser and vinyl cutters, CNC routers, and embroidery machines are just a few examples of this state-of-the-art equipment.

In October of 2015, the Intermediate Unit 1 (IU1) opened its first Fabrication Lab (Fab Lab) in an alternative/special education/social-emotional learning environment. This initiative was made possible through grant-funding from the Chevron Corporation. Chevron drilled and operated several gas wells in the Southwestern, Pennsylvania during this time and the funding was offered as a corporate/community initiative.

Students at this Fab Lab were provided at least one period per week working in this maker-space environment. Since then, informal, preliminary data collected from Individualized Education Plans, Behavior Plans, Goals, etc. has shown that, while working in this environment, these students have shown improvements in behaviors and attendance.

Intermediate Unit 1 provides mental health services through its campus-based program Comprehensive Therapeutic Emotional Support (CTES). These students may or may not be classified as special education. However, all have some form of a mental health diagnosis (bipolar disorder, schizophrenia, etc.) This study focused on three of these classrooms at the Colonial School site. The classes were grouped by grade level: 3-5, 6-8, and 9-12.

The researcher is currently the Executive Director of IU1 and, prior to April of 2019, was the Assistant Executive Director. One of the main duties of this researcher was to oversee all academic phases of the IU1 campus schools.

The purpose of this study was to find a distinct conclusion of determining if the effects of the Project-Based Learning in the Fab Lab environment would improve student discipline and attendance. This study also analyzed teacher perceptions of the Project-Based Learning versus a traditional learning environment.

This study focused on student behaviors and attendance while working in the Fab Lab learning environment. It also analyzed teacher perceptions of this type of learning. While this topic was relevant in my profession, there didn't appear to be much research – particularly with students with mental health needs. Therefore, both practical Action Research as well as participatory and classroom action research methods, in this researcher's professional opinion, were prudent in analyzing project/problem-based learning with students with special needs.

The study included students with mental health disorders located at our Colonial School. Students from three (3) CTES classrooms was the focus, along with the three classroom teachers and social workers assigned to this program. Data collection to create student profiles was collected prior to the actual study beginning. Both qualitative and quantitative methods were utilized through surveys, teacher questionnaires, as well as behaviors charted from the Class Dojo System. Attendance data was collected from the Alma Student Information System. Finally, the Chartlytics Data Analysis system was used to chart ongoing student behaviors/incidents. Chartlytics is a real-time digitized platform that captures running records on iPads, cellular phones, computers, etc. This

program was created out of the Pennsylvania State University and Intermediate Unit 1

has utilized this platform since its inception in 2016.

The research conducted was also team-action oriented. By utilizing a "Design-

Team" approach (a panel representing the entire school community), this process was

used to collect and analyze the relevant data, while formulating a plan to change or alter

the problem. This research also included an ample amount of reflection to support our

findings. This was conducted at the school-level; by using this approach, the goal to

create a somewhat personable, relatable, and real-life education situation.

Research Questions

1. Will students with mental health diagnosis (CTES) show a decrease in negative

   behaviors (Level 1 and 2 infractions) while working in the Fab lab?

2. Will attendance increase for students with a mental health diagnosis (CTES) if

   they spend more time in the Fab Lab than in a traditional classroom setting?

3. What are the teachers' perceptions of utilization of the Fab Lab as a learning

   environment compared to a traditional learning environment?

4. Will students' observable symptoms of mental health diagnoses decrease as a

   result of working in the Fab Lab environment?

   The actual study was conducted from October, 2019 through June, 2020.

However, there were data reviews conducted from June, 2019 – August, 2019 to gain

prior knowledge on students' profiles. The research began with surveys and

questionnaires disseminated to students and staff at the beginning of the school year.

Throughout the course of the study, data was reviewed relative to student perceptions,

behaviors, attendance, and academic achievement. The resources utilized for this study

was the Chartlytics Data Analysis platform, Class Dojo, as well as the ALMA Student Information System.

As mentioned previously, pre-data collection began in the summer of 2019 and provided a baseline for the study. There were two areas focusing on the students – a review of students' past discipline incidents and attendance – that were analyzed and documented. Teacher perceptions of this type of learning were also analyzed. At the beginning of the study, teachers were provided with a questionnaire pertaining to initial perceptions of project-based learning, following an overview of this type of learning.

Chartlytics data (quantitative) was collected throughout the course of the year by both teachers and assigned social workers. This data provided information relative to common behaviors previously documented by these professionals. Student attendance was collected through Class Dojo on a quarterly basis.

Data was also collected and analyzed (beginning, mid-point, and completion of the study) on teachers and social workers relative to perceptions of student progress/behaviors as it will be a vital component of sustainability of this type of instruction.

Chapter 2; A Review of Literature

In recent times, mental health and wellness has become a major focus in education settings. During this same time span, makerspaces or Fab Labs have become quite popular in today's schools. While there were several resources that expound on the benefits of makerspaces/Fab Labs and mental health, there were very few sources that discussed both topics simultaneously. This has made research challenging as the two subjects were rarely associated with one another. The focus of my research reflects the benefits garnered from a makerspace – Fab Lab (Fabrication Laboratory) – that is augmented with the provision of mental health services for Intermediate Unit 1's Comprehensive Therapeutic Emotional Support students who have had issues in the regular education environment. Over the past three years, the Intermediate Unit 1 leadership and staff have added mental health services to Comprehensive Therapeutic Emotional Support students' Fab Lab classes as an integral part of each session. Students also receive continuous time and attention with their social worker in regular classes, their group therapy time, and free time; but the addition of a social worker, as part of the teaching staff in the Fab Lab, is a more recent supplement to the Fab Lab time for students.

Intermediate Unit 1

Pennsylvania's Intermediate Units (IUs) are regional education agencies that reach beyond the level of school districts but below the state Board of Education. While responsibilities span from adult education to teacher training, one key population they support is the student who is not being served by traditional instructional approaches and settings. Some of this support is integrated across public schools, but some other support

occurs in specialized classrooms in campus-based schools operated by the Intermediate

Unit 1 where specific student needs are addressed. Specialized classrooms that are

hosted by Intermediate Unit 1 are Emotional Support, Autistic Support, Therapeutic

Emotional Support, and Comprehensive Therapeutic Emotional Support classrooms.

Here, additional resources – such as individual and group therapy, occupational and

physical therapy, all facilitated by certified specialized educators, are available. Students

enrolled in these specialized classrooms often do so on a temporary basis, with the

overall goal of successfully re-matriculating back into the student's residential district

(Baker, 2018).

Intermediate Unit 1 is one of 29 Intermediate Units across the Commonwealth of

Pennsylvania. Intermediate Unit 1 serves 25 school districts in a three-county area

(Fayette, Greene, and Washington Counties) or approximately 55,000 total students.

Intermediate Unit 1 operates three campus schools (Colonial, Laboratory, and

Waynesburg) with two makerspaces of Fab Labs in both Colonial and Waynesburg

(Laboratory's Fab Lab is currently being constructed). These campus schools consist of

students with a variety of disfunctions and disabilities including but not limited to mental

health, autism, and alternative education (Intermediate Unit 1, n. d.).

> With these types of disabilities, there was much discussion relative to exposing
> this type of learning to these students. The initial hope had been that offering new
> instructional approaches would improve academic engagement for the student
> body. But the effects have been felt far beyond the lab itself. (Baker, 2018)

The History of Makerspaces

Fab Labs weren't always called Fab Labs or even makerspaces, but instead began several years ago in schools as woodshops, metal shops, graphic arts shops, and occupational shops. These programs consisted of a curriculum that included classes such as architectural drafting, electrical and mechanical engineering, and wood design. These shops date back to the late 1950's and were segregated between males and females. The boys' shops consisted of mechanical, building construction, machinery, sheet metal, and electronics. The girls' shops were primarily occupational (retail, restaurant, hairdressing, home management, and hospital services). "The aim of the occupational program is to educate students not only for employment but for personal, social and educational development, so that they may take their place as responsible, respected, contributing members of the community" (Ontario Department of Education, 1969, p. 2).

Except for being segregated by gender, along with modernized equipment, the early labs weren't designed all that differently from our current ones, and the curriculum has similarities. Technology has since replaced design tools such as a compass, or even a tape measure and pencil. In traditional shops there were machines such as bandsaws, lathes, wood planes, grinders, and files. While some of these machines and tools may still be located in a modern makerspace, modern machinery is now programmed to communicate with technology, adding precise detail to the completed project.

For example, as documented from the Ontario Department of Education (1969),

The electronics laboratory suggested here is designed to provide space for student education in the subject theory while giving ample opportunity for experimental work and practical applications. Since many students will proceed to post-secondary education, teachers will likely give a broad introduction to basis

electronic theory with a variety of applications from different segments of the

electronics industry rather than concentrate heavily in any narrow field. (p. 35)

While there are distinct differences between the traditional and modern

occupational labs, surprisingly to this researcher, there is research that supports the fact

that students with disabilities were integrated into traditional makerspaces. One study,

"Woodworking Guide for Visually Handicapped Students" (Gaver, 1972) proved that

there were modified curriculums nearly 50 years ago that supported students with special

needs. An early travel technique for visually-impaired students to move about the shop

was called the "Hand and Forearm Technique" and is explained in a research project.

The technique was used by an individual with a visual impairment to locate obstacles

when traveling without accompaniment in an unfamiliar or changed environment. Any

objects located at shoulder-height would be detected by the individual's hand, which

would provide ample time before the body would make contact with the obstruction.

While it appears that there was support for students with disabilities in traditional

shops, research shows that this existed primarily for students with hearing and/or vision

disorders. Traditional special education classrooms were segregated, and these students

were primarily grouped together. Over a period of approximately 50 years, several

additional diagnoses have been discovered such as autism, attention-deficit disorder,

oppositional-defiance disorder, to name a few. Inclusion, including students with

disabilities in mainstream education, is now prevalent in schools and least-restrictive

environment regulations prohibits schools from segregating students with special needs

and promotes equal participation for all students.

Throughout this research, there were various examples and sources where traditional makerspaces did provide assistance for special-needs students. However, there was no research found that connected Fab Labs/makerspaces with students with mental health diagnosis in traditional forms of making.

Libraries as Makerspaces

By the early 2000's, many traditional wood, metal, and graphic arts shops became somewhat obsolete in high schools as much of these projects and curriculum were moved to career-technical centers. This left a void for students that chose not to attend these programs. At the same time, libraries began to evolve as much more than places to read or find references.

> Libraries have always been places for making knowledge, building insight, and launching investigations into the nature of things. Adding a makerspace component to a library is the natural next step to bring innovative learning and productive self-expression to patrons and helps libraries take their rightful place as cultural and creative community hubs. Now, instead of serving as a passive source of archival information, the library can become an active source of skills acquisition and productivity. (Willingham & DeBoer, 2015, p.1)

Libraries began to evolve into workspaces for entire communities. According to Willingham and DeBoer (2015), the first library Fab Lab was in Fayetteville, New York. This lab focused primarily on 3-D printers and was developed by Lauren Britton. It was developed by librarian Lauren Britton, who said in a *Library As Incubator* article in 2012, "Makerspaces are places where people come together to create, collaborate, and share

resources and knowledge – an idea and concept that fits perfectly with the mission and vision of public libraries" (Willingham & DeBoer, 2015, p.3).

Modern Fab Labs or Makerspaces

Fab Labs are also called "makerspaces" and provide a plethora of valuable learning opportunities for students. According to Anderson and Kim (2019b),

> Maker Spaces are innovative technology-based settings within a school or other facility that create a collaborative workspace for students to explore learning using tools to invent and discover with tools, materials, and technology beyond what they have in their classroom. They allow the designing, making, and production of materials to be the responsibility of the people (students or others) using them. (p. 2)

Unlike traditional classrooms, where students are provided instructions to complete assignments/projects, modern instruction in makerspaces encourages students to brainstorm for potential projects along with creating steps to finalizing the project. Students are now challenged to think beyond a textbook or lesson plan. They are encouraged to create the plan. Failure throughout this process is not considered as negative, but instead as a part of the learning process. In addition, makerspaces place instruction in a culturally or locally relevant context, provide a platform for making meaning of three-dimensional phenomena, and offer a way for students to make sense of the lessons beyond the classroom as recommended for science education going forward (National Academies of Sciences, Engineering, and Medicine, 2011).

Modern makerspaces promote more than completing a task for a grade. They provide opportunities for students to acquire vocational skills, as well as other essential

skills necessary for success in the 21st century, such as problem-solving, working in groups, creativity, and fulfilling a task to completion (Watson Institute, 2018).

The curriculum in makerspaces is cross-curricular by design. Fabrication and design are exposed through science, technology, engineering, and mathematics (STEM). Studies of locally focused student investigations using advanced technologies have found that technology is an effective way to support student inquiry and often significant increases in science content knowledge. Further, using technology and place-based learning allows students to see the use of their STEM skills leading to their being more engaged in STEM learning (Coulter, Lawlor, Klopfer, Sheldon, & Rosenheck, 2011).

Learning in the Fab Lab is designed for students to see the "big picture" of learning with the understanding that students will be provided with experiences that will prepare them for post-secondary education and/or workforce development. Fab Labs (Fabrication Laboratories), as an example of makerspaces, are technical platforms for STEM education, workforce development, and business idea prototyping. Students have the opportunity to explore the entire engineering design process in real-world contexts as they progress in their projects from concept to drawing, models to prototype, and redesign to final product (Fab Foundation, 2019). A Fab Lab affords hands-on learning opportunities to students while fostering cooperation and collaboration skills (Vercelletto, 2018).

Fab Labs also support differentiated instruction through a focus on student interest, giving them a place to invent, learn, mentor, and innovate, with access to the materials and technology needed to do so (Fab Foundation, 2019). In addition to this, many Fab Labs work with the local community, often garnering additional support and

interest in what students are doing. The community involvement also promotes an opportunity for students to take leadership roles and learn how local government operates as they may be asked to attend council or municipal meetings. Students are encouraged to communicate with community leaders to determine projects to be completed.

Students with disabilities often find success in the learning concepts of the Fab Lab. Group projects provide for collaboration and assist in learning appropriate communication skills. Some of the characteristics of the basic Fab Lab approach overlap the set of characteristics of learning environments that are effective with students with disabilities. For example, they can often provide them with a calm environment that allows them to redirect their focus to an education activity (Vercelletto, 2018).

Fab Lab instruction often utilizes an inquiry-based learning model, which encompasses a variety of student learning styles and learning modalities, including visual, kinesthetic, logical, and auditory (White, Kunz, Whitham, Houston, & Nugent, 2015; Kincaid & Jackson, 2006). This mode of instruction is based in problem-solving; thus, being of great interest to teachers (Belland, Ertmer, & Simons, 2006). Due to the consideration of a wide-variety of learning styles and modalities, Fab Lab instruction has also been found to be beneficial for students with disabilities (Kincaid & Jackson). The Fab Lab environment can be easily adapted to meet the developmental levels of all learners (Syvertsen, Muller, & Mau, 2010). Belland et al. (2006) reported higher levels of student engagement, and overall compassion, in the Fab Lab when non-disabled students worked alongside students with disabilities. These attributes were also noted to carryover to classes outside of the Fab Lab environment.

Intermediate Unit 1's Fab Lab is part of the "World-Wide Fab Lab Network." While the 270 individual Fab Labs have considerable autonomy, the Fab Foundation at MIT plays a coordinating role and provides services that the independent Fab Labs cannot obtain or afford on their own. For example, the Fab Foundation provides training to practitioners and helps with the set-up of new labs. It also helps source hard-to-find manufacturing materials and maintains a list of standards that individual Fab Labs are expected to meet in order to be included in the network.

> These requirements are fairly minimal: a common core set of capabilities, public
>
> access to the facility, following and signing the Fab Lab Charter, and participating
>
> in the knowledge-sharing community of the global Fab Lab network in some
>
> fashion (e. g., collaborating on projects with other labs or attending the annual
>
> Fab Lab Meeting). (Stacey, 2014, p. 224)

The curriculum and projects in the Fab Lab focus on Science, Technology, Engineering, and Math (STEM). Entrepreneurship and innovative thinking are also key elements that are exemplified in these projects. Fab Labs represent a new possibility for encouraging learners of all ages to hone their technological skills. The ability to turn ideas into useful goods is going to expand and deepen in the next few decades, and Fab Labs allow a head start on these opportunities, encouraging people who might never have thought of themselves as tinkerers or makers before (Stacey, 2014).

Intermediate Unit 1 is participating in a parallel study with the Mid-Atlantic Regional Education Laboratory (REL) through West Ed. The following charts were presented at a recent meeting with the REL, provided by lead researchers Anderson and Kim (2019a; See Figure 1):

Figure 1

Intermediate Unit 1 Strategies, Resources, and Outcomes

Strategies of IU1's FabLab+	Resources (Inputs)	What is actually happening in the FabLab to improve student behavioral outcomes?	Intermediate Outcomes (Precursors to the Longer-Term Outcomes)
Special education and mental health services are integrated into the FabLab instruction	Students Technology-laden FabLab setting FabLab Instructor		Improvement in student self-management
Student behavior data is gathered and tracked	Mental Health Professional, specializing in FabLab		Increased focus in FabLab and engagement in learning
Collaboration with community organizations aids in student transitions	FabLab Curriculum for STEM Paraprofessionals who help students with projects		

The FabLab learning environment encourages and promotes students to learn in a hands-on environment while developing skills like teamwork and collaboration. This setting is appropriate for instruction though guided science inquiry, which is beneficial for students with specific needs. This supports student learning through different modalities--visual, kinesthetic, logical, auditory—which are also found effective with students with disabilities. Fab Labs also provide students with a calm environment that allows them to redirect their focus to an educational activity. The environment is inclusive—activity-based, sensory rich, and developmentally appropriate and flexible. Students have reported feeling more engaged with their peers, especially as they were able to help those with lower abilities (Vercelletto, 2018).

Research on STEM for students with disabilities shows challenges and potential strategies as many students with disabilities do not receive rigorous science instruction,

face barriers to learning science in classrooms, and lack the specific literacy skills

necessary to effectively learn from textbooks. Many students with disabilities benefit

from concrete, hands-on presentations of science materials and step-by-step processes

that guide their thinking and performance when solving math problems. Through

project-based learning opportunities in the Fab Lab, students with learning disabilities are

exposed to a variety of learning strategies which could compensate for a specific

disability (Anderson & Kim, 2019b).

Research-based instructional strategies can address challenges for students with

emotional disturbance in STEM. Many students with emotional disturbance display

significant struggles with their behaviors, which often interfere with their learning.

Students with emotional disturbance experience academic difficulties throughout their

elementary and secondary school years. Special education programs for students with

emotional disturbances often provide a structure with predictable rules and routines.

Successful strategies used to improve academic performance in emotional support

classrooms at Intermediate Unit 1 include behavior plans, tolerance to classroom

expectations, and use of technology.

Project-based learning might be especially valuable for students with disabilities

as Project-Based Learning is an authentic learning model in which students plan,

implement, and evaluate projects, in groups, that have real-world applications beyond the

classroom. It involves critical thinking, collaboration, and self-direction and motivation

and could show greater promise with this subgroup because it enables students to solve

authentic problems through hands-on activities, collaborate with others, use technology,

and build real solutions. Fab Labs offer students with disabilities STEM-related career

and technical training that can enhance their technical skills, such as prototyping and

machinery operations, and soft skills, such as leadership and communication

(Intermediate Unit 1, n. d.).

Project-Based Learning

Project-Based Learning (PBL), by definition, is a student-centered pedagogy that

involves a dynamic classroom approach in which it is believed that students acquire a

deeper knowledge through active exploration of real-world challenges and problems

(O'Brien, 2020). Since the inception of the federal "No Child Left Behind Act of 2002,"

schools have moved away from practical approaches to learning and have become

immersed in the pedagogy and research behind having all students proficient on state

assessments. Along with this movement, came drastic reductions and even the

elimination in areas such as creative arts, innovation, and other parts of the curriculum

that did not specifically address needs of students being proficient in core content areas.

In PBL, students work in a cross-curricular approach on projects that relate back to initial

content delivered by the instructor.

PBL involves students working on projects over a period of time ranging from a

week to many months. The project focuses determining solutions for real-world

problems. The finished project and subsequent findings are then showcased to

demonstrate the knowledge acquired during the process (Bucks Institute for Education,

2020).

These projects, however, are not arbitrary or randomly selected. Instead, they are

selected based upon higher-order thinking with a vast amount of student input. The Bucks

Institute for Education (2020) designates shorter, less intellectually strenuous projects

following the completion of an instructional unit as "dessert projects," while "main course projects" serve as the instructional unit itself. PBL is "the vehicle for teaching the important knowledge and skills student need to learn. The project contains and frames curriculum and instruction" (para. 5). In contrast to dessert projects, PBL requires critical thinking, problem solving, collaboration, and various forms of communication. To answer a critical question and create high-quality work, students need to do much more than remember information. They need to use higher-order thinking skills and learn to work as a team.

PBL is multidisciplinary in the fact that it does not focus on one area of the curriculum. Instead, it encourages a cross-curricular approach in which several content areas are covered, while providing 21st century learning skills for students. Projects require students to engage in inquiry, solution building, and product construction to help address the real-world issue or a challenge presented. As students do the work, they often use content knowledge and skills from multiple academic domains to successfully complete the project.

Childhood Mental Disorders

Mental disorders for children have drastically increased in recent years. Diagnoses such as depression, anxiety disorder, and attention deficit disorder are some of the common disabilities currently among students in specialized programs at Intermediate Unit 1. Many of these students require a paraprofessional (1-to-1 classroom aide) as well as up to 15 hours of therapeutic services per week to address these issues. Many of these students are seen regularly by a clinical psychologist and, in many cases, medications are prescribed.

According to O'Connell, Boat, and Warner (2009), it is estimated that 13-20% of children living in the United States, or up to 1 out of 5 children, experience a mental disorder in a given year. Furthermore, an estimated $247 billion is spent each year on childhood mental disorders (Centers for Disease Control (CDC), 2019).

Providing therapeutic services, along with regular doctor visits and medications, can be costly, and if a family has poor or no insurance, the cost could become a burden of the school district. In Intermediate Unit 1's Mental Health program, it is estimated that the number of students serviced during the 2019-2020 school year nearly tripled in one year, while the mental health services recorded losses in excess of $200,000. This is related to the number of families in this region that have no insurance to cover the costs of these services.

The statistics of mental health diagnoses in American children is alarming. According to the CDC (2019), a high number of children live with depression, anxiety, Attention-Deficit Hyperactivity Disorder, autism spectrum disorders, Tourette syndrome or a host of other mental health issues. Attention-Deficit Hyperactivity Disorder is the most common diagnosis of children between the ages of three and 17. As a student ages, so does the number of mental disorders with the exception of autism, which is high among children between the ages of six and 11. In terms of gender, boys are more likely to have Attention-Deficit Disorder, conduct issues, and anxiety. Adolescent boys (ages 12-17) are more likely to die by suicide than girls of this age group. However, girls of this age span are more likely to have depression.

Typically, when students are enrolled into mental health programs at Intermediate Unit 1, there is a diagnosis. These range from, but are not limited to: Social Anxiety

Disorder, Adjustment Disorder, Attention Deficit Hyperactivity Disorder, Oppositional

Defiance Disorder, Obsessive-Compulsive Disorder, Trauma, Bipolar Disorder, and/or

Schizophrenia.

Students in the Intermediate Unit 1 Comprehensive Therapeutic Emotional

Support (CTES) programs range from ages 8-19 and receive, at minimum, 15 combined

hours of individual/group therapy weekly. Students see a child psychiatrist on a regular

basis, while a social worker and an aide are assigned to classrooms consisting of no more

than eight (8) students.   The following is a detailed description of the most common

types of mental health diagnosis for these students. Many of these students suffer from

more than one disorder; some have as many as five.

Social Anxiety Disorder

One of the most common forms of mental health disorder is anxiety. In a school-

type setting, Social Anxiety Disorder is prevalent among students in the Comprehensive

Therapeutic Emotional Support classrooms. Through research from years past,

successful adult anxiety diagnosis and treatments have led mental health experts to take a

deeper look into effects of childhood social anxiety disorder and successful treatments.

Once overlooked until adulthood, child social anxiety disorder has been diagnosed earlier

in life; thus, treatment plans (including therapy and/or medication) has become more

common in school-aged children. Unfortunately, a child diagnosed with this disorder is

highly likely to be diagnosed with other mental health disorders.

As discussed by Barlow (2014), "Social anxiety disorder most commonly begins

during early childhood or adolescence and typically follows an unremitting course.

Nevertheless, most individuals with social anxiety disorder do not seek treatment unless

they develop an additional disorder" (p. 124). Barlow continues that approximately 70-80% of people with social anxiety disorder meet the criteria for additional mental health diagnoses. Moreover, social anxiety disorder predates the comorbid condition in most cases. "Compared to individuals with uncomplicated social anxiety disorder, persons with social anxiety disorder and comorbid disorders have higher rates of suicide attempts, are more likely to report significant role impairment, and often use medication to control their symptoms" (p. 124).

Students who enter CTES programs may already be facing Adjustment Disorder. This may increase the level of social anxiety disorder as these adolescents are placed into uncomfortable, awkward social situations.

> Socially anxious individuals are a heterogeneous group in terms of pervasiveness and severity of their fears. In the current diagnostic system, the generalized subtype is specified for individuals who fear most social situations. These individuals often simultaneously have a variety of social interaction fears (e. g., public speaking, playing a musical instrument in front of others), and observation fears (e. g., working in front of others, walking down the street). (Barlow, 2014, p. 124)

Adjustment Disorder

Adjustment Disorder (AD) is defined as a maladaptive reaction to an identifiable psychosocial stressor or multiple stressors that usually emerges within a month after the onset of the stressor. Typical precipitating stressors in economically developed countries include divorce or loss of relationship, job loss, diagnosis of illness, recent onset of a disability and conflicts at home or work (Maercker & Lorenz, 2018). In the school

setting, students who are removed from their respective "home" school and placed in a specialized school or placement tend to suffer initially from AD in addition to other potential mental health diagnosis. Coping skills then play a vital factor in student adaptability and success. Individuals diagnosed with AD utilize maladaptive coping skills, including blaming themselves and using avoidance to manage stress (Vallejo-Sánchez & Pérez-García, 2015).

In the center-based classrooms at Intermediate Unit 1, this tends to be the most common initial diagnosis as students enter into the CTES classrooms. They suffer separation anxiety from being away from their common friends, teachers, administrators, even bus drivers. They are assigned to a new classroom with new peers. This new school could be a great distance (20 plus-miles in some instances). The Intermediate Unit 1 staff is trained to assist students initially with routines that facilitate in aiding any AD. The staff receives background information on each student; their interests, as well as "triggers" that can potentially upset the student and create emotional distress are presented to all staff and administration that may have daily interactions with this student. It is vital to the progress of these students that AD lasts for only a small portion of the beginning of the program.

AD is a common diagnosis when an individual does not adapt to stressful situations. AD is included in the *Diagnostic and Statistical Manual of Mental Disorders*, *5th edition,* (DSM-V). Per the DSM-V, AD involves an inappropriate reaction to psychosocial stressors resulting in a variety of emotional and behavioral symptoms. A decline of functioning in social situations is also noted (American Psychiatric Association, 2013). A prevalence of 1% is evident in the general population. In medical

facilities, including hospitals and mental health clinics, the incidence increases to 5-35%.

In populations who have increased exposure to stressors, the total rises to 50% (Vallejo-

Sánchez & Pérez-García, 2015). With students in the intermediate grades, grades 3-5, the

percentage climbs even higher. The initial step with these students is to assist them in

becoming adjusted to the environment utilizing expedient and non-threatening means.

Attention Deficit Hyperactivity Disorder

Another very common diagnosis of students in Intermediate Unit 1 programs is

Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD).

While this diagnosis is clearly one of the most common across all programs (alternative

education, learning support, etc.), it is quite evident that a high percentage of students in

the Comprehensive Therapeutic Emotional Support classrooms suffer from Attention-

Deficit Disorder or Attention- Deficit/Hyperactivity Disorder.

As indicated by Sjöberg and Dahlbeck (2017), ADHD is a neurological disorder

affecting development and includes difficulties with attention, increased activity levels,

and impulsivity. In today's world, ADHD is a global phenomenon that is spreading

rapidly throughout the world. This is partly due to the increasing dominance of bio-

psychiatric models that aim to understand mental disorders in terms of the biological

function of the nervous system, pharmaceutical companies striving for profit, increasing

media coverage, and schools pushing for performance resulting in an increasing amount

of children and adolescents all over the world receiving a mental health diagnosis. While

Attention-Deficit/Hyperactivity Disorder in a wider historical context is a relatively new

term, the trend of pathologizing children's uncontrolled and immoral behavior is not.

Regarding ADHD, children with perceived problems in attention and levels of activity have been the subject for medical intervention since the late eighteenth century.

Although ADHD is one of the most common and researched disorder in the entire world, the cause of this disorder is somewhat unknown. Some research suggests that it is a "social governance" that has created ADHD, while others implicate neurodevelopmental disorder as the main cause. As described by Sjöberg and Dahlbeck (2017), the origins of ADHD differ amongst mental health practitioners. The primary consensus is ADHD is a genetic, brained-based disorder passed from family member to family member. However, despite extensive research, no diagnostic biological marker exists to confirm this theory. Although the cause of ADHD has yet to be determined, an increasing number of people continue to be diagnosed with the disorder.

Oppositional Defiance Disorder

In addition to Attention-Deficit/Hyperactivity Disorder, another mental health disorder that is prevalent in adolescents is Oppositional Defiance Disorder (ODD). This disorder can be developed through some sort of trauma (family, social, etc.) or as a result of Post-Traumatic Stress Disorder (PTSD). There are students at the Colonial School who have been treated or are currently under treatment for this disorder. In understanding Oppositional Defiance Disorder a bit more, Ford (2002) writes,

> … children with Oppositional Defiance Disorder have high levels of symptoms that are characteristic of Post-Traumatic Stress Disorder (i.e. fear-related problems with sleep, hypervigilance, and startle response). Ford also found that children diagnosed with Oppositional Defiance Disorder had the most severe

overall psychopathology and social impairment, which appeared to be explained

primarily by their Post-Traumatic Stress Disorder symptoms. (p. 30)

Ford concluded children receiving treatment for ODD were likely to be victims of trauma

or possessed post-traumatic symptoms, due to experiencing trauma.

Interestingly, this research differentiates the diagnosis of Oppositional Defiance

Disorder among males and females. According to the research, adolescent boys are more

apt to be diagnosed with Oppositional Defiance Disorder than girls. However, as Ford

elaborates, girls are less likely than boys to be diagnosed with Attention-

Deficit/Hyperactivity Disorder, Oppositional Defiance Disorder, or Conduct Disorder

(CD). Nevertheless, students may develop severe problems with oppositional-defiance

and aggression. Consistent with socio-culturally based differences in the sex role

socialization of girls and boys, girls are more likely than boys to disclose anxiety or

depression. Girls whose temperament or problematic early attachment experiences place

them at risk for oppositional defiance may react primarily inwardly with depression,

anxiety, bodily distress, or social isolation.

Oppositional defiance is a common psychiatric condition in youth and is

associated with a range of psychiatric illnesses found in adults. Included, but not limited

to, anxiety and depression. Thus, since there is a wide range of common mental health

illnesses associated with oppositional defiance, this disorder in youth is more common

than previously predicted (Barker & Salekin, 2012). In understanding this information, it

is very important that teachers, counselors, and social workers have a deeper

understanding of this issue regarding males and females relative to Oppositional Defiance

Disorder.

Obsessive Compulsive Disorder

Obsessive-Compulsive Disorder (OCD) is a condition which inevitably distracts the student from completing routine tasks. According to Barlow (2014), the hallmarks of OCD include persistent obsessions and impulses that significantly interfere with activities of daily living. Barlow defines obsessions "as thoughts, images, or impulses that cause marked anxiety or distress" (p. 165). Compulsions can be classified as behavioral or mental reactions in "an attempt to reduce the distress brought on by obsessions or according to rigid rules" (p. 165).

Common student obsessions could be continued thought of harming oneself or others, making sure items are not lost and in place, fearing that something was not done correctly or adequately, etc. Student examples of compulsions are continuous checking on something, counting or touching things a certain number of times, excessive handwashing, etc. These actions obviously impede the learning process for students, and therapeutic intervention is necessary. Obsessive-Compulsive Disorder is diagnosed in females twice as much as males and typically begins in males from ages 13-15 and females ages 20-24. However, OCD has been diagnosed in children as young as age 2 (Barlow, 2014).

It should be noted that oftentimes Obsessive-Compulsive Disorder is confused with General Anxiety Disorder (GAD). GAD is an anxiety disorder that involves continuous worry and/or anxiety. Those who suffer from this disorder formulate very different conclusions to their worry than those that have Obsessive-Compulsive Disorder.

Individuals with either General Anxiety Disorder or Obsessive-Compulsive Disorder may worry about everyday matters, such as their children getting sick.

However, when worried about their children catching cold, parents with General

Anxiety Disorder might focus their concern on the long-term consequences (e. g.,

falling behind in school, development of a lifelong pattern of debilitation),

whereas parents with Obsessive-Compulsive Disorder might focus on the

contamination aspect of illness (e. g., their child being infested with 'cold

germs'). (Barlow, 2014, p. 167)

It is equally important to discuss avoidance issues in relationship with Obsessive-

Compulsive Disorder. For example, someone who has a general phobia and is concerned

about excessive germs may have a fear of dogs. However, that fear and anxiety level

decreases when dogs are not present. With people who suffer from Obsessive-

Compulsive Disorder, the fear continues long after the dogs are gone. Just the idea that

the dog was there hours before still has an ill-effect on those with Obsessive-Compulsive

Disorder (Barlow, 2014).

Students with Obsessive-Compulsive Disorder sometimes have difficulty working

in groups or using materials/resources that have been touched or used by another

classmate. Therefore, it is important that teachers, social workers, paraprofessionals, etc.

are aware of this diagnosis and have a clear understanding of the students' fears.

Trauma

Trauma is very common among the Comprehensive Therapeutic Emotional

Support students at the Colonial School and, in many examples, is the core foundation or

reason why students suffer from additional mental health diagnosis. Trauma is developed

through exposure to very stressful events in a child's life. This includes child abuse,

exposure to violence, separations, etc. Trauma negative effects emotional, cognitive, psychological, and social development.

> Each day children and adolescents are exposed to traumatic events including abuse, domestic violence, accidents, witness to homicide, divorce and separation, loss, disasters, and war. They may encounter these events from early childhood through teenage years; some experience multiple traumas or live in situations that include chronic neglect, abandonment, and abuse. Given the complexity and variability in the severity of young people's exposure and responses to trauma, it is not surprising that the identification of effective treatment has only recently materialized. (Steele & Malchiodi, 2015, p. 1)

In Pennsylvania, trauma has become more recognized as a diagnosis for children. The Pennsylvania Department of Education has now allocated funding for trainings in "trauma-informed practice or care." According to Steele and Malchiodi (2015), "Trauma-informed care is an approach to engaging people with histories of trauma that recognizes the presence of trauma symptoms and acknowledges the role that trauma has played in their lives" (p. 16). In recent years, there have been services and organizations created to recognize trauma while developing coping strategies and principles. The National Center for Trauma-Informed Care (NCTIC) is one of these organizations and has listed the following principles: (a) understanding trauma and its impact; (b) promoting safety; (c) ensuring cultural competence; (d) supporting consumer control; (e) choice and autonomy; (f) sharing power and governance; (g) integrating care; (h) healing happens in relationships; and (i) recovery is possible. These interventions are designed to

address the consequences of trauma in the individual and to facilitate healing. Survivors

need to be respected, informed, connected, and empowered.

While there must be consideration given to the situation, there is also no one

intervention that aides in the recovery of trauma. Therefore, social workers must be well-

versed in this area. Each of these professionals undergo intense training in the area of

trauma and trauma-informed practices and care.

Bipolar Disorder

Schizophrenia and depression have predominantly been the main focus relative to

stigma research. There has been very little attention to bipolar disorder. Research

demonstrates that students who suffer from bipolar disorder have more negative attitudes

in respect to mania. Compared to depression, bipolar disorder has a much higher

percentage of suicide attempts, work disability, and role impairment (Cassidy & Erdal,

2020).

Students who suffer from Bipolar Disorder are oftentimes the most difficult to

provide a meaningful education due to mood swings (ranging from acute depression to

very manic highs). The direct cause of bipolar disorder is still unknown, but genetics,

along with an altered brain structure does play a vital role in contributing to this

diagnosis. According to Marangoni (2019),

> The classic manic episode is characterized by the discrete appearance of
>
> euphoric/elated mood, talkativeness, decreased need for sleep, impulsivity,
>
> hyperactivity, and greater productivity, with rapid transitions to new and more
>
> stimulating projects. However, bipolar disorder in youth can also present with
>
> dysphoric (or mixed) mania characterized by marked irritability, negative/morbid

thoughts, increased impulsivity, risk-taking and aggressive behaviors, and psychomotor agitation as well as a chronic course and ultra-rapid cycling episodes. (p. 19)

There are students in Comprehensive Therapeutic Emotional Support programs who suffer from this mental health disorder and special therapeutic interventions are provided daily. These students receive at minimal three hours of therapy a day. In the classroom, students are provided with interventions such as autonomy to move about the room. Many of these students are provided a plan that includes moving to another part of the school building; talking to the counselor; or visiting the Fab Lab. Agitation occurs often when students are directed to do things they don't want to do; in many instances, students may be seeking an altercation. As a result, many of these students have a 1-to-1 paraprofessional to assist them in avoiding altercations with other members of the school community.

Schizophrenia

Schizophrenia is a psychiatric disorder that affects approximately 1% of people worldwide.

People with schizophrenia often have hallucinations which are false perceptions that occur when a stimulus is not actually present. Types of hallucinations include auditory, visual, and tactile hallucinations. Auditory hallucinations can be stressful to the person experiencing them. For example, the voices may cause difficulty with concentration, they may insult the person experiencing them, or they may tell the person to do something that the person does not want to do. (Borelli & Solari, 2019, para. 1)

While this disorder is quite uncommon in Intermediate Unit 1 programs, there are a small number of students that have been diagnosed with schizophrenia. Much like bipolar disorder, students are subject to intense therapy with social workers as well as psychiatric services.

Intermediate Unit 1 Fab Labs/Massachusetts Institute of Technology (MIT)/Chevron Corporation

The "maker-movement" began for Intermediate Unit 1 in 2013 with a nominal grant from the Claude Worthington Benedum Foundation. With this funding, Intermediate Unit 1 personnel created its first Design Team that included representatives from professional and support staff, administration, and students. This team reviewed current research on makerspaces and sought input from all stakeholders of the school community. Much of the research behind the Design Team was contributed by *The Third Teacher* (Syvertsen et al., 2010), a book created by a group of international architects and designers who recognized traditional education was failing. This resource took the education system and added design.

Designers solve problems. Faced with complex challenges, the designer's job is to come up with solutions at every scale, from cities and systems to spoons and microchips. Those solutions must be delightful and functional, because great design is an innovative meld of both (Syvertsen et al., 2010).

In late 2013, Intermediate Unit 1 was invited to a meeting with the Chevron Corporation to be introduced to the maker-movement and, more specifically, Fab Labs. Chevron had partnered with the Fab Foundation and the Massachusetts Institute of Technology (MIT) for a project that centered around "digital Fabrication" or Fab Labs.

In common usage, the term "digital Fabrication" refers to processes that use the computer-controlled tools that are the descendants of MIT's 1952 numerically controlled mill. But the "digital" part of those tools resides in the controlling computer; the materials themselves are analog. A deeper meaning of "digital Fabrication" is manufacturing processes in which the materials themselves are digital. A number of labs (including mine) are developing digital materials for the future of fabrication (Gershenfield, 2012).

In the spring of 2014, the Chevron Corporation announced that it would sponsor (or fund) 10 Fab Labs across the nation. Following a 15-month competitive application, review, and interview process, Intermediate Unit 1 was awarded a stationary Fab Lab, as well as a mobile Fab Lab. An intense professional development program in conjunction with the build-out of the initial Intermediate Unit 1 Fab Lab then begun with the assistance of both MIT and the Fab Foundation.

Chevron is committed to advancing STEM – science, technology, engineering and math – education initiatives. This includes project- and problem-based learning, which enables students to build on their classroom experiences by engaging in hands-on activities and solving problems.

In 2014, Chevron partnered with the Fab Foundation to bring its fabrication labs (Fab Labs) to areas where Chevron operates across the United States. Chevron has several active gas wells drilled in Southwest Pennsylvania, which is the in the footprint of the Intermediate Unit 1 service area. The Fab Foundation provides access to tools and technology in order to educate, innovate and invent. The Fab Foundation works in partnership with MIT to build-out and begin the process of Fab Labs in targeted areas,

such as Southwest Pennsylvania. Each Fab Lab consists of a suite of digital fabrication and rapid prototyping machines including 3-D printers. Working in Fab Labs, students can develop the critical thinking, problem solving, and analytical skills needed to be future innovators (Chevron, 2015).

Summary

There is very little research of the Fab Lab as it relates to students with mental health disorders. At the Colonial School, the Comprehensive Therapeutic Emotional Support students – who all have an Individualized Education Program (IEP) – have at least one mental health diagnoses and in many cases have multiple disorders. Teachers, administrators, social workers and paraprofessionals in this school are all trained (at different levels) on both Fab Lab equipment and mental health diagnosis. The goal is to provide these students with a balance of therapy and academic instruction with the goal being to prepare and assist them to have a balanced life. These are students that had difficulty in the mainstream and had very little chance of success in that environment. Every student in the Intermediate Unit 1 Comprehensive Therapeutic Emotional Support classes has both an educational and behavior plan. Both plans include ample time in the Fab Lab working in a project-based environment. Therapy is conducted in this environment which promotes students to discuss issues and recognize and respect the disorders of others. It is my hope that, following this study, this type of non-traditional therapy, teaching, and learning will make a significant impact in the lives of these students.

Chapter 3; Methodology

Introduction

Since the inception of traditional wood, metal, and print shops in public

education, students with diverse backgrounds have been learning outside of the

"traditional" core curriculum of Reading, Mathematics, Science, and Social Studies.

These shops were the first known makerspace (a place or area where people with shared

interests can work on projects, using equipment and knowledge to share ideas). Prior to

the creation of Career-Technical Centers (CTC), where the major focus is on a skill or

trade, students learned how to complete various projects in one of these shops while

remaining in the same building.

The wood, metal, and print shops remained a popular elective for middle and high

school students even after Career-Technical Centers were formed. This environment was

beneficial for students who may not have had a focus on a building/trade career, but

instead wanted to learn simple electricity, carpentry, design, etc. These were students

who may have aspired of pursuing a post-secondary degree or certification. The two

(CTC's and traditional shops) remained popular until the early 2000's when school

districts began receiving pressure for all students to excel on state assessments. Career-

Technical Centers had to change its curriculums to satisfy its member school districts as

student scores of the state assessments in the key areas of Reading, Mathematics,

Science, and Writing were attributed back to the students' respective districts.

Traditional shops in the school-setting began to become less popular as these were

replaced with electives that focused on core subject areas of the assessment. Eventually,

in many districts, these shops were eliminated completely, along with steady declines in

areas of the curriculum where creativity was once promoted and considered an essential life skill. The primary focus of instruction was centered around curriculum and resources that could potentially raise scores in the key areas of the state assessment.

Project-Based Learning

As data on state assessments was collected over ensuing years, it became evident to educators that there were groups of students whose academic needs weren't being met through the type of pedagogy being used to assist students in meeting performance goals on state assessments. This was clearly evident with students with special needs – including those students with special education and mental health diagnosis. As a result, educators were faced with the challenges of attempting to reintegrate creativity while ensuring that academic core standards and assessment anchors ("teaching to the test") were being incorporated in instructional strategies. Project-Based Learning, where students acquire a deeper knowledge of learning through real-world challenges and problems, became the strategy to initiate this type of learning. Initially, school libraries were those makerspaces that reclaimed this type of learning. Encyclopedias were replaced with computers; books were replaced with Kindles and iPads; librarians were now called "teachers of innovation and design." The resurgence of creativity was back but limited to the confines of the equipment and resources the library could contain.

The next such makerspace was one that included technology resources as well as key machinery such as laser and vinyl cutters, CNC routers, 3-D printers, etc. While many schools and organizations began to implement this curriculum, the Massachusetts Institute of Technology implemented a research-based initiative called "Fab Labs." Foundations and corporations across the United States began to take interest in funding

this type of makerspace. In 2014, the Chevron Corporation offered to fund 10 such Fab

Labs across the United States to school districts and educational organizations. In 2015,

Intermediate Unit 1 was awarded both a stationary and mobile Fab Lab from Chevron.

Fab Labs provide a plethora of valuable learning opportunities for students.

These makerspaces are innovative technology-based environments within a school and

promotes a collaborative workspace for students to explore learning through discovery

and inquiry with resources beyond what they would have in a traditional classroom

setting. The Fab Lab curriculum promotes making and designing to be the responsibility

of the students – either individually or while working in a group setting. Unlike

traditional classrooms, where students are provided instructions to complete

assignments/projects, modern instruction in makerspaces encourages students to

brainstorm for potential projects along with creating steps to finalizing the project.

There are many additional validations that could be presented in this argument.

However, it was the receptive behavior and positive reaction to the Fab Lab from a third-

grade Comprehensive Therapeutic Emotional Support student that suffered from

schizophrenia and bipolar disorder that prompted the administration to involve this sub-

group of students to engage in the Fab Lab learning environment

Purpose

The purpose of this study will be to find a distinct conclusion of determining if

the effects of the project-based learning (PBL) in the Fab Lab environment will improve

student discipline and attendance. This study will also analyze teacher and social worker

perceptions of project-based learning versus a traditional learning environment.

This Action Research project will consist of utilizing Mixed Method Research to draw conclusions to both student behaviors and discipline. Qualitative data will be used to determine both teacher and social worker perceptions to project-based learning with students who suffer from mental health diagnosis. Quantitative data, including charting student behaviors through running-records (Chartlytics); analyzing student daily attendance (Alma), and student discipline (Class DoJo) will also be used to answer the research questions related to this study.

The data obtained from this study could prove to be essential in the area of mental health as very little evidence was found to support such a study in the Review of Literature. There was documentation that clearly showed the benefits of Project-Based Learning and students with special education needs as well as students with physical handicaps. However, given the vast research which demonstrated the general success of Project-Based Learning, there was little connection that linked this success with students who had a documented mental health diagnosis.

This study is based on answering the following research questions:

1. Will students with mental health diagnosis (CTES) show a decrease in negative behaviors (Level 1 and 2 infractions) while working in the Fab lab?

2. Will attendance increase for students with a mental health diagnosis (CTES) if they spend more time in the Fab Lab than in a traditional classroom setting?

3. What are the teachers' and social workers' perceptions of utilization of the Fab Lab as a learning environment compared to a traditional learning environment?

4. Will students' observable symptoms of mental health diagnoses decrease as a result of working in the Fab Lab environment?

Setting and Participants

Intermediate Unit 1 (IU1) is an Educational Service Agency that serves as a liaison between the Pennsylvania Department of Education and member school districts. Intermediate Unit 1 provides services to 25 school districts and five Career-Technical Centers in a three-county region in southwestern Pennsylvania (Fayette, Greene, and Washington counties). Its primary function is to provide support to districts in the areas of special education, mental health, professional development, curriculum, technology, and business services. Intermediate Unit 1 also operates three "campus-based" schools that house programs for students such as: Alternative Education, Emotional Support, Comprehensive Therapeutic Emotional Support, Autistic Support, Multi-Disabilities Support (MDS).

The Intermediate Unit 1 Fab Lab program is part of the Appalachia Partnership Initiative (API). The Chevron North America's Social Investment Team launched API to strengthen STEM education in middle and high schools and improve pathways to careers in the oil industry, the gas industry, and advanced manufacturing in three states: Pennsylvania, West Virginia, and Ohio. The Appalachia Partnership Initiative is a partnership of businesses, nonprofit organizations, and education institutions that seeks long-term outcomes across 5 to 10 years, such as improved outcomes in Science, Technology, Engineering, and Mathematics (STEM) postsecondary education and increased employment in the area of energy and manufacturing sectors for students in the region.

Intermediate Unit 1's Colonial School began offering Fab Lab resources and curriculum to students with at least one mental health diagnosis at the start of the 2018-

2019 school-year. Prior to this, this subgroup of students were provided instruction in a

rather traditional approach. Teacher-directed lessons, cooperative learning, and small-

group instruction are just a few examples of what prior learning looked like in a

Comprehensive Therapeutic Emotional Support classroom. This cohort of students were

not afforded the opportunity for Project-Based Learning prior to 2018 for a variety of

reasons: they could injure themselves while working with sharp instruments; they could

injure others; the equipment in the Fab Lab was relatively expensive and, given the

potential explosive behaviors of these students, any student outbursts could damage this

equipment.

 The study would include students with mental health disorders located at the

Intermediate Unit 1 Campus at Colonial School. The Colonial School services students

from the following areas: Alternative Education, Emotional Support, Therapeutic

Emotional Support, and Comprehensive Therapeutic Emotional Support. The students

that attend this specialized school are from member districts of Intermediate Unit 1, along

with two non-member districts from Westmoreland County.   There is a specific

procedure used for the student intake process. This begins by the student's home district

administrator completing the Intermediate Unit 1 Class Enrollment Form (see Appendix

D) and sending all appropriate student records. The Colonial School support team

(consisting of the building administrator, classroom teacher, and social worker) then

analyze the information and make the determination of placement based on the potential

academic/social success of the student. Students are housed in these programs on a

temporary basis with reviews occurring every 45 school days. There is somewhat of a

constant flow of students in and out of the Colonial School throughout the school year as

the primary goal is to place students back in their respective home districts. This can only occur if the support team (consisting of the principal, classroom teacher, social worker, and representative from the student's home district) agrees that the student should be exited from the program. Criteria for a student to be exited from this program could consist of improved behaviors, completion of all goals/objectives in the student's Positive Behavior Support Plan, and consensus from the Colonial School support team. If this occurs, a transition plan, consisting of strategies and goals for the student, is then created by the student's support team. Below is a description from the Colonial School Handbook on our School Wide Positive Behavioral Interventions and Supports Program.

Student Behavior

Student attitude and behavior is key to improved academic achievement. Every student is expected to treat each staff member with respect and dignity, just as every student should expect to receive mutual respect from all staff. Violations of the School-Wide Positive Behavior Program, the Code of Student Conduct, and Federal and State Regulations governing student behavior are outlined in the student discipline policy. Incidents involving students with special needs will be considered on an individual basis and dealt with in accordance with the law.

The IU1 behavior support program focuses on positive, rather than negative measures. Treatment of a demeaning nature, the use of aversive techniques and the unreasonable use of restraints are not permitted. The IU1 behavior support program is:

1. *Proactive*

a. Adjusting the environment to reduce the likelihood of problem behavior occurring

b. Allowing the student to be independent and successful

c. Examples: modifying the curriculum, reorganizing the physical setting, teaching and clarifying routines, procedures and expectations

2. *Educative*

a. Teaching replacement skills

b. Allowing students to meet objectives in more effective, efficient, and appropriate ways (e.g., communication alternatives)

c. Examples: communication alternatives, alternative strategies

3. *Effective*

a. Managing consequences to reinforce desired behaviors and replacement skills

b. Withholding reinforcement following targeted behavior

c. Examples: praise, access to reward, verbal redirection, loss of privileges

There are various strategies used to place the student back into the home district environment. The student could return to the home school full-time or in half-day increments. If the latter is chosen, the support team then can increase this time based upon the success of the student. Once the student returns on a full-time basis to the home school the support team monitors progress of meeting the specific goals and objectives of the transition plan.

The Colonial staff consists of both regular and special education teachers, social workers, paraprofessionals (classroom and/or student aides), clerical and custodial

support, as well as a building administrator. There is also a full-time Fab Lab instructor who is used as an itinerant teacher (students' alternate days between physical education, entrepreneurship, art, as well as other available electives) and provides instruction to all students in this area for at least a one- hour session per week.

Students from three (3) Comprehensive Therapeutic Emotional Support classrooms were the primary focus of this study, along with classroom teachers and social workers. These students may or may not be classified as special education. However, all have at least one mental health diagnosis (bipolar disorder, schizophrenia, etc.) These classes are grouped by grade level: 3-5, 6-8, and 9-12.   Students were provided one to two periods per week working in the Fab Lab learning environment. All students taking part in this study submitted and received Informant Participant Consent.

Intervention and Research Plan

The research plan in this study is based on the ideal that using Project-Based Learning in a Fab Lab environment with students with mental health needs will improve both student attendance at school and reduce classroom disturbances and discipline infractions. The initial concept behind the Comprehensive Therapeutic Emotional Support program was to remedy the social and emotional issues of children *prior* to continuing the child's academic progress. Students enrolled in the Comprehensive Therapeutic Emotional Support classrooms are provided therapy and interventions led by a social worker designated to a class for three (3) hours per day. Traditionally, these sessions were outside of the academic environment, oftentimes conducted in separate rooms with the aid of therapeutic devices. This concept is congruent to past literature reviewed as the academic and therapeutic components of the child's school day have

been separate. Little academic instruction was provided to students as nearly half of the

regular school day consisted of both individual and group therapeutic intervention with a

social worker.

Academic expectations for these students were low as both teachers and social

workers spent most of the academic day providing social and emotional interventions.

With students attending an itinerant class for one hour (mostly physical education) and a

30-minute lunch, academic instruction was limited to just a few hours per day. The

amount of instruction also was dependent upon students' behaviors and classroom

disruptions. The data provided through the Chartlytics system should show a dramatic

increase in class disruptions in this traditional classroom environment.

This research is based upon the concept that addressing the social and emotional

issues of students can occur *in conjunction* with academic progress. By embedding the 15

required weekly hours of therapy in the Fab Lab environment, and while working in

groups to complete a specific lesson or project, it is believed that negative student

behaviors will be reduced significantly. It is also believed that students will learn to

enjoy learning through discovery and inquiry with fewer disruptions; thus, student

attendance should increase.

There was much preparation prior to this Action Research Project as teachers and

social workers were trained to use all equipment in the Fab Lab. These trainings were

created and coordinated by the Intermediate Unit 1 Director of Curriculum/Fab Lab

Supervisor in conjunction with the Intermediate Unit 1 Director of Mental Health

Services. The original Fab Lab curriculum – including all projects and protocols – were

analyzed and altered to address the specific social/emotional needs for students in the

Comprehensive Therapeutic Emotional Support classrooms. Specific learning standards were identified in each lesson, along with the goals to address the social/emotional needs (see Appendix E). The core of this study is to successfully implement such therapy while students are completing projects which, in turn, is expected to increase student-interest and lessen classroom disturbances (discipline infractions).

All teachers and social workers associated with the Comprehensive Emotional Support program at the Colonial School were required to participate in these trainings. These trainings are conducted in the Fab Lab setting at the beginning of each school year during designated professional development days. Professional development days for staff are considered "work days" for staff but does not count toward the required 180 student days. The training topics for these days are determined by the Intermediate Unit 1 professional development committee well in advance. While many of these trainings are required by the Pennsylvania Department of Education, there are days designated for specific trainings requested by both administration and staff. The professional development committee conducts surveys for all Intermediate Unit 1 staff to determine where specific training modules may be in most need. During this professional development, teachers and social workers were taught how to create, design, and/or alter Fab Lab lessons and/or projects to meet the social/emotional needs of students with mental health disorders. Another component of this staff development was for each teacher and social worker to obtain general knowledge of the Fab Lab machinery, including how to operate each piece of equipment, as well as essential safety procedures while operating the equipment. This professional development was done in five (5) days of intensive training. Ongoing support to these trainings were provided by the Colonial

Fab Lab teacher on a daily basis for 30-minute increments at the end of the teacher/social

worker work-day.

Teacher and social worker perceptions are also a key success area of this research.

These two cohorts were provided with both a pre and post-study questionnaire to

determine how perceptions may have been changed or altered throughout the study.

Through compilation of this qualitative data, it will demonstrate if Project-Based

Learning in the Fab Lab learning environment made a positive impact on teacher and

social worker perceptions of this type of learning.

Research, Design, Methods & Data Collection

This study is to focus on student behaviors and attendance while working in the

Fab Lab learning environment. It will also analyze both teacher and social worker

perceptions of this type of learning. As Project-Based Learning and Fab Labs continue to

become more popular in the education environment, there was a sufficient amount of

research focusing on Project-Based Learning and students with learning and/or physical

handicaps in the Review of Literature. However, there was scarce evidence that these

learning strategies had been researched with students with mental health needs.

Therefore, using Mixed-Methods Research, student profiles consisting of the student's

prior attendance and discipline data, as well as the specific mental health diagnosis were

vital to create a baseline.

To begin this study, student data was reviewed to gain knowledge of students

through the creation of student profiles. Data collection to create student profiles

consisted of prior student attendance and discipline records from the previous school

year. Because many of these students attended their respective home school in the prior

year, data relative to student attendance and discipline was collected through the district's

respective Student Information System. In some instances, this information was not

forwarded from the sending district. In these cases, the home school principal was

contacted, and a request was made for this information to be forwarded to the Colonial

School clerical staff. This information would typically be noted on the Intermediate Unit

1 Classroom Enrollment Form (see Appendix D). If the student was at Colonial the prior

year, data was obtained through the Alma Student Information System. Student profiles

were created by extracting both prior attendance and discipline from the students' files

that were already created.

   The profiles began with the school clerical support labeling each student's name

and student identification and placing all written documentation into a folder. Once all

data was collected, the clerical support then added this information to the Alma Student

Information System. This system allows permissions for viewing, adding, and/or editing

for any teacher, administrator, social worker, and paraprofessional that works directly

with this student. At any given time, the student's support team would have real-time

information and data on any particular student.

   Student behaviors were charted from the ClassDojo System. ClassDojo is a

school communication platform that teachers, students, and families can use every day to

capture various items from the classroom. It is a system that creates a learning

community through effective communication via photos, videos, and messages.

Intermediate Unit 1 professionals and paraprofessionals use this platform specifically to

capture and record individual student discipline incidents. At the beginning of each

school year, all Intermediate Unit 1 professionals and paraprofessionals are trained or

retrained on ClassDojo by teacher-leaders that are selected by the school administration. At any time during the school year, staff members may request additional training on this program.

Student attendance data was collected from the Alma Student Information System. Alma is an integrated student information and learning management system that automates school management workflows while assisting school administration in processing vital student data. This system contains features such as a contact database, data management, medical records management, attendance tracking and fee collection. For the purposes of this study, only student attendance was extracted from the Alma system. Again, all Intermediate Unit 1 staff members are trained or retrained on a yearly basis during professional development days designated at the beginning of each school year.

The Chartlytics Data Analysis system was used to chart daily, real-time student behaviors/incidents. Chartlytics is a real-time digitized platform that captures running records on ipads, cellular phones, computers, etc. This program was created out of the Pennsylvania State University and IU1 has utilized this platform since its inception three years ago. It has proved to be a vital resource for students with mental health diagnosis as professionals/paraprofessionals can chart behaviors of individual students in the classroom environment and the time(s) or potential situations when these occurred. All Intermediate Unit 1 staff are trained or retrained on the Chartlytics Data Analysis system during professional development days at the beginning of each school year. Data is collected by all teachers and added to student profiles. This system is managed at the local level by Intermediate Unit 1 Behavioral Specialists and frequent meetings are held

for each student to review behavioral data. The data collected from the Chartlytics Data

Analysis system may reveal particular times, settings, subjects, etc. when a student is

exhibiting negative behaviors that could be impeding his/her learning. This information

could prove to be critical in making modifications and adjustments to the students'

schedules and environment.

An additional resource that was used to complete student profiles were

Individualized Education Programs (IEP). An Individualized Education Program is a

legal document required for all students that qualify for special education services. The

school is required to create this plan and review - at least on a yearly basis. This

document contains specific student goals relative to attendance, discipline, and behavior

and can be reviewed and revised by the Individualized Education Plan team at any point

in time. This team generally consists of the student, parent(s), administrator, teachers,

and social worker that is associated with the individual student (See Appendix F).

The research conducted was also team-action oriented as both cohorts of teachers

and social workers collaborate on lessons and projects. By combining the academic and

therapeutic components this will provide these cohorts to observe the potential impact of

how the two complement one another. Frequent observational data also enables

instructors and or social workers to alter and modify lessons and protocols based on

immediate data.

The students selected to participate in this research were enrolled in the

Intermediate Unit 1 Comprehensive Therapeutic Emotional Support program, either prior

to or during the 2019-2020 school year. These students could have qualified for special

education services, thus having an Individualized Education Plan. However, this is not a

prerequisite to enter the Comprehensive Therapeutic Emotional Support program. The common factor of all students in this program is having at least one diagnosed mental health disorder. All students in this program receive a minimum 15 hours per week of therapy provided by a social worker, as well as being under the care of a psychiatrist contracted through Intermediate Unit 1.

All students selected for this study were provided with parental permission slips to participate. These permission slips were initially sent home in student take-home packets. Parents that did not return these forms by the designated deadline were contacted by the building principal to verbally request these be returned the student's teacher. If parents still did not respond to this request, the permission slips were then mailed to the student's home. All teachers and social workers associated with the student had prior knowledge of these permission slips and also encouraged parents during parent phone or face-face conferences to review and return these forms.

Timeline

Summer, 2019 – Student data review to gain knowledge of student profiles

Summer, 2019 – Project-Based Learning/Fab Lab Training for teachers and social workers

Fall, 2019 – Training and Retraining of Chartlytics and Alma systems

Summer/Fall, 2019 – Develop specific lessons and integrated mental health therapeutic protocols specific to the Fab Lab learning environment.

Fall, 2019 – Develop cohort of students

Fall, 2019 – Pre-questionnaire for teachers and social workers

Fall, 2019 – Distribute and collect parent permission slips

Fall/Spring, 2019/2020 – Input ongoing attendance and discipline data into Alma and

Chartlytics systems.

Spring, 2020 – Post-questionnaire completion for teachers and social workers

Summer, 2020 – Final data compilations; review of findings

       The actual study will take place beginning at the start of the 2019 school year and

ending in June 2020. However, there will be data reviews conducted from October 2019

– August 2019 to gain prior knowledge on students' profiles. The research began with

surveys and questionnaires being disseminated to staff at the beginning of the school

year. Throughout the course of the year, quarterly data was reviewed relative to

teacher/social worker perceptions, student behaviors, and student attendance. The

resources utilized for this study were the Chartlytics Data Analysis platform, Class Dojo,

as well as the ALMA Student Information System.

Validity

       The validity of this study is based on multiple forms of data collection including

both qualitative and quantitative measures. However, the use of the Chartlylics (daily

running record) will provide sufficient evidence of student success based upon a

multitude of variables. For example, a particular lesson and/or protocol may need to be

revised based upon consistent group data and feedback. In addition, teachers and social

workers may develop a deeper understanding of the correlation of a specific project or

task and what may potentially "trigger" an emotional breakdown.

       Another core component of validity are any documented changes of student

behaviors in the traditional classroom environment. While Project-Based Learning

should remain somewhat consistent outside of the Fab Lab, the environment itself could

be an asset or hinderance in student progress. Therefore, observational data of student

behaviors collected during both individual and group settings will be an essential part of

this study. Again, the concept is to determine when outward negative behaviors occur

that can be related to the student's particular diagnosis, and how the environment and

instructional strategies can be adjusted to minimize these behaviors.

Through the use of Alma, attendance data collected will provide evidence if

students are absent on days when they aren't in the Fab Lab learning environment.

Through examination of attendance trends, it can also be determined if a specific project

or task is having an impact on daily student attendance.

Summary/Transition

The Comprehensive Therapeutic Emotional Support program at Intermediate Unit

1 was started in the 2015-2016 school year, a year earlier than the opening of

Intermediate Unit 1's initial Fab Lab. The original intent was not to permit these students

use of this learning space as students could potentially harm themselves or others should

mental health issues arise. Since then, a transformation has taken place as this group of

students utilize and consume the most time in the Fab Lab. Observational data has

proved that this type of learning has created higher levels of social, emotional, and

academic success. By using the Mixed Methods Research approach, evidence through

data collection of qualitative and quantitative research will demonstrate that these

students can congruently advance in the areas of social, emotional, and academic growth.

As per requirements from the Pennsylvania Department of Education, all students

are required to have a College/Career Portfolio. With the inception of this type of

learning for the individuals included in this study, there will be clear evidence of the

successful projects created by the student along with the resources and supports used to

assist. This information will be helpful to both college professors and/or employers to

continue this success in either post-secondary education or workforce development.

Chapter 4; Data Collection

Introduction

Since the inception of traditional wood, metal, and print shops in public education, students with diverse backgrounds have been learning outside of the "traditional" core curriculum of Reading, Mathematics, Science, and Social Studies. These shops were the first known makerspace (a place or area where people with shared interests can work on projects, using equipment and knowledge to share ideas). Prior to the creation of Career-Technical Centers (CTC), where the major focus is on a skill or trade, students learned how to complete various projects in one of these shops while remaining in the same building.

The wood, metal, and print shops remained a popular elective for middle and high school students even after Career-Technical Centers were formed. This environment was beneficial for students who may not have had a focus on a building/trade career, but instead wanted to learn simple electricity, carpentry, design, etc. These were students who may have aspired of pursuing a post-secondary degree or certification. The two (CTC's and traditional shops) remained popular until the early 2000's when school districts began receiving pressure for all students to excel on state assessments. Career-Technical Centers had to change its curriculums to satisfy its member school districts as student scores of the state assessments in the key areas of Reading, Mathematics, Science, and Writing were attributed back to the students' respective districts. Traditional shops in the school-setting began to become less popular as these were replaced with electives that focused on core subject areas of the assessment. Eventually, in many districts, these shops were eliminated completely, along with steady declines in

areas of the curriculum where creativity was once promoted and considered an essential

life skill. The primary focus of instruction was centered around curriculum and resources

that could potentially raise scores in the key areas of the state assessment.

Research Questions

This study is based on answering the following research questions:

1. Will students with mental health diagnosis (CTES) show a decrease in

   negative behaviors (Level 1 and 2 infractions) while working in the Fab lab?

2. Will attendance increase for students with a mental health diagnosis (CTES) if

   they spend more time in the Fab Lab than in a traditional classroom setting?

3. What are the teachers' perceptions of utilization of the Fab Lab as a learning

   environment compared to a traditional learning environment?

4. Will students' observable symptoms of mental health diagnoses decrease as a

   result of working in the Fab Lab environment?

Setting and Participants

Intermediate Unit 1

Intermediate Unit 1 (IU1) is an Educational Service Agency that serves as a

liaison between the Pennsylvania Department of Education and member school districts.

Intermediate Unit 1 provides services to 25 school districts and five Career-Technical

Centers in a three-county region in southwestern Pennsylvania (Fayette, Greene, and

Washington counties). Its primary function is to provide support to districts in the areas

of special education, mental health, professional development, curriculum, technology,

and business services. Intermediate Unit 1 also operates three "campus-based" schools

that house programs for students such as: Alternative Education, Emotional Support,

Comprehensive Therapeutic Emotional Support, Autistic Support, Multi-Disabilities Support (MDS).

The Intermediate Unit 1 Fab Lab program is part of the Appalachia Partnership Initiative (API). The Chevron North America's Social Investment Team launched API to strengthen STEM education in middle and high schools and improve pathways to careers in the oil industry, the gas industry, and advanced manufacturing in three states: Pennsylvania, West Virginia, and Ohio. The Appalachia Partnership Initiative is a partnership of businesses, nonprofit organizations, and education institutions that seeks long-term outcomes across 5 to 10 years, such as improved outcomes in Science, Technology, Engineering, and Mathematics (STEM) postsecondary education and increased employment in the area of energy and manufacturing sectors for students in the region.

Intermediate Unit 1's Colonial School began offering Fab Lab resources and curriculum to students with at least one mental health diagnosis at the start of the 2018-2019 school-year. Prior to this, this subgroup of students was provided instruction in a rather traditional approach. Teacher-directed lessons, cooperative learning, and small-group instruction are just a few examples of what prior learning looked like in a Comprehensive Therapeutic Emotional Support classroom. This cohort of students were not afforded the opportunity for Project-Based Learning prior to 2018 for a variety of reasons: they could injure themselves while working with sharp instruments; they could injure others; the equipment in the Fab Lab was relatively expensive and, given the potential explosive behaviors of these students, any student outbursts could damage this equipment.

The study would include students with mental health disorders located at the Intermediate Unit 1 Campus at Colonial School. The Colonial School services students from the following areas: Alternative Education, Emotional Support, Therapeutic Emotional Support, and Comprehensive Therapeutic Emotional Support. The students that attend this specialized school are from member districts of Intermediate Unit 1, along with two non-member districts from Westmoreland County. There is a specific procedure used for the student intake process.

Data Collection

Student Discipline Data

Students' mental health needs often manifest as negative behaviors resulting in disciplinary infractions. As indicated in Figure 2, there were 227 total discipline infractions (Levels 1 and 2) for the 2019-2020 school year. It should be noted, considering COVID-19 and remote learning taking place for the entire fourth nine-week period, these numbers were somewhat lower than usual. However, in relationship with this Action Research Project focusing on students with mental health diagnoses and negative behaviors in the Fab Lab, there were zero incidents reported.

Figure 2

*2019-2020 Discipline Incident Reports*
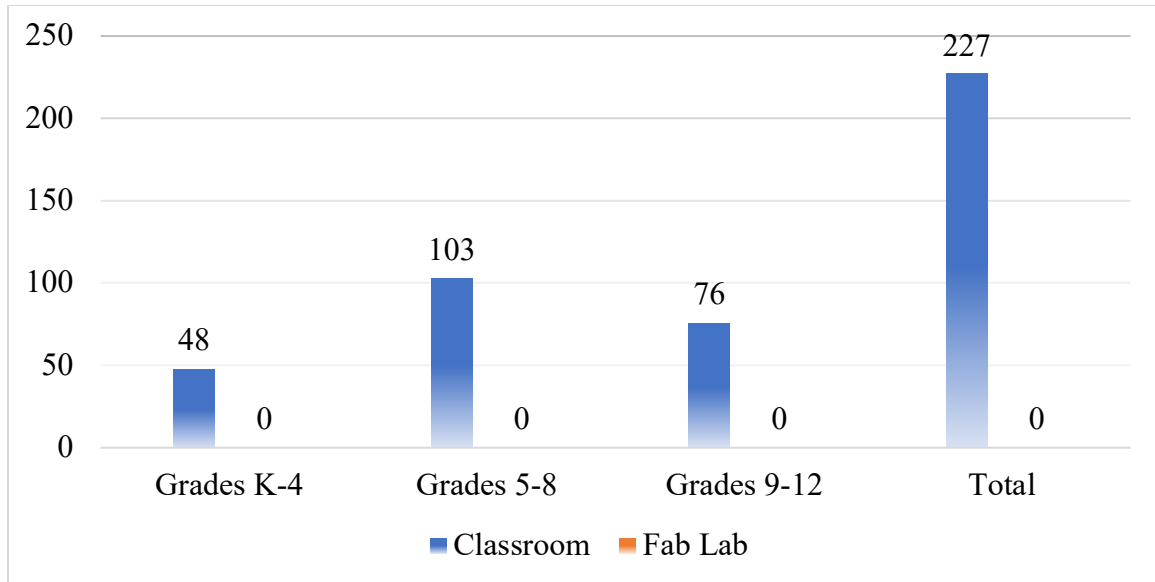
Attendance Data

Student attendance has always been a concern in this school setting, as overall attendance percentages falls well below the average state attendance. However, as noted in Figure 3, on days that students were working in the Fab Lab, student attendance data showed a slight increase. While both grades K-4 and grades 9-12 cohorts showed a slight increase, the grades 5-8 cohort showed an average increase of 4%. It should be noted, originally when the Fab Lab initiative first began, the curriculum was based on this age group. Perhaps there could be a correlation between the maturity of the curriculum, projects and attendance. However, for the purpose of this study, this data shows promise that attendance is on the rise on days students attend the Fab Lab environment.

Figure 3

2019-2020 Student Attendance
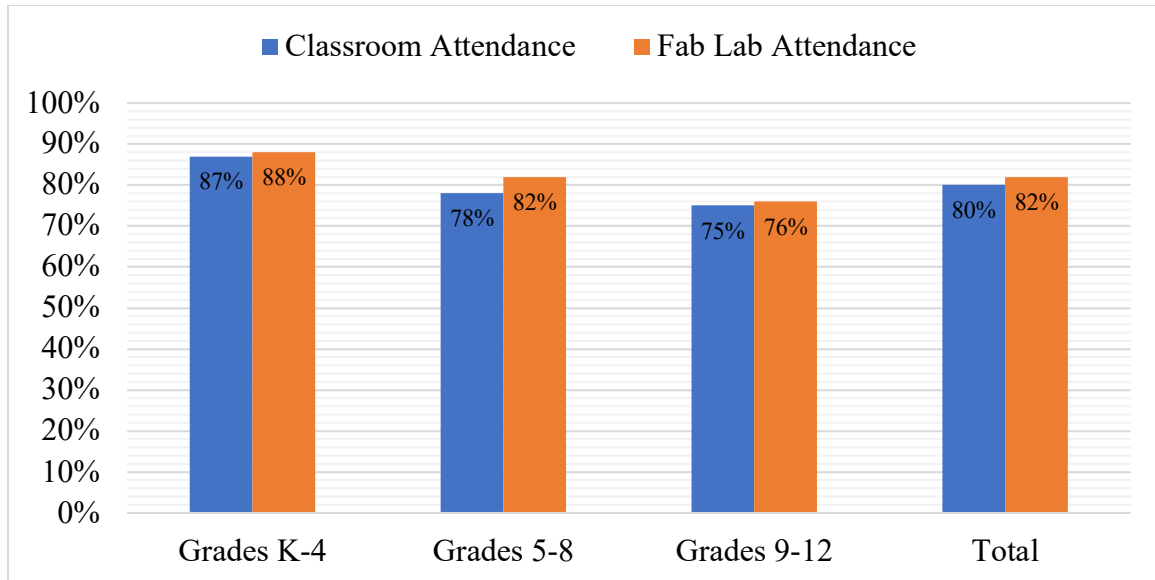
Survey Data

A total of eight professional employees, four Comprehensive Therapeutic Emotional Support (CTES) teachers and four social workers, were administered a pre- and post- survey. The survey consisted of 10 questions focused on perceptions of training, attendance, student discipline, student comprehension, student reactions to group work, structured learning environments, career readiness, and teacher/social worker ability to communicate effectively with students. The teachers and social workers responded to the questions based on a subjective scale (See Appendices A and B). It should be noted a total of six professionals participated in the pre-survey and eight professionals participated in the post-survey. One teacher and one social worker did not complete the pre-survey.

Many of these topics showed little difference between the pre- and post-surveys. Concerning the receipt of training in the area of project-based learning (PBL), an increase of two responses from pre- to post-survey in the area of *Training on some areas of PBL* and an increase of one response in the area of *Not trained in, but have a general*

understanding of PBL. A decrease of no responses was received from the post-survey in the area of *Trained in all phases of PBL.* This decrease could be indicative of no response being needed, if the PBL training had already been received prior to the start of the study. The survey statement concerning training in operating Fab Lab equipment received an increase of two responses in the area of *Trained on some equipment*. Respectively, an increase of one response in the areas of *Not trained in but have a general understanding of the equipment,* and *Not trained and have no understanding of equipme*nt was noted (See Figure 4).

Figure 4

Training in PBL and Fab Lab Equipment
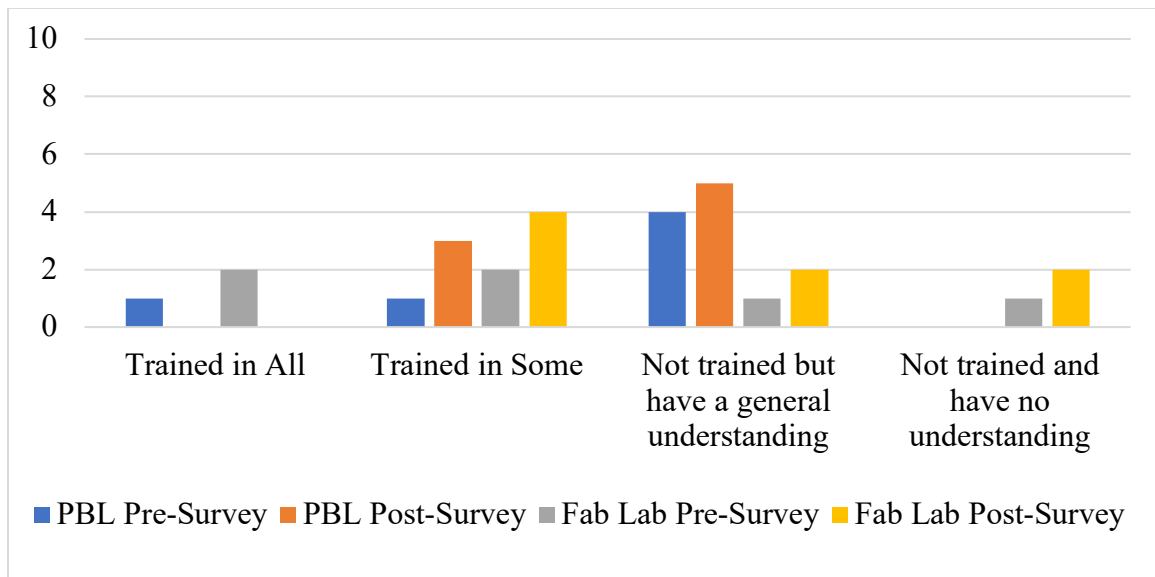
Pertaining to the topic of students learning better in the Fab Lab as compared to the traditional classroom setting, an increase of one response was indicated. An increase of one response respectively in the areas of *Agree* and *Disagre*e was identified concerning the effect of student attendance and participation in the Fab Lab. As previously stated, actual student attendance demonstrated a slight increase when

attending classes in the Fab Lab. A decrease in positive staff perception was noted in the

area of increasing student knowledge of the curriculum through use of the Fab Lab. A

reduction of one response in the area of *Agree* and an increase in the area of *Neutral* by

five responses was indicated. An increase of three responses in the area of *Strongly*

Agree and a decrease in the area of *Agree* was collected pertaining to students enrolled in

the CTES program experience issues working in groups. As viewable in Figure 5, an

increase of two response in the areas of *Neutral* and *Disagree* and one response in the

area of *Strongly Disagree* relative to CTES students requiring a structured learning

environment containing components of a traditional classroom. Lastly, an increase of one

response in the area of *Agree* and two *Neutral* responses were collected concerning the

Fab Lab improving the professional staff members' ability to relate and communicate

with students.

Figure 5

Learn Better in the Fab Lab (#2), Attendance (#4), Student Comprehension (#6), Student

Reactions to Group Work (#7), Structured Learning Environments (#8), and

Teacher/Social Worker Ability to Communicate Effectively with Students (#10)
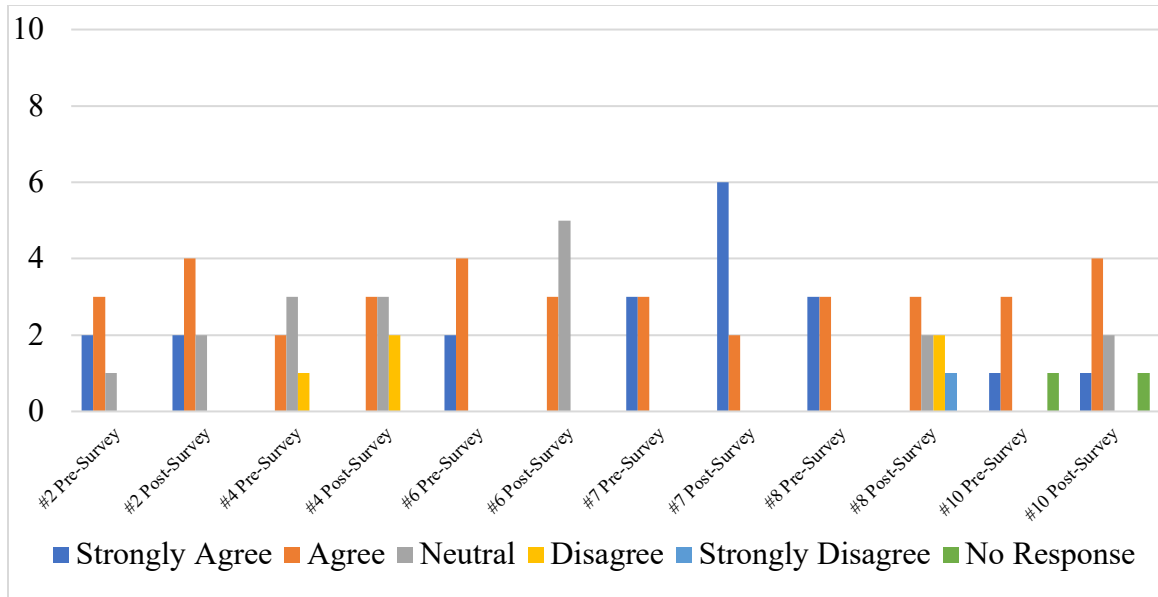
Moreover, the most noticeable differences were in the areas of student discipline

and career awareness. Prior to the study, no professional employee disagreed or strongly

disagreed that student behavior (Level 1 and 2 discipline infractions) would decrease in

the Fab Lab learning environment. An increase of four responses from pre- to post-

survey in the response area of *Strongly Agree* was noted. In addition, an increase of one

response in the response area of *Neutral* was indicated, while a no responses were

received in the response area of *Agree.* There was an increase of teacher/social worker

perceptions in this area as four professionals, or 50% of the total surveyed, perception on

student discipline increased from the pre- to post-survey in a positive manner (See Figure

6).

In the area of career readiness, four teachers, or 50% of the total surveyed, had

adverse perceptions from pre- to post-surveys. Of the responses received from pre- and

post-surveys, a decrease of two responses occurred in the area of *Strongly Agreed* and an

increase of three responses in the area of *Agree.* This statistic is extremely vital feedback,

as the career readiness projects performed in the Fab Lab are directly related to the

curriculum. Therefore, if further data would be acquired in this Action Research project,

it could perhaps focus on areas in the curriculum that may need updated and/or improved.

Figure 6

Student Discipline and Career Readiness
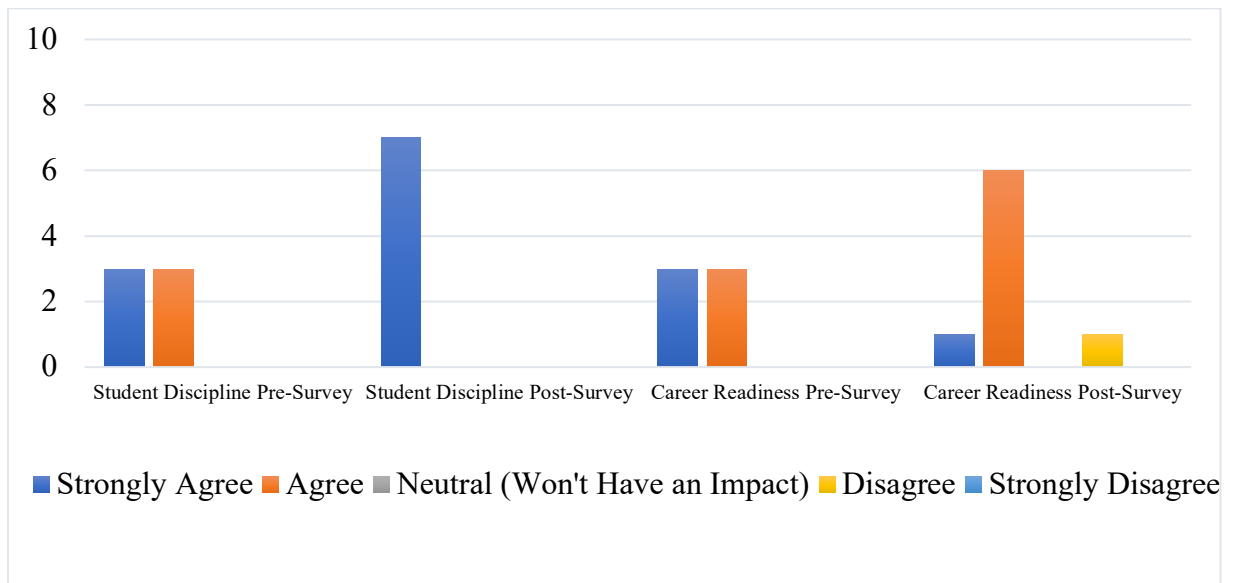
Student Behavior Data

The student behavior data collected as part of this study was documented by a

teacher or social worker and entered into the Chartlytics Data Analysis system.

Chartlytics is a real-time digitized platform that captures specified data a technological

device, including ipads, cellular phones, and computers. This system was created by the

Pennsylvania State University. The Intermediate Unit 1 has utilized this platform since its

inception three years ago. It has proved to be a vital resource for students with mental

health diagnosis as professionals/paraprofessionals can chart behaviors of individual

students in the classroom environment and the time(s) or potential situations when these
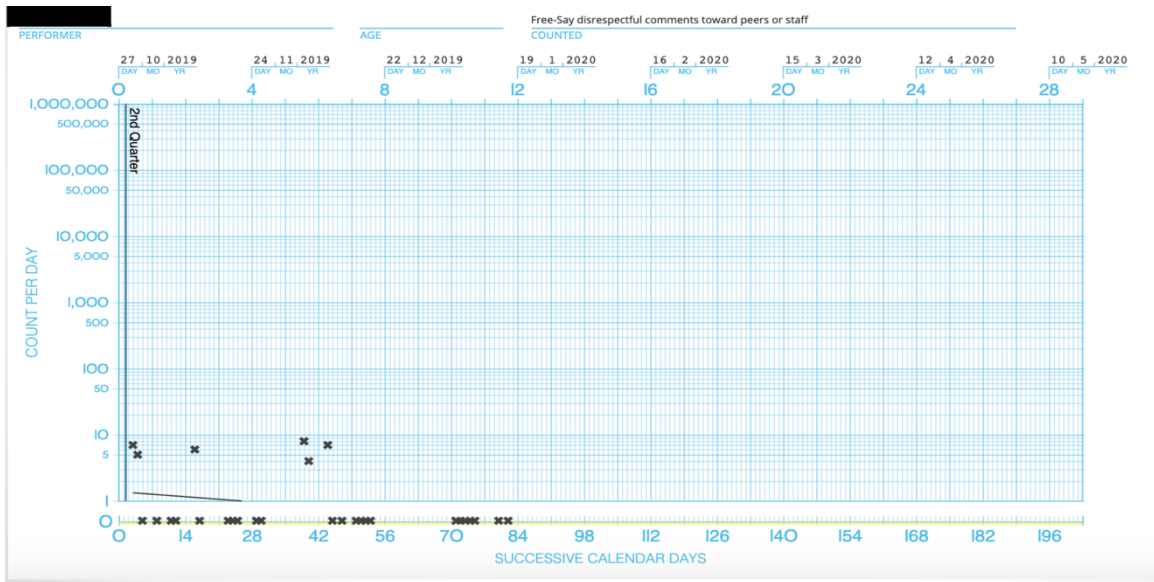
occurred.

The Chartlytics system enables the user to produce a running record demonstrating patterns of behavior. The behaviors indicated for each student have been previously documented in the student's Positive Behavior Support Plan (PBSP) and included as part of the Individualized Education Program (IEP).

The following data highlights four students with at least one mental health diagnosis. The vertical axis of the celeration chart represents the frequency or duration the behavior occurred, while the horizontal axis shows the consecutive calendar days of the school year. Each data point on the celeration chart indicates an occurrence of the identified behavior. The Chartlytics data listed below identifies each student's distinct behavior and the frequency or duration of the behavior in the traditional classroom setting as compared to the Fab Lab environment.

The following celeration charts reflects Student 1, whose behavior of concern includes making disrespectful comments towards peers and/or staff. The first chart provides data collected in the traditional classroom environment, while the second chart reflects data collected while the student was in the Fab Lab. In the traditional classroom environment, Student 1 averaged nearly 8 occurrences of disrespectful comments toward peers or staff (See Figure 7). However, in the Fab Lab environment, in this same duration of time, the student had 0 incidents (See Figure 8).

Figure 7

Student 1. Disrespectful Comments Towards Peer or Staff in the Classroom

Figure 8

Student 1. Disrespectful Comments Towards Peer or Staff in the Fab Lab

Student 2 also demonstrated disrespectful comments towards staff and peers. The average number of occurrences were much higher for Student 2 in the traditional classroom setting (See Figure 9). In contrast, as evidenced in Figure 10, this student had

much fewer instances where he/she made disrespectful comments toward peers or staff in the Fab Lab Environment.

Figure 9

Student 2. Disrespectful Comments Towards Staff/Peers in the Classroom
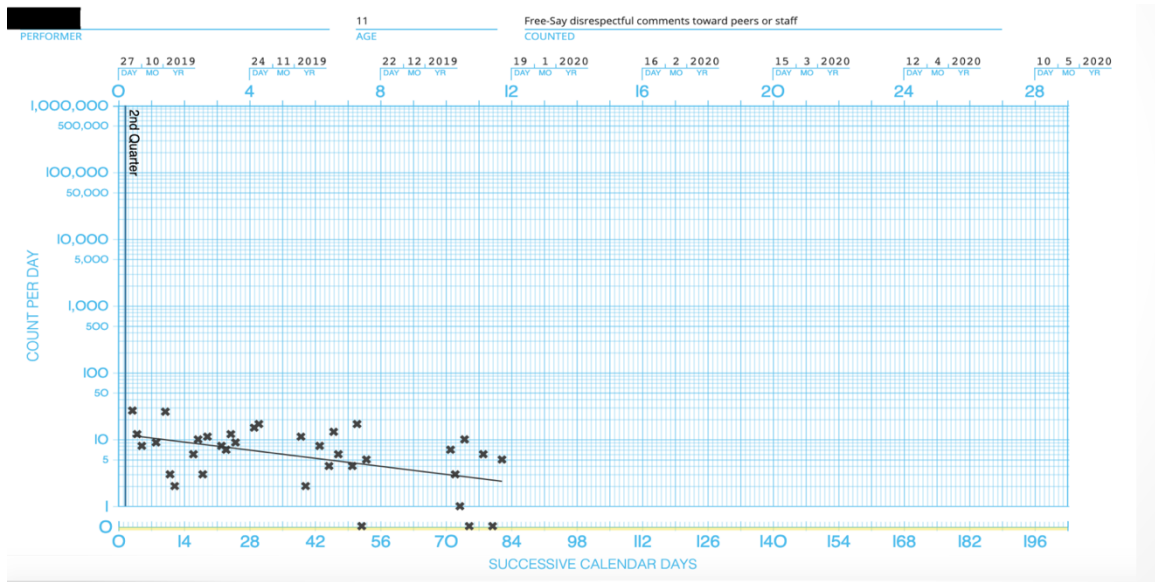
Figure 10

Student 2. Disrespectful Comments Towards Staff/Peers in the Fab Lab
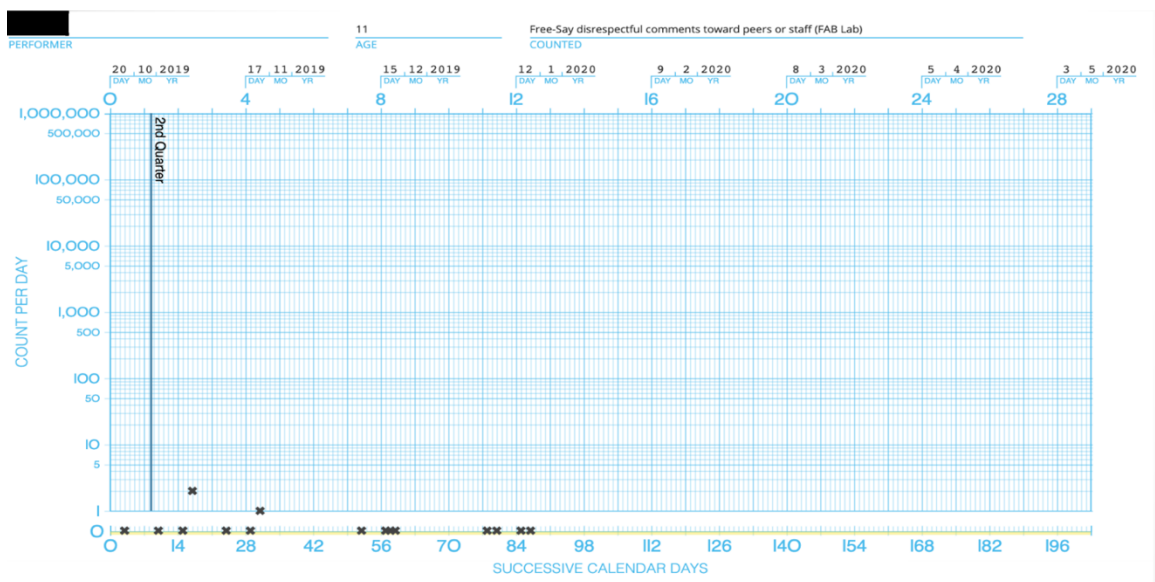
Figures 11 and 12 highlight data collected from Student 3, who has a history of exhibiting self-injurious behaviors. In the traditional classroom setting, this student demonstrated self-injurious behaviors on two occurrences; one lasting for one hour and 15 minutes, while the other occurrence lasted for one hour and 37 minutes (See Figure 11). There were no instances of this type of behavior occurring in the Fab Lab environment during the student observation periods (See Figure 12).

Figure 11

Student 3. Duration of Self-Injurious Behaviors in the Classroom
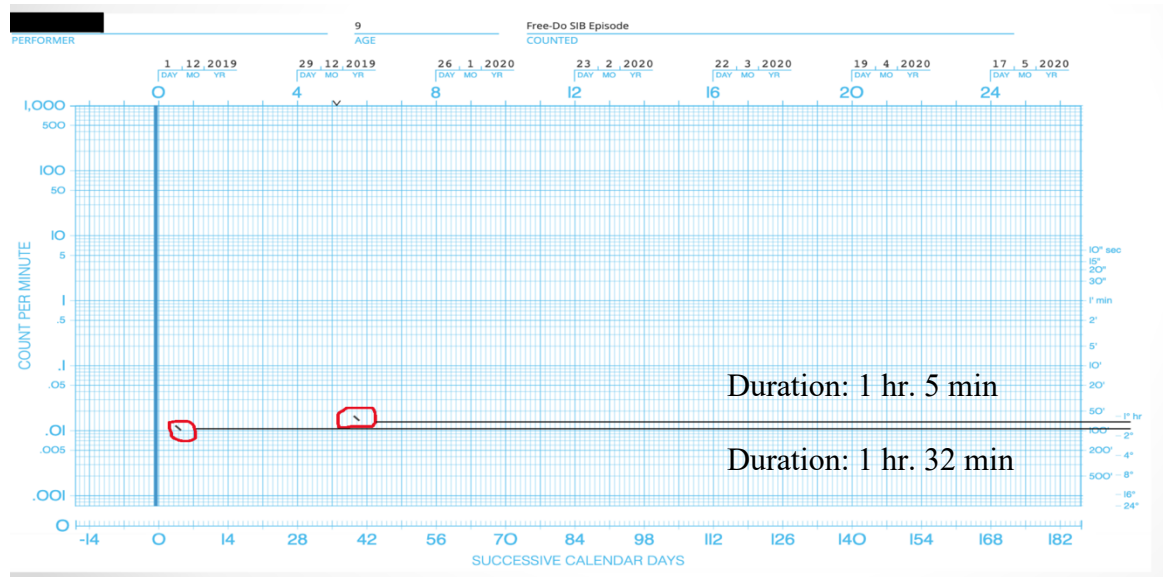
Figure 12

Student 3. Duration of Self-Injurious Behaviors in the Fab Lab
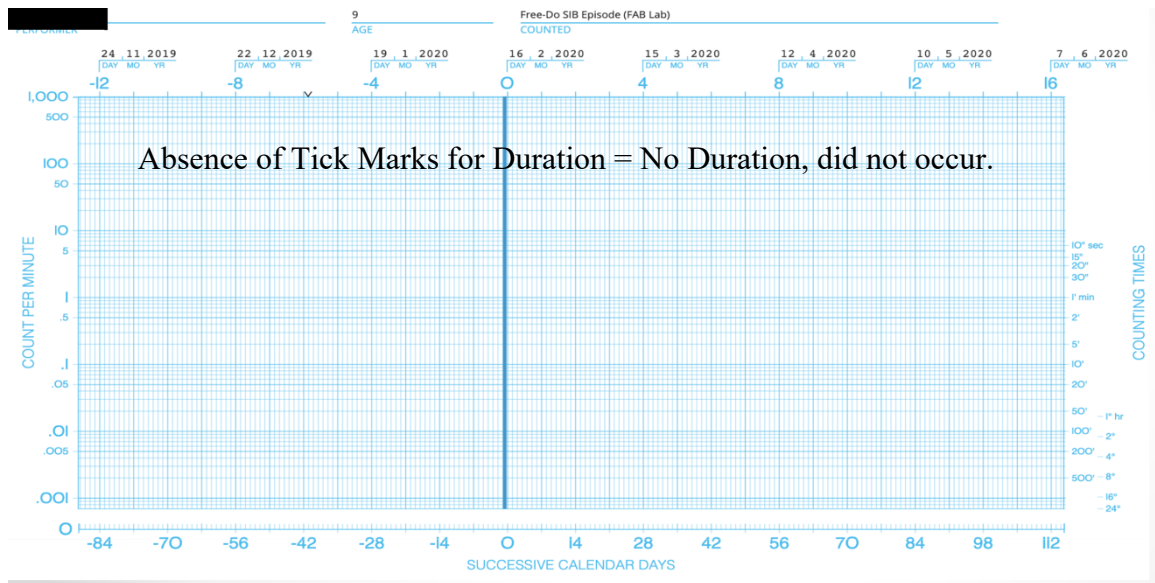
Figures 13 and 14 contains data relative to Student 4, who has a documented history of refusing to complete tasks in the classroom. In the traditional classroom setting, this student had three occurrences of refusal to complete tasks in the classroom between November 17, 2019 to December 15, 2019 (See Figure 13). During the time period of January 12, 2020 through February 9, 2020, the student's behavior increased to six occurrences, with multiple refusals in each occurrence. In the Fab Lab environment, during the same time four-month period, Student 4 exhibited this behavior on three separate occurrences (See Figure 14).

Figure 13

Student 4. Refusal to Complete Tasks in the Classroom
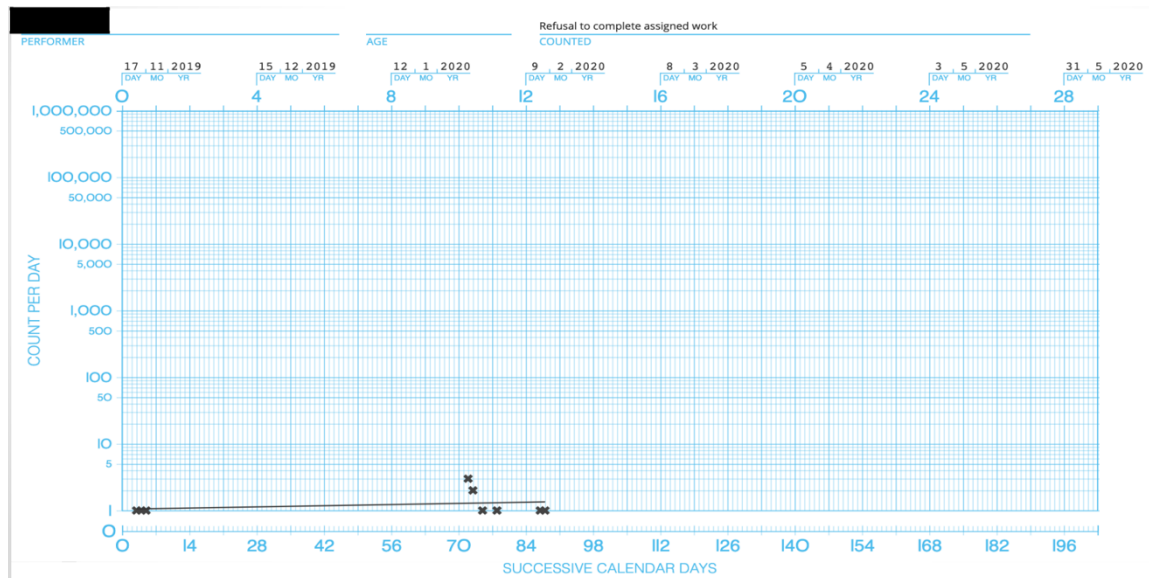
Figure 14

Student 4: Refusal to Complete Tasks in the Fab Lab
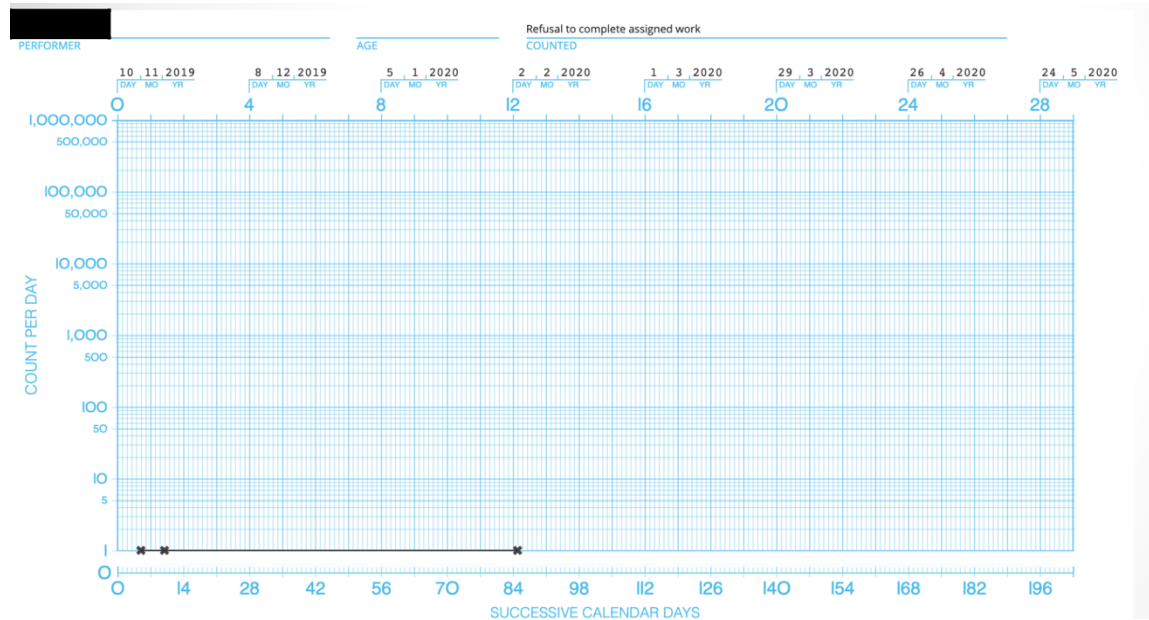
Figures 15 and 16 reflect data collected during observations of a student with the identified behaviors of tantrums involving yelling, throwing objects, and leaving the classroom without permission. In Figure 15, the yellow line on this chart indicates a student goal of tantrums lasting for less than one minute. In the traditional classroom setting, while there were several incidents where this student had tantrums, only one exceeded the one-minute goal. The trend line indicated on this graph demonstrated an increase in the student's behavior of tantrums within the classroom. In the Fab Lab environment, the student only demonstrated two tantrums with one lasting more than the one-minute goal (See Figure 16).

Figure 15

Student 5: Tantrum (i. e., Yelling, Leaving the Classroom, Throwing Items) in the

Classroom
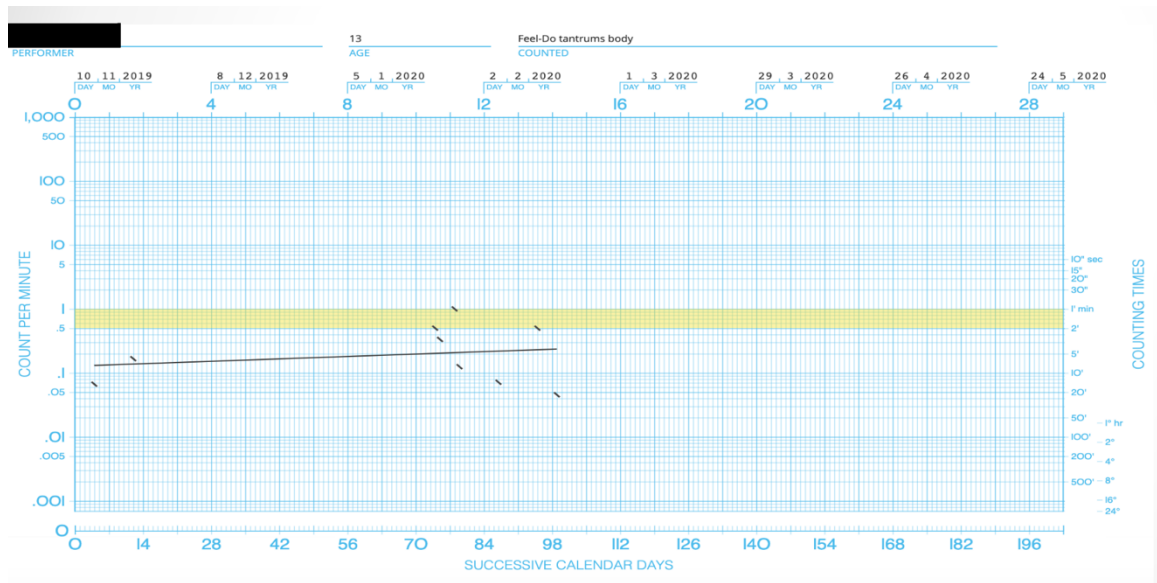
Figure 16

Student 5: Tantrum (i. e., Yelling, Leaving the Classroom, Throwing Items) in the Fab Lab
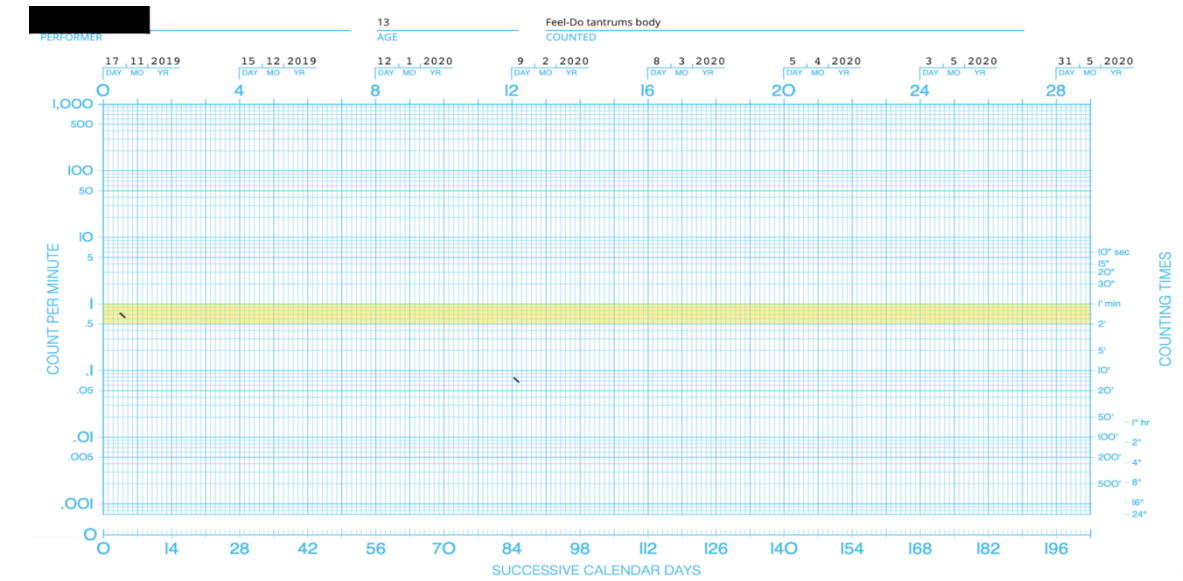
Summary

The initial intent of this study was to collect data in both the traditional classroom setting and Fab Lab for the duration of the 2019-2020 school year. However, data collection was limited by the outbreak of the COVID-19 pandemic. Due to school closures, the students in this study participated in their respective educational programs in

a virtual learning environment; thus, limiting their ability to work in a "hands-on" setting, such as the Fab Lab.

The data collected in this study clearly indicates improvement in key areas such as student discipline, attendance, mental health behaviors, and teacher/social worker perceptions. Student discipline was the key area demonstrating a compelling decrease in discipline infractions when students were in the Fab Lab, compared to the traditional classroom environment. There were no student discipline infractions documented in the Fab Lab during the 2019-2020 school year. This is of great significance, given the increased number of student discipline infractions which occurred within the traditional classroom setting. As mentioned previously, due to COVID-19, student discipline data was not collected for the fourth nine-week period. However, the data collected in for the first, three nine-week periods clearly indicates the positive influence of the Fab Lab on the incidence of student discipline.

While data relative to student attendance didn't have much contrast between the two learning environments, students did attend school more frequently on days in which they were engaged in learning in the Fab Lab. Due to the COVID-19 pandemic school closure, data was not collected for the last nine week period; however, the existing data shows attendance percentages continuing to rise.

When analyzing the student behavior data collected using the Chartlytics system in the traditional classroom as compared to the Fab Lab, the data again demonstrated these behaviors were either non-existent or occurred with less frequently when student learning took place in the Fab Lab. The observations to collect student behavior data occurred on

random days and at various times to avoid skewed data, due to medication or other variables that could potentially influence the observed behaviors.

The pre- and post-surveys for teachers and social workers did not show a large variance in many areas. However, according to the data, these professionals did appear to develop a deeper appreciation for improved student behaviors, as well as more positive perception for these students to excel in a career beyond high school as a result of participating in the Fab Lab.

If this study were to continue, there could certainly be a continuation of data collection between the traditional classroom setting and the Fab Lab. While this study focused primarily on student attendance and behaviors, the contrast of both settings could be examined further through future research focusing on student achievement and growth as it relates to the physical learning environment.

The professionals, teachers and social workers, who participated shared perceptions prior to and following this study relative to individual perceptions of the traditional learning environment and the Fab Lab. A continuation of this portion of the study could focus on taking the Fab Lab instructional strategies into the traditional classroom learning environment, while collecting data on the documented behaviors of students with mental health diagnoses.

Chapter 5; Conclusions and Recommendations

Introduction

For years, educators have made attempts to modify and alter student behaviors through research-based pedagogy. It is evident, when teaching students with mental health diagnoses, challenging behaviors could impede student learning if interventions aren't applied or readily available.   In this section, conclusions will be drawn based on the data analyzed to determine if students with at least one mental health diagnosis will demonstrate improved behavioral and/or attendance outcomes when in the traditional classroom setting as compared to the Fab Lab learning environment. Conclusions will also be made from data analysis pertaining to teacher and social worker perceptions of these two learning environments.

Prior to the introduction to the Fab Lab at the beginning of the 2018-2019 school year, professional staff and students enrolled in the Comprehensive Therapeutic Emotional Support (CTES) classrooms were not privy to project-based learning. Due to severe, disruptive behaviors, resources, other than typical school supplies, were not readily available. Instruction was delivered in the traditional learning environment, while individual and group therapy was conducted in a separate room adjacent to the classroom. Since this time, the students and staff included in this study have been exposed to a more project-oriented learning environment via multiple weekly visits to the Fab Lab. Social workers now conduct group therapy while facilitating projects in the Fab Lab with these cohorts of students.

Each environment contained the same human resources: one teacher, social worker, and paraprofessional. These professionals have been working with the same

cohort of students from the beginning of the school year. At the time of this study, all professionals were beginning to participate in professional development relative to project-based learning.

Student discipline data from the 2019-2020 school year was collected based on students enrolled in the CTES classrooms. The number of incidents were separated by grade spans, including grades K-4, 5-8, and 9-12. This data was also recorded in both the traditional classroom setting and the Fab Lab. Since there was a governor-mandated school closure due to COVID-19 in March, 2020, the final number of incidents were lower than the yearly average recorded at this school.

Student attendance data was also collected during the 2019-2020 school year. Again, due to the pandemic, data was collected only during the first three nine-weeks of school. The total percentage of attendance was isolated by grade level, representing K-4, 5-8, and 9-12. Attendance percentages were recorded in both the traditional classroom setting and the Fab Lab.

This study also includes both a pre- and post-survey focusing on teacher/social worker perceptions to both the traditional learning environment and the Fab Lab. It also analyzed professional development associated with project-based learning. The survey was administered to eight professional staff members (four teachers and four social workers). The survey focused on teacher perceptions on student behaviors in both the traditional classroom setting and Fab Lab. It also highlighted professional development relative to project-based learning, and career readiness and preparation for students with mental health issues.

This study is based on answering the following research questions:

1. Will students with mental health diagnosis (CTES) show a decrease in negative behaviors (Level 1 and 2 infractions) while working in the Fab lab?

2. Will attendance increase for students with a mental health diagnosis (CTES) if they spend more time in the Fab Lab than in a traditional classroom setting?

3. What are the teachers' and social workers' perceptions of utilization of the Fab Lab as a learning environment compared to a traditional learning environment?

4. Will students' observable symptoms of mental health diagnoses decrease as a result of working in the Fab Lab environment?

Conclusions

As mentioned previously, when the Fab Lab initiative began in 2015 at the Colonial School, students in the CTES classrooms were not initially involved in the class rotations. The perception was expensive digital fabrication equipment, along with sharp tools and instruments, may result in injuries to the student or students in the classroom. While these students were still engaged with project-based learning in the traditional classroom, visits to the Fab Lab were minimal.

During the subsequent years leading to 2018, the CTES classrooms made more frequent visits to the Fab Lab. During this time, there were perceptions from teachers and staff relative to improved behaviors of these students with mental health diagnoses on days that the Fab Lab was part of the learning process. Social workers began to note this in daily running records of students; teachers were reporting that behavior class disturbances were reduced on these days. However, these were all general perceptions leading to this formal Action Research Project.

Negative classroom behaviors of students with mental health diagnoses has always been a key discussion point with teachers and social workers. Although not formalized into a study, teachers expressed spending the majority of their day redirecting aggressive student behaviors in attempts to prevent injury to the acting out student and other students in the classroom when observable mental health symptoms began to escalate. As these behaviors became less frequent on days that students visited the Fab Lab, it became evident that formalized research would be beneficial in developing and altering the curriculum of students who suffer from mental health issues.

Will Students with Mental Health Diagnosis (CTES) Show a Decrease in Negative Behaviors (Level 1 and 2 Infractions) While Working in the Fab Lab?

The first research question *Will students with mental health diagnosis (CTES) show a decrease in negative behaviors (Level 1 and 2 infractions) while working in the Fab lab?* became a key focal point of this study. The data regarding this was divided by grade levels K-4, 5-8, and 9-12. While the COVID-19 pandemic and mandatory school closure on March 13, 2020 certainly lowered the overall discipline infractions, data for the first three quarters of the school year was analyzed in two environments: traditional classroom setting and the Fab Lab. In grades K-4, there were 48 infractions reported in the traditional classroom, while not a single infraction was reported in the Fab Lab. In grades 5-8, there were 103 discipline instances reported while no student disciplinary incidents occurred in the Fab Lab. Lastly, in grades 9-12, 227 infractions were reported in the traditional classroom setting. Again, no student discipline infractions were recorded in the Fab Lab. This evidence is astounding given the fact that there were no

discipline infractions reported in the Fab Lab. When analyzed further, it should be noted these observations took place at various times of the day and on different days of the week, as to not skew any reportable data.

Will attendance increase for students with a mental health Diagnosis (CTES) if they spend more time in the Fab Lab than in a traditional classroom setting?

Student attendance at the Colonial School has been a common concern for years. Incentives through Positive Behavior Support programs, individual awards, classroom competitions, and other reward systems have been implemented to entice students to come to school. Therefore, the next research question, *Will attendance increase for students with a mental health diagnosis (CTES) if they spend more time in the Fab Lab than in a traditional classroom setting?* is quite relevant to this school-wide issue.

In grades K-4, students attended school 87% of the time in a traditional classroom setting. There was a one-percent increase in student attendance (88%) on Fab Lab days. In grades 5-8, attendance increased as students attended school 78% of the time in the traditional classroom environment, while attending school 82% of the time on days when learning took place in the Fab Lab. In grades 9-12, students attended school 75% of the time in the traditional classroom setting. These grade levels showed a one-percent increase on Fab Lab days (76%).

To someone outside of the Colonial system, the contrast of attendance in these two learning environments may not appear as drastic. However, as mentioned previously, student attendance has long been an issue in this school; therefore, any increase in this area needs to be analyzed further. The fact attendance increased in all

grade levels on days learning took place in the Fab Lab may demonstrate a need for school leaders to analyze learning in a comprehensive, project-based learning environment. The data proves that students prefer to attend school on days they are going to be engaged in individual/group projects. Additional research may be warranted to further investigate this statement.

What are the teachers' and social workers' perceptions of utilization of the Fab Lab as a learning environment compared to a traditional learning environment?

Analyzing teacher and social worker perceptions of students with mental health diagnoses engaged in Fab Lab learning activities was the next section of data analysis in this Action Research project. As educators, teachers are required to teach the mandated curriculum. However, their perceptions in the manner this curriculum is presented could potentially have an effect on student learning. Therefore, the next research question: *What are the teachers' and social workers' perceptions of utilization of the Fab Lab as a learning environment compared to a traditional learning environment?* was a major focus of this study.

The survey consisted of 10 questions focused on perceptions of training, attendance, student discipline, student comprehension, student reactions to group work, structured learning environments, career readiness, and teacher/social worker ability to communicate effectively with students. The teachers and social workers responded to the questions based on a subjective scale.

The initial portion of the pre- and post-survey focused on teacher and social worker prior trainings on both project-based learning and the equipment in the Fab Lab.

While these results weren't drastic from pre- to post-survey, there was a slight increase in

trainings in both of these categories. It should be noted that cohorts of the professional

staff at the Colonial School were trained in project-based learning throughout the 2019-

2020 school year. The increase simply could have been that these individuals were

scheduled for training during the timeline of this study. This was not the case for the Fab

Lab equipment training. All staff was provided a general overview of the digital

fabrication equipment prior to 2019 and all staff members had the option of receiving

additional training during staff in-service times. The slight increase of Fab Lab

equipment training could have been a result of these professionals choosing to participate

in these additional trainings.

In the area of *students learning better in the Fab Lab*, there was a slight increase

in positive teacher/social worker perception from the pre to post survey; however, in the

area of *student comprehension (or students learning through the Fab Lab curriculum)*,

there was a decrease in teacher/social worker perception that students comprehend the

lesson or activity. As mentioned previously, this study did not focus on student

achievement or growth, so assessments were not a part of the data analysis. This perhaps

could be an indicator as to why these professionals responded in this manner.

In the area of *student reaction to group work*, there was a notable increase in

perceptions from the pre to post survey as 75% of the participants strongly agreed that

students reacted to group work in a positive manner, compared to 50% of the participants

in the pre survey. There was also a slight increase in *teacher/social worker ability to

communicate effectively with students*. It should be noted that the intent of this question

was based upon effective communication during instruction and learning and not during

therapeutic (individual and/or group counseling) services. This researcher would anticipate a much higher average of positive responses from these professionals had communication during therapeutic activities been considered.

The two final areas of the survey, student discipline and career awareness, showed noticeable difference from pre- to post-surveys. In student discipline, positive perceptions changed by 50%. This data point is parallel with the student behavior statistics shared earlier, as student discipline infractions were non-existent when students were engaged in learning in the Fab Lab. On the contrary, survey responses in the category of career awareness perceptions decreased by 50%. This statistic is somewhat concerning as the mere premise of projects and activities in the Fab Lab are centered around career awareness. However, as mentioned previously, this group of students and professionals had been just recently introduced to the Fab Lab learning environment and primary goals of this group is altering behaviors in a positive manner as not to impede upon the learning process. Also, with the decrease in career awareness perceptions, this should warrant further analysis of the curriculum for the CTES program. As Pennsylvania now requires more stringent guidelines and benchmarks for public schools in the area of career awareness, perhaps crosswalks could be created in linking specific careers to the various projects/activities from the Fab Lab curriculum.

Will students' observable symptoms of mental health diagnosis decrease as a result of working the Fab Lab learning environment?

Students who are enrolled in the CTES classrooms at the Colonial School all have at least one documented mental health diagnosis. As a direct result, certain behaviors are exhibited in the school environment that can directly be related to this diagnosis. The

final research question, *Will students' observable symptoms of mental health diagnosis decrease as a result of working the Fab Lab learning environment?* is ultimately very important in the learning process. If students can control and minimize these symptoms through the engagement in the Fab Lab environment, it is obvious there is more opportunity for learning to occur.

In this Action Research project, the Chartlytics Data Analysis system was utilized to capture time encrypted data relative to a student's observable mental health symptoms. Chartlytics is a real-time digitized platform that documents specified data through the use of a technological device, including iPads, cellular phones, and computers. This system was created by the Pennsylvania State University. The Intermediate Unit 1 has utilized this platform since its inception three years ago. The Chartlytics system enables the user to produce a running record demonstrating patterns of behavior. The behaviors indicated for each student have been previously documented in the student's Positive Behavior Support Plan (PBSP) and included as part of the Individualized Education Program (IEP).

Data was collected on five students with mental health diagnoses in both the traditional classroom environment and in the Fab Lab. These students are categorized as Students 1, 2, 3, 4, and 5 respectively.

Students 1 and 2 had a history of making disrespectful comments toward peers and/or staff. When observed in the traditional classroom setting, Student 1 averaged nearly eight occurrences of disrespectful comments in the traditional classroom setting; however, when the same student was observed in the Fab Lab, there were zero occurrences of this behavior. Student 2 had many more instances of disrespectful comments made to staff/peers. Although this student continued to demonstrate the

identified behavior in the Fab Lab with two documented occurrences, there was still a

noticeable contrast of the behavior between the two settings.

This extremely critical information supports the conclusion students can control

behavior when engaged in the Fab Lab curriculum. The behavior of making disrespectful

comments is indicated in both students' Positive Behavior Support Plans. Several

prompts of redirection are provided when engaged in this behavior. Despite the provision

of redirection, the students still exhibited these behaviors in the traditional classroom. Yet

none to very few prompts or redirection were necessary in the Fab Lab, as the

occurrences were extremely minimized. This information could indicate that these

students were so engaged in the lesson's activities they did not have their attention

diverted. As this information was observed on various days during different types of

projects, it is apparent the mere difference in the delivery of instruction, along with a

more welcoming group-oriented atmosphere, could be the reasons for the drastic change

of behaviors.

A common mental health observable symptom in students enrolled in the CTES

program at the Colonial School is self-injurious behavior(s). Another key consideration

in this category of behavior is the duration of the incident. Student 3, who had a history

of exhibiting self-injurious behaviors, was observed in both the traditional classroom

environment and the Fab Lab. This student was observed to display self-injurious

behaviors on two occurrences; one occurrence lasting for one hour and fifteen minutes

and the other lasting for one hour and 37 minutes. This student did not exhibit any self-

injurious behaviors while observed in the Fab Lab during the same time period.

It is compelling that this student exhibited these behaviors while in an environment that offered limited items to create a self-injury. On the contrary, in the Fab Lab environment, where there are several instruments, tools, and items that could aid in self-injurious behaviors, this student had no occurrences. Again, this data supports the conclusion that students' observable symptoms of mental health diagnoses decrease as a result of working in the Fab Lab environment.

Another frequently observed symptom of students in the CTES program is the refusal to complete tasks in the classroom. It should be noted the tasks the student is asked to complete are ones that he/she clearly understands. Again, the task refusal behavior was identified in the student's Positive Behavior Support plan, as a common symptom.

Student 4 was observed on several occasions during two separate time periods. During these time periods, there were nine total occurrences of this student refusing to complete tasks with each occurrence having multiple refusals in the traditional classroom setting. During this same time period, the student had three occurrences of refusal to complete tasks while in the Fab Lab. Again, this could be directly linked to the student's interest in the Fab Lab projects and activities provided. The student completed tasks at an increased rate in the Fab Lab with little redirection, supporting the conclusion that observable symptoms linked to a mental health diagnoses reduce significantly while engaged in the Fab Lab environment.

Undoubtedly, the most common observable mental health related symptom of the CTES students is the tantrum. This would include behaviors such as yelling, leaving the classroom without permission, and throwing items. Again, the duration of each tantrum

is a vital in this analysis. Goals for duration are generally under one minute. With Student 5, this behavior was exhibited on several occasions, with only one tantrum lasting more than one minute in the traditional classroom. On the contrary, in the Fab Lab, this same student only demonstrated two tantrums with one lasting more than the one-minute goal. This contrast of data in this behavior again supports the conclusion that observable symptoms of students with mental health issues clearly diminish when students are exposed to the Fab Lab environment.

The comprehensive data analysis completed in this project provides concrete evidence that student behaviors, attendance, and observable mental health symptoms improve while engaged in activities in the Fab Lab compared to the traditional classroom. These are all critical factors that could impede the learning process. When students decrease outward behaviors and attend school on a more regular basis, it is anticipated that self-image would improve which, in turn, could raise self-expectations.

The information and data collected from the professional participating in this study did not prove to be a huge contrast from pre- to post-studies in many areas; however, in the area of perceptions on discipline, this demonstrated the most drastic increase. Again, teacher/social worker positive perceptions on students could initiate a better relationship and connection; thus, potentially impacting student self-expectations and ultimately raising the bar on student achievement.

Recommendations

If this project were to advance, student achievement would be a key area to examine through research and data collection. Project-based learning occurring in the Fab Lab provides cross-curricular connections in the content areas of science, math,

english language arts (ELA), and social studies, while fostering increased student engagement. Analysis of the results of local and state assessments, such as the Pennsylvania State System of Assessments (PSSA) and Keystone Examinations, would prove to be beneficial in establishing the correlation between student learning in the Fab Lab and student achievement.

Another area of potential research is determining the effectiveness of therapeutic support while engaged in Fab Lab activities and projects. Currently, all social workers at the Colonial School have been trained on the Fab Lab equipment. This was the initial step in the process of providing both individual and group therapy to students with mental health diagnoses. It would be quite interesting to analyze the results of a future study focusing on success of student therapy while engaged in the Fab Lab activities and projects. Progress monitoring data of the students' IEP goals and perception data of social workers and students could serve as the basis for data analysis in this area.

In addition, post-secondary and/or career success for students with mental health diagnoses should be examined further. Generally, post-secondary outcomes for students with mental health needs are very poor. If students improve behaviors, attendance, and discipline, will this have a direct impact on life successes beyond high school? Further research is greatly needed on this topic.

Finally, a key area of potential research regarding this student population would be the implementation of project-based learning in the traditional classroom environment. The Fab Lab could obviously be the hub of activities and projects, while cross-curricular activities could be implemented in other disciplines that would support the required core academic standards.

This study was conducted in a school that specialized in special education, mental health, and alternative education. I believe it would be beneficial for a regular public school elementary/middle/or high school duplicate this study as these schools include a population of students with very diverse backgrounds. Discipline and attendance are barriers to learning in all schools; it would be interesting to see if students from a public school setting that includes such a diverse group of students would benefit from this study.

It could also be very interesting to analyze data relative to state assessments of students from a regular school environment and determine if learning in the Fab Lab improves student achievement and/or growth – regardless of the students classification (i.e. special education, mental health, regular education, gifted, etc.).

Summary

Since the inception of the Fab Lab concept in 2015, Intermediate Unit 1 has worked with key partners in modifying and making improvements to this program/curriculum. Members of the core Fab Lab team from Intermediate Unit 1 has attended yearly World-Wide Fab Lab Network Conferences in Boston, MA., Chile, Shenzhen, and France, oftentimes being invited to be key speakers at these events.   In 2019, Intermediate Unit 1 representatives were invited to the HundrEd Innovation Summit in Helsinki, Finland. Based on its successful work in the area of incorporating mental health students in the Fab Lab learning environment, Intermediate Unit 1 was one of 10 Pittsburgh, PA Innovative Programs to be selected to attend and present at this prestigious conference.

Intermediate Unit 1 has also partnered with the Mid-Atlantic Regional Education Laboratory (REL) to further analyze the data and statistics of the successes of students with mental health diagnoses. At the time of this publication, Intermediate Unit 1 was selected to participate in a national study of the REL which will focus on various coaching models that will support this type of learning.

This study clearly shows the need for students with mental health diagnoses to have opportunities for learning beyond the traditional classroom. The Fab Lab proved to be a valuable and conducive setting for students, as drastic improvements were observed and recorded. Positive results were noted in the areas of student discipline, attendance, and behaviors associated with mental health diagnoses when participating in learning activities in the Fab Lab. With the creation of the Fab Lab being somewhat recent, there is very little research documented in relationship to the success of this learning environment and students with mental health diagnoses. A key factor could be the stereotype of mental health and how this group of students could potentially injure themselves and/or others while engaged in projects. Regardless, increased research is needed in this area for the benefit and success of students who experience mental health issues.

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Appendix A; Institutional Board Approval Email
Institutional Review Board
California University of Pennsylvania
Morgan Hall, 310
250 University Avenue
California, PA 15419
instreviewboard@calu.edu
Melissa Sovak, Ph.D.

Dear Donald,

Please consider this email as official notification that your proposal titled "The Effects of the Fab Lab Learning Environment of Students with Mental Health Diagnosis" (Proposal #19-007) has been approved by the California University of Pennsylvania Institutional Review Board as submitted.

The effective date of approval is 10/7/19 and the expiration date is 10/6/20. These dates must appear on the consent form.

Please note that Federal Policy requires that you notify the IRB promptly regarding any of the following:

(1) Any additions or changes in procedures you might wish for your study (additions or changes must be approved by the IRB before they are implemented)

(2) Any events that affect the safety or well-being of subjects

(3) Any modifications of your study or other responses that are necessitated by any events reported in (2).

(4) To continue your research beyond the approval expiration date of 10/6/20 you must file additional information to be considered for continuing review. Please contact instreviewboard@calu.edu

Please notify the Board when data collection is complete.

Regards,

Melissa Sovak, PhD.

Chair, Institutional Review Board

Appendix B; Informed Consent

TITLE OF STUDY

The Effects of the Fab Lab Learning Environment of Students with Mental Health Diagnosis

PRINCIPAL INVESTIGATOR

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Approved by the California University of Pennsylvania Institutional Review Board. This approval is effective 10/15/2019 and expires 06/30/2020

PURPOSE OF STUDY

You are being asked to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.

The purpose of this study is to find a distinct conclusion of determining if the effects of project-based learning (PBL) in the FAB Lab environment will improve student discipline and attendance. This study will also analyze teacher perceptions of PBL versus the traditional learning environment.

STUDY PROCEDURES

This study is to focus on student behaviors and attendance while working in the FAB Lab learning environment. It will also analyze teacher perceptions of this type of learning. While this topic is relevant in my profession, there doesn't appear to be much research – particularly with students with mental health needs. Therefore, both practical Action Research as well as participatory and classroom action research methods, in my professional opinion, will be prudent in analyzing project/problem-based learning with students with special needs.
The study would include students with mental health disorders located at our Colonial School. Students from three (3) CTES classrooms will be the focus, along with the three classroom teachers and the FAB Lab teacher. Data collection to create student profiles would begin in June, 2019 and go through August, 2019. Both qualitative and quantitative methods would be utilized through surveys, teacher questionnaires, as well as behaviors charted from the Class Dojo System. Attendance data would be collected

from the Alma Student Information System. Finally, the Chartlytics Data Analysis system will be used to chart ongoing student behaviors/incidents. Chartlytics is a real-time digitized platform that captures running records on iPads, cellular phones, computers, etc. This program was created out of the Pennsylvania State University and IU1 has utilized this platform since its inception three years ago.

The research I plan to conduct will also be team-action oriented. By utilizing a "Design-Team" approach (a panel representing the entire school community), this process will be used to collect and analyze the relevant data, while formulating a plan to change or alter the problem. This research will also include an ample amount of reflection to support our findings. This will be conducted at the school-level as opposed to district-level as opposed to the entire district/entity. By using this approach, it is my goal to create a somewhat personable, relatable, and real-life education situation.

RISKS

There is minimal to no risk in the use of each procedure in this study. Teacher surveys, observations, and interviews will be held in confidence according to the confidentiality section below. You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

Student specific data will be collected. However, all discipline and attendance data will be disaggregated by entire groups of students (CTES Elementary, Middle, and High School classes) and not on specific students.

BENEFITS

Through the use of Project-Based Learning (PBL) in the FAB Lab environment, it is my hope that the data will reflect higher attendance rates and lower discipline infractions (Levels I and II) within the classroom environment. If successful, this type of learning will be incorporated in a cross-curricular approach in the regular classroom setting.

CONFIDENTIALITY

Your responses to surveys and/or questionnaires will be anonymous. Please do not write any identifying information on them. Every effort will be made by the researcher to preserve your confidentiality including the following:

 Assigning code names/numbers for participants that will be used on all research notes and documents

Keeping notes, interview transcriptions, and any other identifying participant information in a locked file cabinet in the personal possession of the researcher.

All behavior and attendance data will be numerical and not student-specific.

Participant data will be kept confidential except in cases where the researcher is legally obligated to report specific incidents. These incidents include, but may not be limited to, incidents of abuse and suicide risk.

CONTACT INFORMATION

If you have questions at any time about this study, or you experience adverse effects as the result of participating in this study, you may contact the researcher whose contact information is provided on the first page. If you have questions regarding your rights as a research participant, or if problems arise which you do not feel you can discuss with the Primary Investigator, please contact the Institutional Review Board at (865) 354-3000, ext. 4822.

VOLUNTARY PARTICIPATION

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

CONSENT

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

Appendix C; Teacher/Social Worker Perception Pre/Post-Study Questionnaire

You are about to begin a year-long process of working with students in a Project-Based Learning environment in the IU1 Fab Lab with the study titled: ***The Effects of the Fab Lab Learning Environment of Students with Mental Health Diagnosis.***

The following questionnaire is an important component of this study as it measures both teacher and social worker perceptions relative to Project-Based Learning in the Fab Lab. You are asked to complete this to the best of your ability and knowledge. You will be asked to complete an additional questionnaire at the conclusion of this project. This survey is anonymous, and the data collected will in no way be teacher-specific.

Please circle the answer that best describes you currently in your profession.

1. I have been formally trained prior to this study in project-based learning (PBL).
    A. Trained in all phases of PBL
    B. Trained on some areas of PBL
    C. Not trained but have a general understanding of PBL
    D. Not trained and have no understanding of PBL

2. I believe that students will learn better in a project-based learning environment in the Fab Lab opposed to traditional learning in a classroom setting.

    A. Strongly Agree
    B. Agree
    C. Neutral (Won't have an impact)
    D. Disagree
    E. Strongly Disagree

3. I believe that discipline infractions (Level I and II) will decrease while students are engaged in Fab Lab activities.
    A. Strongly Agree
    B. Agree
    C. Neutral (Won't have an impact)
    D. Disagree
    E. Strongly Disagree

4. I believe that student attendance will increase overall as a result of students participating in regular projects in the FAB Lab environment.
    A. Strongly Agree
    B. Agree
    C. Neutral (Won't have an impact)
    D. Disagree
    E. Strongly Disagree

5. I have been formally trained in operating all equipment in the IU1 FAB Lab.
    A. Trained in all phases of equipment
    B. Trained on some of the equipment
    C. Not trained but have a general understanding in some equipment.
    D. Not trained and have no understanding of the equipment

6. Using the FAB Lab and concentrating on projects will increase student comprehension in the related area of the curriculum.
    A. Strongly Agree
    B. Agree
    C. Neutral (Won't have an impact)
    D. Disagree
    E. Strongly Disagree

7. In my past experiences as a teacher in the Comprehensive Therapeutic Emotional Support classroom setting, students have had issues working in groups.
    A. Strongly Agree
    B. Agree
    C. Neutral (No impact)
    D. Disagree
    E. Strongly Disagree

8. In my past experiences as a teacher in the Comprehensive Therapeutic Emotional Support Classroom setting, I believe that students need to have a structured learning environment which includes components of the traditional classroom environment (i.e. desk structure, classroom procedures, etc.).
    A. Strongly Agree
    B. Agree
    C. Neutral (No impact)
    D. Disagree
    E. Strongly Disagree

9. While working in the FAB Lab learning environment, I believe that students will have more of a broad perspective of career readiness including specific trades relative to the project(s) being conducted.
    A. Strongly Agree
    B. Agree
    C. Neutral (No impact)
    D. Disagree
    E. Strongly Disagree

10. I believe that working in the FAB Lab learning environment will enhance my professional ability to relate and communicate with students.

      A. Strongly Agree
      B. Agree
      C. Neutral (No impact)
      D. Disagree
      E. Strongly Disagree

Appendix D; Intermediate Unit 1 Classroom Enrollment Form

All special education paperwork must be completed by the sending school district prior to enrollment.

Related Services/Program (Place an X next to service if appropriate.):

Related Services		Program	
Occupational Therapy		Autistic Support	
Physical Therapy		Comprehensive TES	
Speech & Language Support		Learning Support	
Vision Support		Life Skills Support	
Hearing Support		Multi-disabilities Support	
Personal Care Assistant		Therapeutic Emotional Support	
Other (Please specify):		Other (Please specify):	

Requested Program Location:

Student Demographics:

Student Name:_____ Date of Birth:

Parent/Guardian:_____Home Phone:

Address:_____ Work Phone:

_____ Cell Phone:

_____ Email address:

Student Information:

PA Secure ID #:_____Gender (M/F):_____

Primary Disability: _____
Secondary Disability: _____

School Information:

Referring School District:

_____

Contact Person (LEA): _____ Phone/email:

_____

Student Home School District:

_____

  Student Home School:

_____

District Where Parent/Guardian Reside:

_____

Language Spoken:_____ Economically Disadvantaged:_Yes
_____No

Ethnicity:_____ ESL Services:___Yes___No

Current Grade:____Date Enrolled in 9th Grade:_____District Enrollment Date:_____
_____

State Enrollment Date:_____ US Enrollment Date:_____

Current Educational Placement: General Education:_____
Special Education:_____
Other (specify):_____

_____

_____

_____

_____

Parent Notification of Pending Placement:___Yes_____No

Method and Date of Contact: ____Conference   Date:_____

_____Phone Call   Date:_____
_____Other (specify)   Date:_____

_____

_____

Required Special Education Information:
Attach all documents or ensure IEPWriter access for IU Case Manager:

_____Evaluation Report (ER) or Reevaluation Report (RR) reflecting   Date:__
_____

change in placement.

_____Invitation to IEP meeting addressing change in placement.   Date:_____
_____

_____Individualized Education Program (IEP) reflecting change in placement.   Date:__
_____

_____Notice of Recommended Placement (NOREP)   Date:_____
_____

_____Positive Behavior Support Plan (PBSP)   Date:__
_____

_____Current Progress Reports   Date:_____
_____

Student Risk Factors:

Homeless	Yes _____	No_____	Unsure_____
In Foster Care System	Yes _____	No_____	Unsure_____
Family Abuse/Neglect	Yes _____	No_____	Unsure_____
Sexual Abuse	Yes _____	No_____	Unsure_____
Depression/Suicide Attempt(s)	Yes _____	No_____	Unsure_____
Pregnant/Teen Parent	Yes _____	No_____	Unsure_____
Parent Incarcerated	Yes _____	No_____	Unsure_____
Parent Unemployed	Yes _____	No_____	Unsure_____
Family Mental Health Problems	Yes	_No_____	Unsure_____
Drug/Alcohol Involvement	Yes _____	No_____	Unsure_____
(Student or Family)			
Family Poverty	Yes _____	No_____	Unsure_____
Other (specify)	Yes _____	No_____	Unsure_____

_____

_____

AXIS I Diagnosis:

_____
_____
_____

Please include the following current documents:

Educational Records:
1. Psychological Documents
2. Evaluation/reevaluation educational
3. Individual Education Plan
4. NOREP
5. Report Card
6. Disciplinary Records

Health Records:
1. Immunization records

Other:
1. Legal

(Custody,

rights, etc.)

_____   _____   _____

          District LEA Signature   Title
          Date

Appendix E; Fab Lab Lessons Developed for Students with Mental Health Diagnosis

https://www.scopesdf.org/intermediate-unit-1-collection/

Appendix F; Individualized Education Program (IEP)

INDIVIDUALIZED EDUCATION PROGRAM (IEP)   **School Age**

Student's Name: _____

IEP Team Meeting Date (mm/dd/yy): _____

IEP Implementation Date (Projected Date when Services and Programs Will Begin): _____

Anticipated Duration of Services and Programs: _____

Date of Birth: _____

Age: _____

Grade: _____

Anticipated Year of Graduation: _____

Local Education Agency (LEA): _____

County of Residence: _____

Name and Address of Parent/Guardian/Surrogate: _____   Phone (Home): _____

_____   Phone (Work): _____

_____

_____

_____

Other Information: _____

The LEA and parent have agreed to make the following changes to the IEP without convening an IEP meeting, as documented by:

| |
| |

Date of Revision(s)	Participants/Roles	IEP Section(s) Amended

The Individualized Education Program team makes the decisions about the student's program and placement. The student's parent(s), the student's special education teacher, and a representative from the Local Education Agency are required members of this team. Signature on this IEP documents attendance, not agreement.

Role	Printed Name	Signature
Parent/Guardian/Surrogate		
Parent/Guardian/Surrogate		
Student*		
Regular Education Teacher**		
Special Education Teacher		
Local Ed Agency Rep		
Career/Tech Ed Rep***		
Community Agency Rep		
Teacher of the Gifted****		

*   The IEP team must invite the student if transition services are being planned or if the parents choose to have the student participate.
**   If the student is, or may be, participating in the regular education environment.
***   As determined by the LEA as needed for transition services and other community services.
****   A teacher of the gifted is required when writing an *IEP* for a student with a disability who also is gifted.
One individual listed above must be able to interpret the instructional implications of any evaluation results.

Written input received from the following members:

Transfer of Rights at Age of Majority

For purposes of education, the age of majority is reached in Pennsylvania when the individual reaches 21 years of age. Likewise, for purposes of the Individuals with Disabilities Education Act, the age of majority is reached for students with disabilities when they reach 21 years of age.

PROCEDURAL SAFEGUARDS NOTICE

I have received a copy of the *Procedural Safeguards Notice* during this school year. The *Procedural Safeguards Notice* provides information about my rights, including the process for disagreeing with the IEP. The school has informed me whom I may contact if I need more information.

Signature of Parent/Guardian/Surrogate: _____

MEDICAL ASSISTANCE PROGRAM BILLING NOTICE
(Applicable only to parents who have consented to the release of billing information to Medical Assistance programs)

I understand that the school may charge the School-Based Access Program ("SBAP")—or any program that replaces or supplements the SBAP—the cost of certain special education and related services described in my child's IEP. To make these charges to the SBAP, the school will release to the administrator of that program the name, age, and address of my child, verification of Medicaid eligibility for my child, a copy of my child's IEP, a description of the services provided and the times and dates during which such services were provided to my child, and the identity of the provider of such services. *I understand that such information will not be disclosed, and such charges will not be made, unless I consent to the disclosure.* I acknowledge that I have provided written consent to disclose such information.

I understand that my consent is ongoing from year-to-year unless and until I withdraw it. I can withdraw my consent in writing, or orally if I am unable to write, at any time. My refusal to consent or my withdrawal of consent will not relieve the school of the obligation to provide, at no cost to me or my family, any service or program to which my child is entitled under the Individuals with Disabilities Education Act ("IDEA") or that is necessary to enable my child to receive a free appropriate public education as described in my child's IEP.

I understand that the school cannot—

Require me or my family to sign up for or enroll in any public benefits or insurance program, such as Medicaid, as a condition of receiving a free appropriate public education for my child;

Require me or my family to incur any expense for the provision of a free appropriate public education to my child, including co-payments and deductibles, unless it agrees to pay such expenses on my or my family's behalf;

Cause a decrease in available lifetime coverage or any other insured benefit;

Cause me or my family to pay for services that would otherwise be covered by a public benefits or insurance program and that are required for my child outside the time that he or she is in school;

Risk the loss of eligibility for home and community-based waivers, based on aggregate health-related expenditures.

I. SPECIAL CONSIDERATIONS THE IEP TEAM MUST CONSIDER BEFORE DEVELOPING THE IEP. ANY FACTORS CHECKED AS "YES" MUST BE ADDRESSED IN THE IEP.

Is the student blind or visually impaired?

☐ Yes   The IEP must include a description of the instruction in Braille and the use of Braille unless the IEP team determines, after an evaluation of the student's reading and writing skills, needs, and appropriate reading and writing media (including an evaluation of the student's future needs for instruction in Braille or the use of Braille), that instruction in Braille or the use of Braille is not appropriate for the student.

☐ No

Is the student deaf or hard of hearing?

☐ Yes   The IEP must include a communication plan to address the following: language and communication needs; opportunities for direct communications with peers and professional personnel in the student's language and communication mode; academic level; full range of needs, including opportunities for direct instruction in the student's language and communication mode; and assistive technology devices and services. Indicate in which section of the IEP these considerations are addressed. The Communication Plan must be completed and is available at www.pattan.net

☐ No

Does the student have communication needs?

☐ Yes   Student needs must be addressed in the IEP (i.e., present levels, specially designed instruction (SDI), annual goals, etc.)

☐ No

Does the student need assistive technology devices and/or services?

☐ Yes   Student needs must be addressed in the IEP (i.e., present levels, specially designed instruction, annual goals, etc.)

☐ No

Does the student have limited English proficiency?

☐ Yes   The IEP team must address the student's language needs and how those needs relate to the IEP.

☐ No

Does the student exhibit behaviors that impede his/her learning or that of others?

☐ Yes   The IEP team must develop a Positive Behavior Support Plan that is based on a functional assessment of behavior and that utilizes positive behavior techniques. Results of the functional assessment of behavior may be listed in the Present Levels section of the IEP with a clear measurable plan to address the behavior in the Goals and Specially Designed Instruction sections of the IEP or in the Positive Behavior Support Plan if this is a separate document that is attached to the IEP. A Positive Behavior Support Plan and a Functional Behavioral Assessment form are available at www.pattan.net

☐ No

Other (specify):

II. PRESENT LEVELS OF ACADEMIC ACHIEVEMENT AND FUNCTIONAL PERFORMANCE

Include the following information related to the student:
- Present levels of academic achievement (e.g., most recent evaluation of the student, results of formative assessments, curriculum-based assessments, transition assessments, progress toward current goals)
- Present levels of functional performance (e.g., results from a functional behavioral assessment, results of ecological assessments, progress toward current goals)
- Present levels related to current postsecondary transition goals if the student's age is 14 or younger if determined appropriate by the IEP team (e.g., results of formative assessments, curriculum-based assessments, progress toward current goals)
- Parental concerns for enhancing the education of the student
- How the student's disability affects involvement and progress in the general education curriculum
- Strengths
- Academic, developmental, and functional needs related to student's disability

---

III. TRANSITION SERVICES – **This is required for students age 14 or younger if determined appropriate by the IEP team.** If the student does not attend the IEP meeting, the school must take other steps to ensure that the student's preferences and interests are considered. Transition services are a coordinated set of activities for a student with a disability that is designed to be within a results oriented process, that is focused on improving the academic and functional achievement of the student with a disability to facilitate the student's movement from school to post school activities, including postsecondary education, vocational education, integrated employment (including supported employment), continuing and adult education, adult services, independent living, or community participation that is based on the individual student's needs taking into account the student's strengths, preferences, and interests.

POST SCHOOL GOALS – Based on age appropriate assessment, define and project the appropriate measurable postsecondary goals that address education and training, employment, and as needed, independent living. Under each area, list the services/activities and courses of study that support that goal. Include for each service/activity the location, frequency, projected beginning date, anticipated duration, and person/agency responsible.

For students in Career and Technology Centers, CIP Code:

Postsecondary Education and Training Goal:					Measurable Annual Goal Yes/No (Document in Section V)
Courses of Study:					
Service/Activity	Location	Frequency	Projected Beginning Date	Anticipated Duration	Person(s)/Agency Responsible
Employment Goal:					Measurable Annual Goal Yes/No (Document in Section V)
Courses of Study:					
Service/Activity	Location	Frequency	Projected Beginning Date	Anticipated Duration	Person(s)/Agency Responsible

Independent Living Goal, if appropriate:					Measurable Annual Goal Yes/No (Document in Section V)
Courses of Study:					
Service/Activity	Location	Frequency	Projected Beginning Date	Anticipated Duration	Person(s)/Agency Responsible

IV. PARTICIPATION IN STATE AND LOCAL ASSESSMENTS
Instructions for IEP Teams:
Please select the appropriate assessment option. Information on available testing accommodations may be found in the Accommodations Guidelines available on www.education.pa.gov

State Assessments

Not Assessed

	No statewide assessment is administered at this student's grade level.
	No English proficiency assessment administered because the student is not an English Learner.

PSSA (Math and English Language Arts (ELA) administered in grades 3-8; Science administered in grades 4 and 8)

Tested Subject	Without Accommodations	With Accommodations	Accommodations to be Provided
Math			
Science			
ELA			

Keystone Exam (Replaces the 11th grade PSSA in high school; Student must participate by 11th grade)

Tested Subject	Without Accommodations	With Accommodations	Accommodations to be Provided
Algebra 1			
Literature			
Biology			

Keystone Project Based Assessment (Available when student is unable to demonstrate proficiency on a Keystone Exam or Keystone Exam module.)

Tested Subject	Without Accommodations	With Accommodations	Accommodations to be Provided
Algebra 1			
Literature			
Biology			

Validated Local Assessment (Available when selected as option by LEA)

Tested Subject	Without Accommodations	With Accommodations	Accommodations to be Provided
Algebra 1			
Literature			
Biology			

PASA (Administered in grades 3-8, 11 for English Language Arts (ELA) and Math; Grades 4, 8, 11 for Science)

Student will participate in the PASA:
The IEP team must review each of Pennsylvania's 6 eligibility criteria to determine participation in the PASA. The IEP team must answer "YES" to ALL six criteria in order for the student to participate in the PASA. If the answer is "NO" to any of the questions, the student must participate in the PSSA/ Keystones with or without accommodations, as determined appropriate by the IEP team.

1. Will the student be in grade 3,4,5,6,7,8, or 11 by September 1st of the school year during which the IEP will be operative?
2. Does the student have significant cognitive disabilities? Pennsylvania defines significant cognitive disabilities as pervasive and global in nature, affecting student learning in all academic content areas, as well as adaptive behaviors and functional skills across life domains.
3. Does the student require intensive, direct, and repeated instruction in order to learn and generalize academic, functional, and adaptive behavior skills across multiple settings?
4. Does the student require extensive adaptations and support in order to perform and/or participate meaningfully and productively in the everyday life activities of integrated school, home, community, and work environments?
5. Does the student require substantial modifications to the general education curriculum?
6. Does the student's participation in the general education curriculum differ substantially in form and/or substance from that of most other students? Students found eligible to take the PASA must have measurable annual goals AND short-term objectives reflected in the IEP.

| | Student will participate in the PASA. |

Explain why the student cannot participate in the PSSA or the Keystone Exams, even with accommodations:

Explain why the PASA is appropriate considering the six eligibility criteria:

Explain any specific accommodations the student may require on the PASA (i.e., Assistive Technology, Signing):

ACCESS for ELs (Administered in grades K-12)

Domains	Without Accommodations	With Accommodations	Unable to Participate	Accommodations to be Provided or Rationale for Inability to Participate in Selected Domains
Listening				
Reading				
Writing				
Speaking				

Alternate ACCESS for ELs (Administered in grades 1-12)

	Student will participate in the Alternate ACCESS for ELs.

Explain why the student cannot participate in the ACCESS for ELs:

Explain why the Alternate ACCESS for ELs is appropriate:

Domains	Without Accommodations	With Accommodations	Unable to Participate	Accommodations to be Provided or Rationale for Inability to Participate in Selected Domains
Listening				
Reading				
Writing				
Speaking				

Local Assessments

☐ Local assessment is not administered at this student's grade level; OR

☐ Student will participate in local assessments without accommodations; OR

☐ Student will participate in local assessments with the following accommodations; OR

☐ The student will take a local alternate assessment.

Explain why the student cannot participate in the local regular assessment:

Explain why the local alternate assessment is appropriate:

V. GOALS AND OBJECTIVES – Include, as appropriate, academic and functional goals. Use as many copies of this page as needed to plan appropriately. Specially designed instruction may be listed with each goal/objective or listed in Section VI.

Short-term learning outcomes are required for students who are gifted. The short-term learning outcomes related to the student's gifted program may be listed under Goals or Short-Term Objectives.

MEASURABLE ANNUAL GOAL Include: Condition, Name, Behavior, and Criteria (Refer to Annotated IEP for description of these components)	Describe HOW the student's progress toward meeting this goal will be measured	Describe WHEN periodic reports on progress will be provided to parents	Report of Progress

SHORT-TERM OBJECTIVES – Required for students with disabilities who take an alternate assessment aligned to alternate achievement standards (PASA).

Short-term objectives / Benchmarks

VI. SPECIAL EDUCATION / RELATED SERVICES / SUPPLEMENTARY AIDS AND SERVICES / PROGRAM MODIFICATIONS – Include, as appropriate, for nonacademic and extracurricular services and activities.

A. PROGRAM MODIFICATIONS AND SPECIALLY DESIGNED INSTRUCTION (SDI)
- SDI may be listed with each goal or as part of the table below.
- Include supplementary aids and services as appropriate.
- For a student who has a disability and is gifted, SDI also should include adaptations, accommodations, or modifications to the general education curriculum, as appropriate for a student with a disability.

Modifications and SDI	Location	Frequency	Projected Beginning Date	Anticipated Duration

B. RELATED SERVICES – List the services that the student needs in order to benefit from his/her special education program.

Service	Location	Frequency	Projected Beginning Date	Anticipated Duration

C. SUPPORTS FOR SCHOOL PERSONNEL – List the staff to receive the supports and the supports needed to implement the student's IEP.

School Personnel to Receive Support	Support	Location	Frequency	Projected Beginning Date	Anticipated Duration

D. GIFTED SUPPORT SERVICES FOR A STUDENT IDENTIFIED AS GIFTED WHO ALSO IS IDENTIFIED AS A STUDENT WITH A DISABILITY – Support services are required to assist a gifted student to benefit from gifted education (e.g., psychological services, parent counseling and education, counseling services, transportation to and from gifted programs to classrooms in buildings operated by the school district).

Support Service	
Support Service	
Support Service	

E. EXTENDED SCHOOL YEAR (ESY) – The IEP team has considered and discussed ESY services, and determined that:

☐ Student IS eligible for ESY based on the following information or data reviewed by the IEP team:

OR

☐ As of the date of this IEP, student is NOT eligible for ESY based on the following information or data reviewed by the IEP team:

The Annual Goals and, when appropriate, Short-Term Objectives from this IEP that are to be addressed in the student's ESY Program are:

If the IEP team has determined ESY is appropriate, complete the following:

ESY Service to be Provided	*Location*	*Frequency*	*Projected Beginning Date*	*Anticipated Duration*

VII. EDUCATIONAL PLACEMENT

A. QUESTIONS FOR IEP TEAM – The following questions must be reviewed and discussed by the IEP team prior to providing the explanations regarding participation with students without disabilities.

It is the responsibility of each public agency to ensure that, to the maximum extent appropriate, students with disabilities, including those in public or private institutions or other care facilities, are educated with students who are not disabled. Special classes, separate schooling or other removal of students with disabilities from the general educational environment occurs only when the nature or severity of the disability is such that education in general education classes, EVEN WITH the use of supplementary aids and services, cannot be achieved satisfactorily.

- What supplementary aids and services were considered? What supplementary aids and services were rejected? Explain why the supplementary aids and services will or will not enable the student to make progress on the goals and objectives (if applicable) in this IEP in the general education class.

- What benefits are provided in the general education class with supplementary aids and services versus the benefits provided in the special education class?

- What potentially beneficial effects and/or harmful effects might be expected on the student with disabilities or the other students in the class, even with supplementary aids and services?

- To what extent, if any, will the student participate with nondisabled peers in extracurricular activities or other nonacademic activities?

Explanation of the extent, if any, to which the student will not participate with students without disabilities in the regular education class:

Explanation of the extent, if any, to which the student will not participate with students without disabilities in the general education curriculum:

B. Type of Support

   1. Amount of special education supports

      ☐ Itinerant: Special education supports and services provided by special education personnel for 20% or less of the school day

      ☐ Supplemental: Special education supports and services provided by special education personnel for more than 20% of the day but less than 80% of the school day

      ☐ Full-Time: Special education supports and services provided by special education personnel for 80% or more of the school day

   2. Type of special education supports

      ☐ Autistic Support

      ☐ Blind-Visually Impaired Support

      ☐ Deaf and Hard of Hearing Support

      ☐ Emotional Support

      ☐ Learning Support

      ☐ Life Skills Support

      ☐ Multiple Disabilities Support

      ☐ Physical Support

      ☐ Speech and Language Support

C. Location of student's program

Name of School District where the IEP will be implemented: _____

Name of School Building where the IEP will be implemented: _____

Is this school the student's neighborhood school (i.e., the school the student would attend if he/she did not have an IEP)?

☐ Yes

☐ No. If the answer is "no," select the reason why not.

☐ Special education supports and services required in the student's IEP cannot be provided in the neighborhood school

☐ Other. Please explain:

_____

VIII. PENNDATA REPORTING: Educational Environment **(Complete either Section A or B; Select only one Educational Environment)**

To calculate the percentage of time inside the regular classroom, divide the number of hours the student spends inside the regular classroom by the total number of hours in the school day (including lunch, recess, study periods). The result is then multiplied by 100.

SECTION A: For Students Educated in Regular School Buildings with Non Disabled Peers – Indicate the Percentage of time INSIDE the regular classroom for this student:

Time spent outside the regular classroom receiving services unrelated to the student's disability (e.g., time receiving ESL services) should be considered time inside the regular classroom.
Educational time spent in age-appropriate community-based settings that include individuals with and without disabilities, such as college campuses or vocational sites, should be counted as time spent inside the regular classroom.

Calculation for this Student:

Column 1	Column 2	Calculation	Indicate Percentage	Percentage Category
Total hours the student spends in the regular classroom per day	Total hours in a typical school day (including lunch, recess & study periods)	(Hours inside regular classroom ÷ hours in school day) x 100 = % (Column 1 ÷ Column 2) x 100 = %	Section A: The percentage of time student spends inside the regular classroom:	Using the calculation result – select the appropriate percentage category
			_____% of the day	☐ **INSIDE the Regular Classroom 80% or More of the Day** ☐ **INSIDE the Regular Classroom 79-40% of the Day** ☐ **INSIDE the Regular Classroom Less Than 40% of the Day**

SECTION B: This section required only for Students Educated OUTSIDE Regular School Buildings for more than 50% of the day – select and indicate the Name of School or Facility on the line corresponding with the appropriate selection: (If a student spends less than 50% of the day in one of these locations, the IEP team must do the calculation in Section A)

☐Approved Private School (Non Residential) _____
☐Approved Private School (Residential)   _____
☐Other Private Facility (Non Residential)   _____
☐Other Private Facility (Residential)   _____
☐Other Public Facility (Residential)   _____

☐Other Public Facility (Non Residential) _____
☐Hospital/Homebound   _____
☐Correctional Facility   _____
☐Out of State Facility   _____
☐Instruction Conducted in the Home   _____

EXAMPLES for Section A: How to Calculate PennData-Educational Environment Percentages

	Column 1	Column 2	Calculation	Indicate Percentage
	Total hours the student spends in the regular classroom-per day	Total hours in a typical school day (including lunch, recess & study periods)	(Hours inside regular classroom ÷ hours in school day) x 100 = % (Column 1 ÷ Column 2) x 100 = %	Section A: The percentage of time student spends inside the regular classroom:
Example 1	5.5	6.5	(5.5 ÷ 6.5) x 100 = 85%	85% of the day (Inside 80% or More of Day)
Example 2	3	5	(3 ÷5) x 100 = 60%	60% of the day (Inside 79-40% of Day)
Example 3	1	5	(1÷ 5) x 100 = 20%	20% of the day (Inside less than 40% of Day)

For help in understanding this form, an annotated *IEP* is available on the PaTTAN website at www.pattan.net Type "Annotated Forms" in the Search feature on the website. If you do not have access to the Internet, you can request the annotated form by calling PaTTAN at 800-441-3215