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Reviewed and approved* by the following:

Dr. Jonte Taylor
Professor of Special Education
Thesis Supervisor

Dr. Scott McDonald
Professor of Science Education
Honors Adviser

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

This paper attempts to answer the question of how to help students receiving special education services achieve success in the general education science classroom. Literature was reviewed and one group of students with special needs was focused on for proposing modification of evidence-based practices to help them succeed throughout one lesson in a science classroom. While the results proposed are completely hypothetical, the practices and desired results are based upon evidence and previous research.

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Chapter 1

Introduction

Before the 1970s, special needs learners faced blatant discrimination, especially in regards to the educational system. The Rehabilitation Act of 1973 focused on prohibiting federally funded agencies from discriminating against people with disabilities. Still, until the Individuals with Disabilities Education Act (IDEA) was passed in 1975, only one in every five children with disabilities was enrolled in public school. The IDEA states that all students have the right to a "free, appropriate, public education in the least restrictive environment." Amendments were added in both 1997 and 2004 focused on improving accommodations for special needs students among other things. However, the current situation for students receiving special education services is far from ideal. For example, in 2005, the graduation rate for students with special needs was 46% while the graduation rate for general education students was 75% (Kaldenburg, 36-39). Closing this gap is still a major focus for the education system in 2017. Despite the movement toward greater inclusion, students with disabilities are still more likely to get instruction in settings different from students who do not receive special education services.

The "gap" referenced in the previous paragraph about graduation rate differences between students with special needs and general education students is also especially apparent between the same groups of students' science achievement. When comparing National Assessment of Educational Progress data between the groups and tracking improvement over years, it is striking how much the achievement of students with special needs have not improved.

For example, in 2009, the average scores of students receiving general education services fell into the proficient category at 153. This improved significantly over the course of six years. In 2015, the average score for students receiving general education services was 158. The differences in scores for students with special needs from 2009 to 2015 was not quite so positive. In 2009, the average score for this group of students fell into the basic category at 123. In 2015, the improvement of scores was not significant. It was 124. While the gap of being proficient vs basic on average between the groups of students may be valid based on ability, the improvement between years for each specific group of students should not be so significantly different. (The Nation's Report Card)

Several factors contribute to the low achievement levels of students with special needs in science classroom. To begin with, the phrase "students with special needs" applies to a wide range of disabilities that affect each individual differently. Students with learning disabilities (LD) often struggle with reading on varying levels. Presenting these students with a textbook or passages from which they are expected to identify important information or evidence of scientific concepts will overwhelm them. The students will become anxious and overwhelmed, not find success, and most likely shut down due to an inevitable feeling of learned helplessness. The act of reading such materials alone provides enough challenge to students with LD, so they lose momentum and motivation before discovering the scientific concept outlined in the reading and making connections to their prior knowledge (Kaldenburg, 36-39). Secondly, students with emotional and behavioral disabilities (EBD) struggle with non-academic issues. However, such non-academic struggles manifest in the classroom as less academic progress, lower grades, and more internalizing and externalizing behaviors that negatively affect the classroom environment. While studies have generally focused on non-academic interventions in the past, recent studies

that focus on implementing academic interventions to help students with EBD have shown more success with these students both academically and behaviorally. These behavior issues in the classroom for students with EBD usually stem from a lack of ability to relate to the teacher, their peers, and the material (Therrien, "Science Instruction for students with Emotional and Behavioral Disorders," 1). Finally, students with autism spectrum disorder (ASD) and intellectual disabilities (ID) struggle from things like sensory overload and feeling overwhelmed with information to learn and memorize that they are unable to connect to their existing prior knowledge. Students with ASD or ID have shown growth in classrooms that have structure and scaffolding (Rizzo, 1-13).

In order to help students with special needs succeed in general education classrooms, teachers require training regarding working with students of this demographic as well as in depth content knowledge to be a better resource for these students. There is an alarming gap between the academic growth in standardized science assessment scores of students receiving special education services and those receiving general education services as illustrated by the NAEP data of 2009 and 2015. This gap may be a result of a disconnect between teachers who could be collaborating to best serve students with special needs and foster academic progress within them (The Nation's Report Card). For example, elementary teachers spend much of their college careers studying how to include students with special needs in their classrooms, but less time specifically practicing methods of science teaching. Conversely, middle level and secondary educators spend the majority of their studies practicing the methods of science teaching, but less time practicing inclusive strategies to best service the students with special needs that may attend their science classes. Lastly, special education teachers acquire expert knowledge on how to best manage the behavior and assist in the learning progress of students with special needs to help

them meet their goals, but they lack a depth of content coursework preparation in disciplinary areas, particularly science. Perhaps if more emphasis was put on equipping teachers with a more well-rounded tool belt of educational practices and collaboration techniques, both students with special needs and students receiving general education services would improve their academic progress in science classrooms. Necessarily, some teachers will be more specialized than others in their chosen fields, i.e. special education or science education. To compensate for that, teachers should have training in the collaborative skills in order to bring their expertise together to provide better opportunities for individual students.

The purpose of this paper is to highlight modifications, evidence-based strategies, and instructional supports for teachers to increase opportunities for students with disabilities to be successful in science classrooms. If implemented into lesson plans correctly, instructional supports can help science teachers reach learners of all achievement levels to help them succeed. Science classes should be an integral part of school for all students as they enhance skills used across all subjects and promote inquiry based learning. In this paper, I will focus on the case of one specific existing lesson and make modifications to it to best serve the needs of students with individualized education plans in the general education science classroom.

To reach every student as a single teacher is a daunting task, therefore teachers understanding supports and strategies is essential for special learners. One instructional framework that has shown to be successful in providing students with special needs supports in science classrooms is Universal Design for Learning (UDL). The idea of UDL in the classroom came from architecture designed for all individuals to have access common needs. Every day, we encounter instances of universal design around us in the architecture. For example, there is an option to open doors automatically by pushing a button. Not only does universal design in

architecture allow for people with disabilities more access to their environment, but these changes make the world more accessible for people who are not considered disabled. Someone carrying a briefcase and a hot cup of coffee will be able to use the button to open the door automatically so that they do not hurt themselves trying to pull the door handle. This idea has been translated to the classroom over the course of 30 years. UDL is an approach to provide learning supports for all students including those with disabilities.

UDL is "an evidence based approach to curriculum and instruction that increases access to learning for students with widely diverse backgrounds and learning styles" (Taylor, 60). One major key to UDL is flexibility. Providing options for students in terms of mode of assessment, learning activities, and content demands allows students to engage in the style of learning that best suits them and allows them to reach their fullest potential (Therrien, "Science Instruction for students with Emotional and Behavioral Disorders," 1-11). In *Universal Design for Learning* by Post and Rainesville, they suggest that we learn by using three main networks of neurons in our brain. The first of the three is sensory in nature and has to do with recognizing what it is we are to be learning. The second group of neurons pertains to our cognitive and motor skills and has to do with strategizing how we are going to learn the content. The last of the three deals with a more emotional part of ourselves and has to do with achieving a meaningful engagement with the content. Students need to be able to understand *why* they are learning something. For every individual, these areas of the brain are activated and engaged differently. While one student may be very adept at writing out his or her explanations for different scientific phenomena, another student may need to speak instead of write. Some students may need technological supports to complete learning activities, and the special needs students should not be singled out or embarrassed for using different options. In fact, the same options should really be made

available to all the students to use, because everyone is different, even those who are looked at as "average."

Currently, teachers adapt their classrooms to a more universally designed environment only once a student is failing significantly enough to cause for concern. When a student is not grasping the content well enough and a teacher notices, they first make a list of strengths and weaknesses for the student and later make adaptations for the student to succeed. This is called retrofitting, meaning the teacher is working backwards to fix something that did not work in the first place. UDL is intended to avoid this by creating a student-focused classroom. Instead of focusing on the content that needs to be covered in a certain amount of time, instead UDL suggests focusing on the students' abilities and teach so that each one can learn the content in their own way. This also takes away wasted time going back to fix something that was not working for a student, because the teacher will design in advance multiple ways for students to grasp the content in their own way from the beginning.

Just as UDL in architecture focuses on making the world and basic needs accessible to people with disabilities, an inquiry-based approach strives to make complicated or abstract concepts accessible to diverse learners. One of the main characteristics of inquiry-based learning is connecting classwork to scientific phenomena that the students are familiar with outside of school. By framing the new ideas from the classroom in a way that helps students explain or understand things happening in the world around them, they are more likely to retain their knowledge and practice positive, engaged behavior. This is because they are able to make connections between the new material and their prior experience or knowledge. The inquiry-based approach utilizes UDL, because in order to connect new material covered in the classroom to outside sources, various media must be used in the classroom. Furthermore, students can

demonstrate their knowledge in a way that best suits their strengths if they can fully digest the material and explain it in their own way instead of memorizing what the teacher said.

With that in mind, science learning should be inquiry based. Historically, there has been a tradition of regurgitation in education; teachers present students with knowledge on a subject and then later test the students for their memory of that knowledge. Inquiry based learning promotes problem solving skills and critical thinking skills that will transfer to learning other subjects, as well as being useful in the professional, real world. This style of teaching possesses the potential to improve the academic progress of students receiving general education services as well as students receiving special education services. Students receiving special education services will be able to relate concepts they are learning in the classroom to something tangible and real. This will help them make connections to their prior knowledge, ensuring their retention of new concepts. Finally, students of all abilities will be able to focus on big ideas and major concepts rather than small details that could prove difficult to piece together and visualize. Practices like this will reduce anxiety and promote participation and academic motivation in the classroom. In the following pages, I will discuss the current research that describes the idea of inquiry-based classrooms, or ambitious science teaching, as well as make plans to implement these practices in order to better support the needs of students receiving special education services.

Chapter 2

Literature Review

For this paper, the articles that were reviewed focused on education in the STEM fields. More specifically, they focused on improving the academic achievement of students receiving special education services. The studies varied with regard to the specific disabilities of the subjects and included: learning disabilities, emotional and behavioral disabilities, autism spectrum disorder, and intellectual disabilities. Other areas of literature reviewed focused on practical ways to implement ambitious science teaching, evidence based practices that improve academic achievement of students with special needs, as well as the education and training of teachers. All of the practices suggested and explored by these articles fit nicely with each other. Teachers who have more training in collaboration and the needs of students with disabilities are more likely to be able to take an inquiry-based approach in their classrooms. They will understand the value of helping students make a connection between abstract concepts to real life phenomena.

The article entitled *Three Keys to Success in Science for Students with Learning Disabilities* by Erica Kaldenberg et. al. outlines the different struggles that students with learning disabilities face in a science classroom specifically. The researchers compared two different approaches for teaching science including the traditional textbook approach and the inquiry based approach. In the traditional textbook approach, students were expected to use mainly readings and teacher guided instruction to understand concepts. In the inquiry-based approach, students were expected to test their own ideas about scientific phenomena and later explain their findings. The research team concluded that the inquiry based approach provided benefits for students with learning disabilities, because there was decreased rote memorization and more

performance based assessments. However, the researchers specified that students with learning disabilities required more structure and teacher guidance within the inquiry based approach. Examples of structure and guidance suggested in this article were focusing on big ideas, using graphic organizers, and providing mnemonic strategies for students to remember vocabulary needed for standardized assessments and proper explanation of different scientific phenomena. Successful implementation of all these ideas led to more actively engaged students (Kaldenburg, 36-39). Students who are more engaged are likely to have more academic achievement. Giving these students the opportunity to be more inquisitive about the concepts their learning and the tools to test things will help them be more engaged. Then, tools like graphic organizers and mnemonic strategies will help them organize their own thoughts and retain the new knowledge.

The article entitled *Science Instruction for Students with Learning Disabilities: A Meta-Analysis* by William J. Therrien et. al. reviewed literature from the years 1980 or later to answer the following questions: "What classroom based instructional methods are effective at increasing the science achievement of students with LD?" and "What student characteristics are necessary to benefit from the intervention(s) summarized in the meta-analyses?" (Therrien, "Science Instruction for Students with Learning Disabilities: A Meta-Analysis," 189). The team was inspired to research these questions because of the poor performance of American students on science assessments. For example, in 2009, only 29% of American students scored at or above a level four for science proficiency according to the Program for International Student Assessment (PISA), meaning they were able to "…select and integrate explanations from different disciplines of science or technology and link those explanations to aspects of life situations." While the 29% describes the performance of all American students, students with learning disabilities scored significantly lower. After reviewing eleven studies that explored the effects of

an inquiry-based approach in science classrooms on the achievement of students with learning disabilities, the research team concluded that implementing inquiry-based instruction with more structure significantly increases academic performance of students with learning disabilities. However, the eleven studies reviewed by this team assessed academic achievement based on immediate and specific assessments. Standardized or general assessment data was not used in assessing the effect of inquiry-based instruction. More research is necessary to determine the impact on standardized assessment scores. One of the main ideas of inquiry-based classrooms is presenting students with an overarching question that deals with something they see every day. For example, one overarching question could be "Why do trees grow?" Throughout the class, the students will learn about all the reasons and factors involved in plant growth. They will have something to connect this new material to, though and be able to focus on big ideas. For students with learning disabilities, that can be very valuable.

An article by William J. Therrien et. al. entitled *Science Instruction for Students with Emotional and Behavioral Disorders* reviewed different studies that used an inquiry based approach intervention in a science classroom. The researchers established that students with Emotional and Behavioral Disorders (EBD) have less academic progress, lower grades, and more disciplinary referrals. Even though students with EBD now receive an average of eighty percent of their core instruction in general education classrooms, the achievement gap between these students and students without special needs has not been reduced significantly. The article focused on instruction in the science classroom, and suggested reasons for the low achievement of students with EBD including limited content knowledge, poor academic motivation, and difficulty connecting prior knowledge to new information.

Instead of implementing different interventions to improve non-academic factors including externalizing and internalizing behaviors, researchers were interested in academic interventions being implemented to improve both academic and non-academic issues for students with EBD. The researchers reviewed eleven different studies that implemented an inquiry-based approach in science classrooms to help improve the achievement of students with EBD. While this approach could look different case by case, commonalities existed between all of them. All of them put an emphasis on data, looking at evidence as a foundation for claims, and using argumentation and analysis of evidence to develop scientific ideas. When comparing inquiry-based instruction to traditional instruction, there was a significant effect in both academic achievement and behavioral issues (Therrien, "Science Instruction for students with Emotional and Behavioral Disorders," 1-11). Again, like with students with learning disabilities, the inquiry-based approach helped students with EBD because they were able to link the new information with something with which they are familiar. It helps them focus on the big idea, which lessens the stress. Also, as inquiry-based learning encourages students to make their own theories about scientific phenomena and then test those theories, students with EBD perhaps feel as if they have a voice in the classroom and feel safer participating in classroom activities.

The article *Effects of Inquiry Based Instruction on Science Achievement for Students with Disabilities: An Analysis of Literature* by Karen L. Rizzo and Jonte C. Taylor provides an overview of the effects of implementing an inquiry based approach in a science classroom for students with various disabilities instead of focusing on one type of disability. More than half of the students participating in the studies reviewed in this article had learning disabilities, intellectual disabilities, emotional and behavioral disorders, autism spectrum disorder, multiple disabilities or attention deficit hyper activity disorder. The remaining portion of students

participating in the studies reviewed in this article did not report having a specific disability. The article reported results that suggested the inquiry-based approach has shown to be effective at improving the achievement of students with the previously stated wide range of disabilities. However, instead of discussing those results, the article focused more on how the inquiry-based approach looks in a classroom. The inquiry-based approach exists on a spectrum, with open being the least explicit instruction with the least teacher guidance, and structured being the most explicit with the most teacher guidance. Probably the most important discussion point of this article was that the achievement rate of students with disabilities is highest when a structured inquiry approach is in place. Teacher guidance, support, and scaffolding is necessary to help students with disabilities grasp the different concepts and eventually be able to explain scientific concepts completely on their own (Rizzo, 1-13). This article provided evidence that the inquiry based approach does support student learning, but it should be modified for students with disabilities. Students with special needs require more direct instruction in order to organize their thoughts and ideas. The next articles focus on practical ways to modify inquiry-based instruction.

Another article entitled *Promoting Inclusive Practices in Inquiry Based Science Classrooms* by Sarah J. Watt et. al. also discusses the idea that students with disabilities most benefit from a structured approach. The structured approach gives explicit enhancements and specific feedback so that misconceptions are not indirectly reinforced, but still does not limit students' ability to freely investigate and discuss ideas in science. Ideally, as time goes on, the supports offered within the structured approach are faded, and the classroom operates from a more open approach. Students will be more confident in their own learning styles and able to succeed. Universal design for learning should be present as well, so that there is a wide range of

opportunities for students to demonstrate their knowledge, and be more successful and independent learners. Not only did this article discuss classroom characteristics that support inquiry-based instruction and students with disabilities, but also emphasizes the importance of professional collaboration to best support students with disabilities in the general education science classroom. These practices are best implemented when the general education teacher and special education teacher work together to provide this type of instruction and these supports. They should work together to create goals for students. In the classroom, the general education teacher can present the big ideas to the class, and the special education teacher can provide different scaffolds for students with special needs (Watt, 40-48).

The article entitled *The Power of Multimodal Representations: Creating and Using Visual Supports for Students with High Incidence Disabilities* by Erica Kadenberg et. al. offered practical, evidence-based suggestions on how to better assist students with learning disabilities or emotional and behavioral disorders understand scientific concepts. Because students with high incidence disabilities struggle to connect prior knowledge to new information, teachers should offer more supports to aid their acquisition of new knowledge. This article breaks down the visual supports into two categories: modes and formats. Modes of visual supports include ways the teacher can present information or assist the student in creating so that they can better connect different ideas. Concept maps and pictures were emphasized as two modes that help students with high incidence disabilities. Formats of visual supports are scaffolding techniques that assist students in creating projects or written work. The article suggested different templates or textual representations to help students analyze, interpret, or evaluate data (Taylor, 60-65). The things discussed in this article align with universal design for learning, because teachers and

students present information in different, unique ways. This will help students thrive in all of their own different learning styles and unique personalities and strengths.

The article *Stemming on STEM: A STEM Education Framework for Students with Disabilities* by Jiwan Hwang and Jonte C. Taylor suggests adding the arts to science, technology, engineering, and math education, or going from STEM to STEAM. By integrating the arts into science instruction, teachers may alleviate some stress and frustration for students with disabilities who may have had unpleasant or unsuccessful experiences in such classrooms before. Things like arts and music assist students in making connections between scientific ideas as well as to their prior knowledge, which aids in retention of new ideas. Often times, students with disabilities such as learning disabilities or intellectual disabilities struggle to make sense of abstract ideas. Artistically representing those ideas gives the student a more concrete, tangible example from which they can synthesize information and retain the new knowledge. In addition, integrating the arts into science classrooms helps teachers be more flexible in their practice, supporting universal design for learning, which promotes success of students with varying abilities (Hwang, 39-45).

Finally, three articles written by Mark Windschitl et. al. were reviewed, because they focused on teacher development and education. The first of the three, *Proposing a Core Set of Instructional Practices and Tools for Teachers of Science,* suggests the need for a core set of practices to be taught to future educators so that they can go on to refine these practices and better assist student learning. The article emphasizes a need for model-based inquiry, and explains that scientific theories should be tested and evaluated in the classroom. Students should be encouraged to ask questions and have the opportunity to observe scientific phenomena in real life. This will help them make connections to their prior knowledge and have a more complete

understanding of scientific ideas. The use of public representation of student ideas, back-pocket questions, scaffolds for student participation and vocabulary acquisition, and emphasis on student interaction is called ambitious science teaching. In this article, Windschitl et. al. discuss the need to educate college students majoring in education about ambitious science teaching and foster problem solving techniques through student collaboration (878-903). The second article, *Transcending Simple Forms of School Science Investigation: The Impact of Preservice Instruction on Teachers' Understandings of Model-Based Inquiry*, discusses the use of models in science classrooms and the understanding of the scientific method. Again, the subjects in question were preservice teachers. The article offered evidence based practices that help future educators widen their ideas of what can be used as a model. Ideally, real life examples will be explored in the classroom with students. They also focused on tackling the "simplistic view" of the scientific method that most student teachers have as they start their college careers. The authors of this article, Windschitl et. al. propose having preservice teachers participate in immersion, or experience of ambitious science teaching first. Then, they should move on to microteaching with discussion and revision of lessons. After that, they go to their field experiences, with discussion after the fact and more microteaching later (Windshitl and Thompson, 783-835).

This learning schedule emphasizes collaboration and revision of lessons, or problem solving techniques. The third and final article about the education of teachers, *How Novice Science Teachers Appropriate Epistemic Discourses Around Model-Based Inquiry for Use in Classrooms*, outlines steps future educators should take to be successful ambitious science teachers. Throughout their college careers, future educators should be following steps to make and revise lessons that emphasize the evaluation of scientific theories rather than the presentation

of them. The six heuristics for progressive disciplinary discourse (HPDD) are listed in the article as follows, “Model prototypical cases of disciplinary activity/discourse early, problematize content, give students authority, give experience taking on discursive roles and stances in recurring social contexts, hold students accountable to disciplinary norms, provide relevant resources” (Windschitl, Thompson and Braaten, 321). The article provided testimonials from preservice teachers learning to implement ambitious science teaching and highlighted their understanding of multiple, real life models and importance of student authority and interactions. The participants experienced significant changes in the ways they thought about education (Windschitl, Thompson and Braaten, 310-378).

All of the articles discussed here were reviewed for this paper to better understand how to help students with disabilities succeed in a general education science classroom. The specific needs of students with varying disabilities helps to design specific modifications to assist all students. The practical suggestions of universal design for learning helps to better understand how to be flexible in the classroom and reach students of all learning styles and levels during one class period. Finally, the emphasis on ambitious science teaching and teacher training helps to understand the principles behind the inquiry based approach and how it can be properly implemented in a science classroom to yield student success.

Chapter 3

Student Support Development

For this paper, I focused on improving the achievement of five students with special needs taking a science class in the general education classroom setting. One student is diagnosed with a learning disability, and three are diagnosed with autism spectrum disorder. The last student does not have a specific diagnosis on his individualized education plan. For confidentiality purposes, all names of students were changed for this paper. The practices suggested in this paper are strictly for potential use, and projected results will be discussed. However, the practices will not be field tested in the classroom for these specific subjects.

When discussing the subjects of this paper, it is important to note the demographics of the area in which the subjects attend school. Ethnically, the school is not very diverse; over ninety percent of the student population identifies as Caucasian. Just under seven percent identifies as black, and a small percentage of students identify as Asian, American Indian, or Hispanic ("Altoona Area Junior High School in Altoona, Pennsylvania"). When analyzing the performance of students on standardized tests, the disparity between ethnic groups is still high, with African American students scoring lower than the others do. In general, compared to the state average of students who pass the PSSA as proficient, this area has a lower percentage of students passing. The state average is above sixty percent, but in this area just above forty-five percent of students pass ("Altoona Area Junior High School in Altoona, Pennsylvania").

Socioeconomically, more than half of the student body is eligible for free lunch, and in addition, more than eight percent of the student body that does not qualify for free lunch is eligible for reduced lunch. In order to qualify for receiving free lunch, the student's family income must fall below $15,171 ("Altoona Area Junior High School in Altoona, Pennsylvania").

While this particular paper focuses on five students with special needs, the school reports that twenty-two percent of students have a learning disability, which is significantly higher than the state's report of eighteen percent of students having a learning disability ("Altoona Area Junior High School in Altoona, Pennsylvania"). Each of the five students that was treated as a potential subject for this study has unique needs and their individualized education plans (IEPs) call for distinct modifications to traditional classroom instructions and routines. The next section of this paper will outline the disabilities and required modifications listed in the IEPs of each student.

Luke's IEP states that he has a specific learning disability. He has severe challenges with reading and writing as well as math. Due to his disability, different modifications are required to be offered to him in the general education classroom and are listed on the IEP. These include modified tests and assignments, math manipulatives, having materials read aloud to him, and extended test time. Not only does Luke have challenges with learning new material due to his disability, but also frustration from these challenges can translate into poor behavior. Often times, he can be found wandering around the classroom in an effort to avoid doing classwork. When the teacher talks with him about his behaviors, he comments that the work is too hard.

Both Sara and Todd are diagnosed with autism spectrum disorder, and it is listed on their IEPs. While each case of autism spectrum disorder is unique, these students have similar challenges in the classroom. They both struggle severely with social interaction and struggle

with basic reading skills as well as math skills. Although they both have difficulty interacting socially with peers, Sara's deficits are more communication based. Todd, however, lacks the ability to recognize certain social cues. One modification for both of these students is prompting from the teacher. Prompting could be done verbally or non-verbally, which could look like notes or other signals. They are also both required to receive extended test time, math manipulatives, modified tests and assignments as well as having materials read aloud to them. Behaviorally speaking, Sara is very motivated in the classroom, but she does require more assistance. Todd, on the other hand is more independent with his schoolwork in the sense that he is able to comprehend and work with more complex materials, but his behaviors are more negative. He will get extremely frustrated when prompted to complete work and often growls at the teacher or his peers.

Howard is also diagnosed with autism spectrum disorder as well as various specific severe medial needs. Because of his medical needs, he spends a large amount of time at the nurse receiving specific treatments. In the general education classroom, too, he is required to receive modifications based on his academic abilities. The main area of academics that he struggles with is also reading. According to his IEP, he should be offered word manipulatives as well as extended test time and modified tests and assignments. Anything that helps him read through and comprehend material really boosts his achievement in the science classroom. Behaviorally speaking, he does not have many negative habits or disruptive behaviors. However, the challenge of his absences when he spends time at the nurse is difficult, because the teacher needs to spend a time catching him up to rest of the class.

Lastly, Trevor has an IEP and receives special education services, but there is no specific diagnosis listed on his IEP. The modifications he is required to receive in the general education

classroom include modified tests and assignments, math manipulatives, extended test time, and having materials read aloud to him. He has severe struggles with reading especially. On top of his difficulties understanding academic concepts in the science classroom, he practices several avoidance behaviors. Of all the students in the class, he has missed the largest number of classes. Similar to Luke, when asked about his behavior, he responded that the class was too hard. He is very kind and respectful to his teachers and peers, but is not motivated to complete school work.

For all five students discussed here, plans were made based on literature to improve their science achievement. Each student's unique behavior and specific academic difficulties are addressed in individual organizers listed in Appendix 1. By making each plan and modification specific to the individual student, their achievement levels should improve significantly. The next section will discuss the changes I suggest based on my research as well as potential results.

Chapter 4

Rationale and Desired Results

Because the plans for this study will not be carried out in the actual classroom, this section of the paper is dedicated to the desired results of the plans for these five particular students receiving special education services. Please reference Appendix 1 for the STEAM organizers which outline the education standards and goals as well as modifications for each of the subjects of this research.

For all of the students, the lesson referenced in the STEAM organizers follows an inquiry-based approach. Students will be working through a lab in which they are responsible for planting soybean seeds, some of which have been genetically modified and some of which have not. While the soybean plants grow, they will make observations and conclusions about genetic modification and biotechnology. This lab takes place over several days, and during those days, the students will collaborate to make predictions about their soybean plants, read and discuss articles about biotechnology, watch and discuss videos about biotechnology, as well as participate in smaller scale labs that will help them understand the DNA that is in all living things. By the end of the lab, the students will be able to explain in their own words what DNA is and its significance in all living things and the process of genetic modification. In addition to that, the students will have formed an educated opinion that they are capable of sharing with others.

To begin, Luke would benefit from explicit instruction, the use of graphic organizers, and supported inquiry-based instruction, becausemost of Luke's academic difficulties revolve around reading. He gets extremely stressed about reading and writing. Usually, he will claim that the task is too hard and engage in behaviors to avoid completing the task including walking around

the classroom. I believe that if given explicit instruction while reading, he would be more engaged in the activity of the classroom. The teacher could be there to offer a step-by-step guide of what he should be doing and prompt him when necessary. When it comes time that he should be able to explain his thinking, he may dictate his ideas to the teacher, and she will write them down. Because he has help completing the task, his stress level should decrease and his behaviors should improve along with academic achievement. As time goes on, this support could be faded. Secondly, the use of graphic organizers could assist Luke with his retention of knowledge and comprehension of reading. By helping him organize the big ideas, he will know what to focus on and how to make connections. Furthermore, bringing an artistic element into the graphic organizer by making it themed as something he is already interested in will increase engagement and help him make connections to his prior knowledge and experiences. Lastly, Luke will benefit from inquiry-based instruction as it encourages his active participation and encourages questioning, but he will require more supports and scaffolds so that the task does not become overwhelming. All of these modifications will help Luke be less stressed in the classroom, allowing him to achieve higher academically and decrease negative behaviors.

Of all five students, Todd will benefit most of all by adding an artistic element to his science classroom. He is a very talented artist; usually, when he is not engaged in classroom activities, it is because he is drawing at his seat. For his modifications, I propose self-management strategies, graphic organizers, as well as supported inquiry-based instruction. With self-management strategies, Todd will be able to have some control over his learning and track his own progress. When making observations about the soybean plants, he may choose to either write his observations or draw pictures of what he is observing. This way, he will be utilizing his artistic strengths in the science classroom which has been challenging for him. Also, he will be

given checkpoints throughout the lab at which he can take a drawing break. When he gets to the checkpoints, he will be able to spend ten minutes drawing a picture of whatever he chooses. This will provide motivation to complete goals and tasks and boost engaged behaviors. By boosting his motivation to complete goals, his academic achievement will increase. The use of graphic organizers will also help Todd focus on the big ideas of the class, making it less overwhelming. This will also help him with his social goals. He struggles to communicate with his peers, but with the use of a graphic organizer, he can positively contribute to the class discussions, because his thoughts are organized in front of him. Lastly, Todd will benefit from inquiry-based instruction, because it will assist him in making connections between the abstract, complicated processes being discussed in class with something qualitative he has already seen and described in simpler terms. Because inquiry-based instruction emphasizes collaboration between students and testing their own theories, it will help Todd meet his goals related to social skills as well as boost academic achievement. Other students will benefit from this type of instruction for similar reasons, but he does require more supports and scaffolding, so that he can better manage his time one step at a time, and not get overwhelmed with academic tasks or social interaction.

Sara also has autism spectrum disorder, but she spends much more time engaged in class work than Todd does. She wants to learn and improve both her academic skills and social skills. To best assist her in this science classroom, I propose that peer-related strategies, graphic organizers, and explicit instruction. Because Sara has the drive to improve her skills, she accepts assistance when it is offered to her. In order to increase both her academic and social skills, I believe assigning a peer to work closely with her throughout the lesson will be beneficial. She will have someone to help her through the material, especially reading, and be able to practice

her social skills that she learns in the resource room in the least restrictive environment. Over time, she will grow in her ability to maintain relationships with peers and increase her academic achievement. Secondly, I believe the use of graphic organizers will help Sara understand new material more quickly and easily. Due to the severity of Sara's reading difficulties, a more artistic graphic organizer made up of pictures would be of great benefit to Sara. She can use the graphic organizer to understand the big ideas of the lesson without the added stress of deciphering reading material. This will make her better equipped to complete readings about this material when the task is given to her, because she will have reviewed concepts and made connections to her prior knowledge. I believe having that tool will greatly increase Sara's academic achievement. While most students with special needs benefit from supported inquiry-based instruction, I believe Sara will improve more with explicit instruction. Her academic difficulties are so severe, if she is overwhelmed, her behaviors will become negative. She needs that extra support and guidance to remain engaged and positive throughout the lesson. Over time, Sara will become more independent and these supports can be gradually faded.

Howard also is diagnosed with autism spectrum disorder as well as a different health condition, which is serious. Howard spends a large portion of class time at the nurse because of this other health condition. His academic achievement and social skills suffer because of his absences. When present, he works very hard to increase his academic achievement. For him, I propose using peer-related strategies, graphic organizers, and supported inquiry-based instruction. Like Sara, Howard will be assigned two peers to work closely with throughout the lesson. Two peers will be assigned to work with Howard so that in his absences, they will still have a partner with whom they can collaborate. His peers can help Howard overcome his academic difficulties. Also, being with the same peers long term will help Howard improve his

social skills. He will be able to become more comfortable initiating and maintaining conversations as he becomes more comfortable with a small amount of peers. He will also learn a great deal about maintaining relationships. Being more comfortable in the classroom will boost time spent engaged in classroom activities, and consequently increase academic achievement. The use of graphic organizers will help Howard focus on the big ideas of the lesson. By using pictures and drawings to spark his creativity, Howard will be able to make connections between prior knowledge and new concepts. This will help him comprehend and retain knowledge, boosting his academic achievement. Furthermore, he can use the graphic organizer as a conversational tool when collaborating with peers. This will make social situations less stressful. Overtime, he will not have to use the tool. Being comfortable in his social environment will help his academic achievement and behavior. Lastly, Howard will require explicit instruction from teacher as well throughout the lesson. Mainly, this is due to his large number of absences from class. He needs to be reminded and coached through the parts of lesson he misses. The peers working with him will be able to help the teacher with this as well. Because of his health condition, he will most likely continue to have a large amount of absences, so this modification will not be faded.

Finally, Trevor does not have a specific diagnosis listed on his individualized education plan. However, he has severe deficits with reading. When reading any passage, he uses an iPad to hear the words instead of reading. For Trevor, I suggest implementing the use of graphic organizers, technology-related strategies, and supported inquiry-based instruction. Trevor struggles with reading and comprehension. The use of graphic organizers will help him make connections and better comprehend new ideas. He can also use pictures and words in the graphic organizer to help him make connections between the ideas and written communication. By using

the graphic organizer to help him focus on the big ideas as well as increase his ability to read, Trevor's academic achievement should improve significantly. As his reading continues to advance, he will be able to gradually decrease his dependence on the graphic organizers. Secondly, the iPad should continue to be utilized to assist Trevor when learning new materials or going through activities. Its uses may be expanded so that he can make associations between words and images. He can start to recognize more vocabulary this way and ultimately become a more independent reader. Not only will this boost his academic achievement in the science classroom, but he will show improvements in all his classes. Lastly, Trevor will require more scaffolding when participating in lessons that are inquiry-based. He will need help formulating his ideas and discussing concepts with the correct vocabulary. Word manipulatives like word banks and picture associations will help Trevor in this area, especially. With time, he will gain confidence and increase academic achievement. As those factors improve, he will become more comfortable in the class and less overwhelmed. He will attend more class, further increasing his success in school. For all students mentioned in this paper, graphic organizers and inquiry-based instruction will help. The graphic organizers utilized will look different for each individual student. To some degree, they all will benefit from using pictures in a graphic organizer. It may be because the creativity channeled allows them to use their strengths to improve a weaker area, like Todd, or the connection between pictures and associated words helps improve their reading skills, like Trevor. For all of them, however, the graphic organizers will help them focus on the big ideas of each lesson, decreasing the stress so the students are not overwhelmed. The inquiry-based instruction encourages students to make connections to their own experience by trying to understand scientific phenomena in the world around them. They learn by forming their own ideas first, then testing them to see how the phenomena really work. The students work

collaboratively in these types of classrooms, which helps students with special needs work on their social and behavioral skills as well as academic. They also make connections between abstract ideas and prior knowledge, aiding in comprehension and retention of knowledge. Not only would these students benefit immensely from an inquiry-based approach that encourages active participation in discovering science and discussion of scientific concepts, but also all the students of the classroom receiving general education services would show improvement.

Chapter 5

Conclusion

This paper focused on reviewing evidence based practices to help students receiving special education services find academic success in the general education science classroom. The achievement gap between students with special needs and their non-disabled peers is alarmingly high despite the legal advancements made by the special education community. Reviewing recent literature shows that there are specific evidence based practices that support inquiry-based instruction in the general education science classroom that will increase the success of students with special needs. Not only should it help students achieve more academically, but with that, their behaviors in the general education classroom should improve. Furthermore, social interaction between all students (special needs and general education) will improve due to the collaboration involved with inquiry-based science teaching. Applying this to a specific classroom will look very different for each student, because it is important to work with students' individual strengths and plan lessons that are universally designed, so that different styled learners may achieve the same level of success. The STEAM organizers help create modifications to utilize the individual strengths of each student. These specific strengths are different, but the use of creativity in science helps them all make more connections and retain more knowledge learned in the classroom. Along with the modifications of the STEAM organizers, an inquiry-based approach implemented by a teacher that is equipped with enough training will encourage the active participation and collaboration of all students, which will in turn boost engagement and consequently academic achievement. . The implementation of

practices proposed in this paper is strictly potential and discusses desired results. More research would be necessary to have conclusive data from the suggested modifications for specific students.

Appendix A

STEAM Organizers

1. file:///C:/Users/Amanda1/Desktop/STEAM%201.pdf
    a. Follow link above to view the STEAM Organizer for Luke.
2. file:///C:/Users/Amanda1/Desktop/STEAM%202.pdf
    a. Follow link above to view the STEAM Organizer for Todd.
3. file:///C:/Users/Amanda1/Desktop/STEAM%203.pdf
    a. Follow link above to view the STEAM Organizer for Sara.
4. file:///C:/Users/Amanda1/Desktop/STEAM%204.pdf
    a. Follow link above to view the STEAM Organizer for Howard.
5. file:///C:/Users/Amanda1/Desktop/STEAM%205.pdf
    a. Follow link above to view the STEAM Organizer for Trevor.

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ACADEMIC VITA

Academic Vita of Amanda Rees
Amr5979@psu.edu
Address optional (this will be on the web)

Education
Major(s) and Minor(s): Secondary Education, Biology Option, Minors in Special Education and Spanish
Honors: Secondary Education

Thesis Title: Teaching Science to Special Needs Students
Thesis Supervisor: Dr. Jonte Taylor

Professional Memberships: PSEA

Community Service Involvement: THON, VIPS

International Education (including service-learning abroad): Ireland, short-term student teaching abroad program (Global Gateway for Teachers)

Language Proficiency: Spanish