

BARRIERS AND BEST PRACTICES: TEACHING STUDENTS WITH LEARNING AND
COGNITIVE DISABILITIES IN THE GENERAL EDUCATION SCIENCE CLASSROOM

by

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ABSTRACT

Inclusive education, where students with and without dis/abilities learn together in one space, has been a hallmark of U.S. education for several decades. Yet, students with dis/abilities are not achieving at the same level as their peers and teachers report feeling ill-equipped to teach a variety of learners. The purpose of this study was to determine the current best practices for teaching science to students with learning and cognitive dis/abilities in the general education science classroom, and to understand what is preventing teachers from meeting the learning needs of these students. First, surveys were collected from students and teachers addressing what strategies each group felt helped students with dis/abilities learn. Then, individual students and teachers were interviewed to gather a deeper understanding of what methods helped learning and discussed what they felt prevented teachers from helping their students with learning dis/abilities. From the data gathered, it became clear that individualized and small group focused strategies were seen as the most successful by staff and students. While barriers preventing teachers from meeting the needs of their dis/abled students mainly stemmed from issues outside of the teacher's control: (i.e., class sizes, testing requirements, mental health concerns, and curriculum rigidity), to make education equitable for our students with learning dis/abilities, professionals beyond the classroom need to make accessible science education a priority.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

School Demographics

Park Center Senior High is a 9-12 school in Brooklyn Park, Minnesota. In total we have around 1800 students in the school, though that number was higher before the beginning of the COVID-19 pandemic. We have a very diverse population: 37.7% Black or African American, 29.6% Asian, 15.1% Hispanic or Latino, 11% White, 5.9% Two or More Races, 0.6% American Indian or Alaska Native, and 0.1% Native Hawaiian or Pacific Islander. Furthermore, we have a high rate of poverty within our school with 63.6% of our students qualifying for free or reduced lunch, and 2.2% of our students are homeless or home insecure. Finally, 14.6% of our students are identified as English learners, and 12.2% of our students qualify for special education services (Minnesota Department of Education, 2023). We are a part of the Osseo Area School District which has a wide racial and economic disparity, which students are abundantly aware of. For example, the high school on the other side of the district has 72.1% white students, 13.3% free or reduced lunch, and only 7.1% special education students (Minnesota Department of Education, 2023). I believe the information regarding the other side of our district is relevant because it reflects the disparities our students are seeing and experiencing on a day-to-day basis.

Context of the Study

I am in my seventh year of teaching 9th grade science at Park Center. I have not taught at other schools. Currently, 9th grade is physical science which is roughly half introductory physics

and half introductory chemistry. Due to the diversity of our students, I already see an incredibly wide range of academic ability and prior knowledge. On top of our standard population, I co-teach two of my 9th grade science classes with a special education teacher. In these classes, one third of students placed into our class have Individualized Education Plans (IEPs) and their team decided they needed more in-class support. The other two thirds are filled as usual with students who signed up for the 9th grade science course. Due to our concentration of students receiving special education services, we usually have more than a third of our students with IEPs because some students were randomly assigned on top of the third determined to need more support. Our school values co-teaching and about 70% of 9th grade courses are co-taught. We also have co-taught courses with English as a Second Language (ESL) teachers and reading teachers.

I frequently struggle to teach and create learning experiences where all students are challenged and successful. Often my lessons fall to one side or another: (a) either they are simple, and some students finish quickly and are bored, or (b) they are challenging and some of my students struggle. As I began to research teaching strategies that would benefit all my students, I noticed how few studies related specifically to science teaching strategies for special education students in a general education setting. The studies either focused on students with more severe dis/abilities which kept them out of the general education setting, or they were more general teaching practices not specific to science. I also noticed the studies and methods I did find were much harder to implement as they focused on the curriculum design or unit planning level versus easier to implement instructional strategies. Although these methods may be successful, in most situations teachers are provided curriculum that they are either not allowed to

modify at that level or are required to do work above and beyond the provided scope to create lessons best suited for students with dis/abilities.

Overall, a lot of these methods felt unattainable. I began to wonder if the barriers teachers face is what are preventing special education students from succeeding to the best of their abilities. Therefore, I decided I wanted to investigate best practices for teaching students with learning and cognitive dis/abilities as well as the barriers teachers face in implementing the best practices for their dis/abled students in science. I believe my study can point out further areas for investigation and analysis that impact our education system related to this topic.

Focus Question

My focus question was, What are the best practices for teaching science to students with learning and cognitive dis/abilities?

My sub-question includes the following:

1. How do we overcome the barriers encountered by general education science teachers when implementing these best practices for teaching science to students with learning and cognitive dis/abilities?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

History of Inclusion

In the United States, a free and public education began rising in popularity in the 1800's. More schools were opening, and land grants allowed for public schools and universities to be established (Kober, Retner, & Ferguson, 2020). By 1918, all American children were required to attend some amount of school (Watson, 2008). However, the schooling students received looked vastly different depending on your location, race, and dis/ability status. Students with identified dis/abilities were often considered unteachable and exempt from any schooling or placed in institutions where little to no schooling happened. Others, who we would now recognize as having a dis/ability, were placed in lower classes and not given the support necessary for success (Kober, Retner, & Ferguson, 2020). This changed on November 29th, 1975 when the Education for All Handicapped Children Act, now known as the Individuals with Disabilities Education Act or IDEA, was signed into law. From this point forward, all students regardless of dis/ability status were entitled to a Free and Appropriate Public Education (FAPE) in the Least Restrictive Environment (LRE) (US Government, 2022). Between 1975 and presently, the law has been updated several times to lay out the expectations more clearly for how education should be delivered and what students are entitled to. As we know it, special education in public schools only had 48 years to develop (US Government, 2022). As such, it is no surprise that students, staff, and parents feel as though our special education system needs to do more for students.

Best Practices in Science Instruction for Teaching Students with Dis/Abilities

Relevant, engaging, and hands-on are the hallmark traits of teaching especially for students with dis/abilities. While there are a large range of strategies found to be best practices, a vast majority can be summarized as increasing relevancy, engaging students, and giving hands-on opportunities (Maciver et al., 2017). Furthermore, these methods not only help students with dis/abilities, but also increase comprehension and academic success for all learners (Cumming & Rose, 2021). Inclusive strategies not only help bring dis/abled students up to the level of their peers, but they also help all students reach the same achievement level.

Universal Design for Learning (UDL) is one overarching philosophy frequently referenced as an inclusive best practice (Cook & Rao, 2018; Cumming et al., 2021; Picard, 2015; Tosun, 2022). UDL places students at the center of instructional design, giving them the tools to be successful and help themselves before experiencing any kind of failure (Cumming et al., 2021; Rose, 2021). Furthermore, educators can “reduce barriers, update, and enhance effective practices that we know to work” (Cook & Rao, 2018, p. 188). When students can identify their struggles, access materials, and practice skills before submitting work for grading, they tailor their learning to their needs. Similarly, teachers need to differentiate between the specific content knowledge or skill they are asking students to demonstrate and the method by which they ask students to show this learning. An essay is not the only way for students to explain their thoughts and show what they’ve learned; the same goal can be achieved by video or voice recordings (Picard, 2015). When teachers can separate what they are assessing they allow students with dis/abilities to show the same learning as their peers without limitations related to their specific disability.

Inquiry-based instruction is another popular method where students are given the freedom to ask questions and interact with materials to determine their own answers. Allowing students to explore on their own dramatically improves conceptual understanding as well as students' attitudes towards science (Aydeniz et al., 2012). Vavougiou et al. (2016) found similar constructivist approaches on top of providing accommodations specific to student disabilities brought near equal success for students with and without disabilities. When a student understands why something works, they develop a transferable conceptual understanding, benefiting them well beyond the classroom. While constructivist ideas of facilitating learning for students as opposed to delivering content is not new; redesigning the setup of adults in a classroom is gaining steam over the last decade or so. Multiple teachers provide enhanced opportunities for multiple methods of learning the same material, all while still guided by a teacher (Moorehead & Grillo, 2013). Students can assess their learning needs and pick the activity or teacher that best matches what they need in that moment, a freedom not as accessible with one teacher who is able to facilitate one activity at a time.

Best practices are not limited to the strategies teachers implement in planning and delivering curriculum; they also are relevant in teacher training. Teacher understanding and buy in to the concept of an inclusive classroom is essential according to Reynaga-Peña et al. (2018); teachers cannot adequately apply inclusive practices when they do not understand how and why they are necessary. Furthermore, teachers cannot overcome the obstacles of facilitating the learning of every student when they doubt their ability to cater to all types of learning needs (Tosun, 2022). Only when teachers feel confident in their ability to implement best practices can they affect change in the classroom.

Instructional Strategies for Teaching Science to Students with Dis/Abilities

A wide variety of instructional strategies are suggested for teaching students with learning and cognitive dis/abilities. This includes cross-disciplinary skills such as self-monitoring and repeated reading (Cook & Rao, 2018). Grumbine and Alden (2006) identified six practices to help students with learning dis/abilities access science: (a) teach to diverse learning styles and strengths, (b) explicit instruction in skills and strategies, (c) clear organization, (d) explicit objectives, (e) consistent feedback, and (f) helping students develop self-knowledge. These strategies can be applied to any content area, yet are essential to help dis/abled students access science content.

As students have access to more technology, researchers continue to evaluate digital methods of teaching as compared to the more traditional direct instruction. Karabulut and Yikmis (2021) found there was not a significant difference in the comprehension and achievement level of students with dis/abilities who used tablets to aid in their instruction as compared to those who did not. However, they noted that the students enjoyed the tablet use, and the tablets weren't used to provide strategies and resources unattainable without technology (Karabulut & Yikmis, 2021). More research is needed to evaluate the efficacy of tablets in supporting students with learning dis/abilities.

When students see and experience science as opposed to hearing or reading about it, they develop a deeper level of comprehension and can more easily apply that knowledge to novel situations. A thematic and hands-on based curriculum increases student achievement for those with dis/abilities when compared to a traditional textbook based approach (McCarthy, 2005). Students can test out and experience the content which allows for more connections to be made;

as well as help students to “generate positive attitudes toward science” (McCarthy, 2005, p. 258).

Hands-on approaches increase both academic achievement and a positive perception of science.

Utilizing the environment around the students increases relevancy, engagement, and achievement. When students are allowed to conduct science experiments and observations in the area surrounding their school, they connect more deeply to the science being learned, and retain a higher level of understanding when tested on the content learned (Melillo, 2015). By connecting science content to the environment students are familiar with, it gives them concrete examples and increases their retention. Finally, as stated by Melillo (2015), student happiness increases when outside and it also improves energy and engagement.

One concern as we move toward more student-centered learning is how students with learning dis/abilities will adapt to less structure or clear expectations. As Grumbine and Alden (2006) asserted, dis/abled students need clear organization and expectations, as well as direct instruction in skills. This poses a challenge for the inclusive science classroom teacher as we need to balance student-driven inquiry with clear expectations and direct instruction. Systemic prompting along with frequent reinforcement and feedback allow the teacher to provide direction and support to the students that need it without limiting the inquiry process (Spooner et al., 2011). Overall, knowing and adapting to individual students needs builds the inclusive classroom.

Constructivist methods such as hands on activities, projects, and examining misconceptions, help students with learning dis/abilities stay engaged with the material and develop their understanding. When activities and labs are student-directed and scaffolded with multiple supports, all students improve their comprehension (Vavougiou et al., 2016). Teachers

need to examine their activities and laboratory practices to make sure they are not only used to confirm what has been told to them; rather, students need to investigate their own questions or conduct experiments where they don't already know the outcome (Vavougiou et al., 2016). When used to develop knowledge constructivist concepts, allow students with learning dis/abilities to access the same level of comprehension as their peers.

Inquiry-based instruction is not only a current best practice in science (NGSS, 2013), but it is a common suggestion to engage students with learning dis/abilities. While learning dis/abled students can acquire science content knowledge through inquiry practices (Aydeniz et al., 2012), it is essential teachers provide accommodations and scaffolds to students. McGrath and Huges (2018) argue it is “questionable whether students with [learning dis/abilities] were able to truly engage in inquiry” due to the reliance on reading comprehension and math skills of most inquiry lessons (p. 139). However, when teachers provide accommodations and scaffolds specific to the student's dis/ability, student achievement is higher (Rizzo & Taylor, 2016). Inquiry-based instruction is a highly engaging and successful teaching practice for all students regardless of dis/ability status when appropriate scaffolds and accommodations are provided.

A broad examination of lessons and teaching practices with the perspective of serving students with dis/abilities helps teachers make all lessons and activities accessible to all students. Co-teaching partnerships where teachers work together to decide on outcomes for a lesson, plan the lesson, teach the lesson, and reflect on the lesson, builds stronger skills and supports for students with learning dis/abilities (Mutch-Jones et al., 2012). Similarly, when teachers can examine all aspects of their teaching and classroom with the intention of using inclusive design teachers are more able to support all of their students with learning dis/abilities' needs (Picard,

2015). When teachers have the time, knowledge, and flexibility to examine and adapt their practices for learning dis/abled students, all can learn.

Overcoming Barriers When Implementing Best Practices for Science Teaching for All Students

To successfully implement best practices, teachers need to be confident in their knowledge and ability to teach students with learning dis/abilities. Many programs are rushing the teacher training process and incorporate little to no focus on inclusive classrooms (Connor & Cavendish, 2018). When teachers haven't been properly prepared, they do not feel confident and cannot provide the best education for their dis/abled students. Gookool-Baurhoo and Asghar (2019) claimed teachers' insufficient knowledge and skills is the biggest barrier to implementing best practices. Furthermore, the National Center for Learning Disabilities (Galiatsos et al., 2019) found that only 17% of general education teachers said they were prepared to teach students with learning dis/abilities. Consistently, teachers report feeling unprepared to teach students with learning dis/abilities and desired more training and experience in their preparatory programs (Aydeniz et al., 2012; Reynaga-Peña et al., 2018; Stefanich & Norman, 1996; Tosun, 2022).

Continued professional development, beyond training and during preparatory teacher programs, to further support teaching students with dis/abilities, is essential. Frequently, teacher professional development does not include current understanding of dis/abilities or methods and practices for teaching students with dis/abilities (Gookool-Baurhoo & Asghar, 2019). Lack of continuing education on dis/abilities causes a lack of confidence in teachers and a lack of understanding of dis/ability (Vavougios et al., 2016). In fact, only 50% of teachers said they thought their students with learning dis/abilities could meet grade level standards (Galiatsos et al., 2019). According to Tosun (2022):

In order to overcome obstacles, it is important for teachers to overcome their anxiety and doubts. When the right support is given to teachers and teachers see what students with special needs can do, they will like this situation. A science teacher who has not received any training related to the education of students with special needs may not know which teaching strategies to adapt and which resources to use (p. 364).

Preservice and continuing professional development is integral to creating inclusive classrooms.

Often, peer teachers and student input are one way to continue learning new resources and teaching practices for supporting all varieties of learners. However, even having peer teachers who are very successful in working with students with learning dis/abilities, often struggle to describe their methods since the methods are often nuanced and implicit (Maciver et al., 2017). Similarly, teachers seek input from their students about what they need to be successful, but due to the peer pressure and negative stereotypes, special education students don't often feel comfortable advocating for themselves (Picard, 2015). Without the typical avenues of support and learning, teachers struggle to learn the skills to help their students with dis/abilities.

Co-teaching is often viewed as a remedy to a general education teacher's lack of knowledge on teaching students with dis/abilities, yet this style of teaching does not help in all situations. While students frequently stated they felt they could learn more when two teachers were present in the classroom, many stated they thought the special education teacher was a "helper" to their main teacher (King-Sears et al., 2018). Students are less likely to ask for help or feel confident in the help given if they view one of the teachers as subordinate. Furthermore, with co-teacher pairings, there is often a difference in knowledge base the co-teachers need to work through, they are not given enough time to plan and prepare together for teaching, and administration often does not give detailed instruction on what their roles or expectations are

(Moorehead & Grillo, 2013). Co-teaching presents its own challenges in teaching students with dis/abilities.

Inquiry-based education is considered one of the best practices for teaching science to all learners (NGSS, 2013); however, it often comes with inadequate training and preparation on how to make inquiry work for students with learning dis/abilities. Particularly for elementary teachers, they feel less prepared to teaching science inquiry and, overall, hold negative views on science as a discipline (Aydeniz et al., 2012). Many teachers cite a lack of preparation on how to modify inquiry and provide supports to make it accessible. And when inquiry is applied without the necessary accommodations, it is less successful for students with learning dis/abilities than traditional textbook teaching (Rizzo & Taylor, 2016). Teacher preparation and professional development must include explicit instruction on effectively using inquiry-based science curriculum in order to serve our dis/abled students (McGrath & Hughes, 2018). Specific and relevant professional development is a fundamental need for allowing all learners to access science content.

Even when teachers are aware of the best practices to accommodate their students with dis/abilities, time and other duties prevent the implementation. Gilmour and Wehby (2020) found that the more students with dis/abilities a teacher had, the higher probability they had of leaving the profession. They hypothesized this was due to lack of time, more stress, and more demands from administration (Gilmour & Wehby, 2020). Administrative expectations and educational policies also add to the time and duties that pull teachers away from implementing best practices for all students (Vavougiou et al., 2016). When teachers are trained on what they need to do for

their students, other duties and responsibilities prevent them from doing what is best for students with learning dis/abilities.

CHAPTER THREE

METHODOLOGY

Demographics

The purpose of this study was to determine what the best practices are for teaching science to students with learning and cognitive dis/abilities. The secondary question at the center of this research is, How do we overcome the barriers encountered by general education science teachers when implementing these best practices for teaching science? The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for work with human subjects was maintained (Appendix A).

This study was conducted between January and March 2023 at Park Center Senior High, a 9th-12th grade school in Brooklyn Park, Minnesota with about 1800 students. For this study, the student survey, Science Learning Student Survey, was posted in our online classroom through Schoology. It was made accessible to my four 9th grade science classes and my elective class, Animal Kingdom. Participation was completely voluntary, and many students did not complete the survey. I also asked our special education department to post the survey online for their time management classes which are specifically for students with learning and cognitive disabilities. Within my sections, the survey was made available to 134 students. Of those students, 39 are identified as having a dis/ability. I do not have data on the number of students it was made available to from the special education classes. In total, 54 students completed the survey, and their ages ranged from 14 to 17, though a majority were 14 or 15 years old. Ten of the students who completed the survey identified themselves as having a dis/ability. Dis/abilities listed by

students included: ADHD, autism, and learning disability. From that group, two students were interviewed, one who identifies as male, and one who identifies as female. The female student has ADHD and autism, while the male student has a specific learning disability.

The staff who answered the survey consisted of seven members from the science department and two from the special education department, for a total of nine participants. Their ages ranged from 21 to late 50's and their experience ranged from a student teacher up to a teacher with more than 30 years of experience. Two teachers were interviewed, one who is a science teacher, and one who is a special education teacher.

Treatment

My focus questions for this research were: (1) What are the best practices for teaching science to students with learning and cognitive dis/abilities? (2) How do we overcome the barriers encountered by general education science teachers when implementing these best practices for teaching science to students with learning and cognitive dis/abilities? To collect relevant data to address these questions, I collected perspectives from students through the Science Learning Student Survey (Appendix B) and student interviews (Appendix C). Staff perspectives were similarly collected with the Science Learning Staff Survey (Appendix D) and staff interviews (Appendix E).

The surveys were initially distributed about halfway through the school year. At this point, all students were familiar with how science classes worked and would have experiences from this school year to reflect on. Initially, the Science Learning Student Surveys were distributed to my four sections of 9th grade science students and my one section of the elective Animal Kingdom course. In February, I had not gathered much data from my students with

learning or cognitive dis/abilities, so I asked the special education department to distribute the survey in their time management classes. This course is for students on IEPs, often with learning or cognitive dis/abilities. Some classes were given time in class to complete it, and others were given access to the survey and asked to complete it in their own time. Overall, fifty-four students responded to the survey across grades 9-12. Similarly, staff from both the science and special education departments were given the Science Learning Staff Survey through an email explaining my project and what I hoped to learn.

Both student and staff surveys were then used to identify individuals to schedule more in-depth interviews with. Student interviews were scheduled during our Advisory period, which happens weekly on Wednesdays for 68 minutes. A colleague across the hall took my students after the assignments for the day were done so students who were being interviewed had privacy while the interview was conducted. Overall, two students were interviewed.

Staff interviews took place over a variety of times, based on how our schedules were aligned. All were conducted in private spaces where staff felt comfortable. Overall, two staff members were interviewed.

Data Collection and Analysis Strategies

The goal of this method was to determine staff and student perspectives towards teaching students with learning or cognitive dis/abilities in the general education science classroom.

Below is a table explaining what instrument corresponds to each question (Table 1).

Data Collection Methods

Table 1. Data Triangulation Matrix.

Data Collection Instruments	Focus Question	
	What are the best practices for teaching science to students with learning and cognitive dis/abilities?	How do we overcome the barriers encountered by general education science teachers when implementing these best practices for teaching science to students with learning and cognitive dis/abilities?
Student Survey	X	
Student Interview		X
Staff Survey	X	X
Staff Interview		X

Science Learning Student Survey. In the Science Learning Student Survey, the first thing students were asked was a series of Likert scale questions. These questions were developed to gauge students' overall feeling and attitude towards learning, science methods, and academic success. Likert questions are a common qualitative data source in education research. They ask respondents to rank their attitudes on a scale typically from strongly disagree to strongly agree (Cook & Rao, 2018). Considering my survey aimed to gather data on attitudes towards science learning and teaching strategies, a Likert survey aligns with my goals. Next was a short answer section where students were asked six questions about what specific types of learning and activities worked for them, and what didn't work. They were also asked to explain how science is different from other classes and what teachers can do to make them more successful and interested in science. This survey gave me quantitative data about student attitudes in science, allowing me to compare dis/abled students and those who are not dis/abled. When students elaborated on strategies they like and dislike in class, it gave me their perspectives on what can

help them to learn in a science class. In other words, what the students might consider best practices for teaching science.

Student Interviews. The Student Interview Questions is a list of questions used to gather qualitative data about student perspectives on science learning and teaching. As Grumbine and Alden (2006) clarify, interviews are a good data collection method for gaining insight on individual experiences and perspectives. By asking students about a time that they remember learning a lot, it allowed me to evaluate what teaching methods their teacher used, even when students don't have the language to describe what their teacher is doing in the way a teacher would. I could also gather information on what they would like to see happening in science classes, and what they think could be helpful for them to be more successful.

Science Learning Staff Survey. In the Science Learning Staff Survey, staff were asked to respond to Likert questions about their level of confidence in teaching science to students with learning dis/abilities, and on potential barriers they face in trying to teach these students in a general education classroom. Similar to the student surveys, I am looking to gather data on the attitudes of teachers towards their teaching practices and what they feel are barriers to implementing strategies for students with learning dis/abilities. Likert surveys provide quality data on the attitudes of respondents (Cook & Rao, 2018). I also asked staff to describe their teaching methods and experience, along with what they view as the potential obstacles to doing what they believe is the best for our students with learning and cognitive dis/abilities. These questions gave me quantitative data about the level of confidence general education teachers have in teaching science to students with learning or cognitive dis/abilities, and what they believe is needed to help them be a better teacher for this population of students. The short

answer questions also allowed me to compile a list of the unique strategies teachers could list off the top of their heads for teaching our dis/abled students.

Staff Interviews. The Staff Interview Questions asks teachers to reflect on ideal lessons, both real and imagined, and what that looks like. This gets at what teaching methods may be used if barriers are not in place. It provides me with qualitative data on what staff perceive to be successful for teaching students with learning dis/abilities (Grumbine & Alden, 2006). Next, they are asked to describe what barriers they face when trying to make sure their learning dis/abled students are achieving at an equitable level to their non-dis/abled peers. Gathering this information helped me to see what staff experience and understand where teachers and schools can focus their efforts to improve achievement for our students with learning or cognitive dis/abilities.

Analysis Strategies

According to Mertler (2019) both qualitative and quantitative research methods are often used in classroom action research. I am using what Mertler calls, the Triangulation Mixed-Methods Design, where both the quantitative and qualitative data are collected and are given equal importance (p. 108).

Quantitative Data Analysis Technique. The Likert scale questions were used to gather my quantitative data in both the staff and student surveys. Likert scale questions are common data collection methods for educational research, and are frequently used for similar research goals similar to my own (Cook & Rao, 2018). The collected responses of strongly agree, agree, unsure, disagree, and strongly disagree were assigned numerical values from 1 to 5 for analysis

purposed. I was then able to determine the percentage of participants that chose each response. For the student data, I was able to plot these percentages on a stacked bar chart and compare SpED (Special Education) students with Non-SpED students side-by-side. Finally, a percentage difference was calculated to demonstrate how similar or different the two groups' responses were.

Qualitative Data Analysis Technique. Short answer questions from the surveys and the interviews were used to collect qualitative data. For the short answer responses in both cases, I grouped responses with other similar responses to identify themes or trends in the methods suggested, a common method for research that includes interviews (Apanasionok et al., 2019). The interviews were very limited, with only two interviews for students, and two for staff. Therefore, no explicit analysis techniques were used, other than highlighting relevant suggestions or quotes to support the quantitative findings.

CHAPTER FOUR

DATA ANALYSIS

Student Survey and Interview Results

The student survey, Science Learning Student Survey results demonstrated 80% of dis/abled students were *unsure* or *disagreed* that their grades in science are reflective of what they know. Whereas only 40.91% of non-disabled students were *unsure* or *disagreed* (Figure 1).

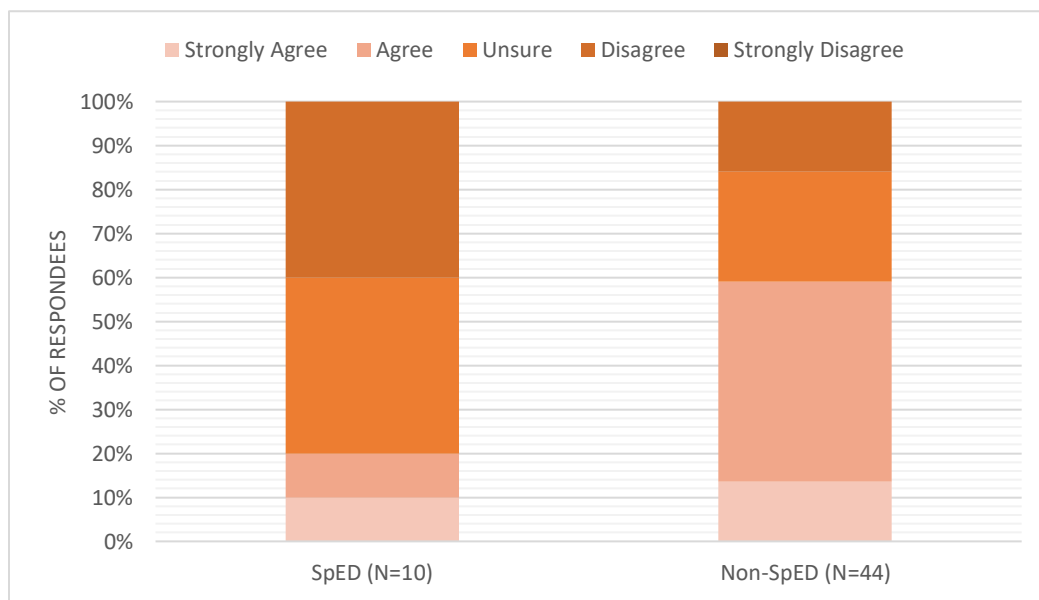


Figure 1. Likert responses from the student survey ratings of “I think my science grade shows how much I actually know,” (N=54).

The students who self-identified as dis/abled cited “hands on activities” and group or discussion work as two strategies that best help them learn. When students were asked to share their perspectives on whether their science teachers knew how to help them learn, 30% of dis/abled students were *unsure* or *disagreed* that their science teachers knew how to help them learn. In contrast, only 9.09% of non-dis/abled students were *unsure* and 0% *disagreed* (Figure 2). This is

a 106.9% difference in perspectives about whether teachers know how to help them learn between dis/abled and non-dis/abled students (Figure 2).

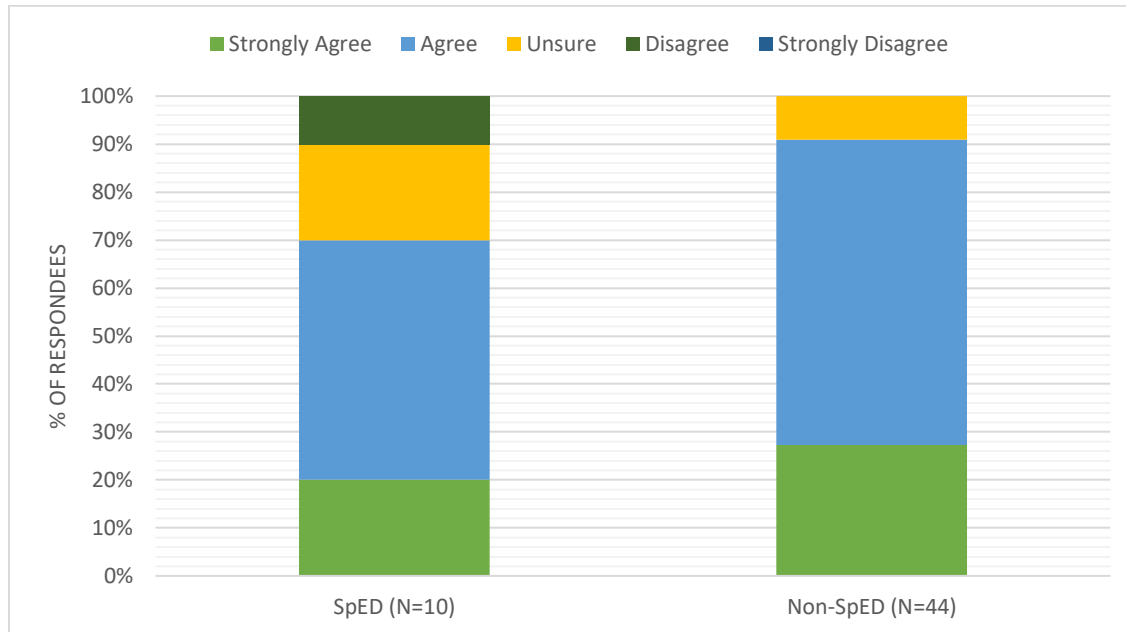


Figure 2. Likert responses from the student survey ratings of “I feel like my science teachers know how to help me understand things in class,” ($N=54$).

When the dis/abled students were asked what strategies are not working in class, 40% stated they did not know. One could not pinpoint what activities, assignments, or ways of learning in class were unhelpful, simply saying “my ADHD is the reason I’m having hard times focusing.”

Similarly, when asked what the science teachers can do to help, 70% of the students could not put into words what they needed to be successful. One of the students interviewed explained “I like what the teachers do sometime but mostly I don’t know.”

Both students who were interviewed, described lessons where they were actively engaged in a task. They experienced a sense of wonder and there were many ways to learn, which made the material accessible for all students in the room. One remarked “I was confused sometimes,

but so was everyone else. We weren't all confused at the same time, so it worked." When pressed about why they felt they could learn a lot that day, the student explained "we went back and forth, sometimes we did stuff, sometimes everyone (the whole class) did stuff." Terminology and reading are two problems that came up recurringly in both interviews with students with dis/abilities. They struggled with reading detailed lab directions, understanding the questions asked, or remembering what the new words meant. "There are too many letters" one student said, referencing units and variables, while another said "each lab is like fifteen steps, way too many." When asked what teachers should be doing to help them both, students talked about working with the teacher alone or in small groups, less reading just to do a lab, and "just show it to me, I can do it if you show me how."

Staff Survey and Interview Results

The Science Learning Staff Survey results demonstrated a variety of confidence levels in finding and using strategies to teach students with learning or cognitive dis/abilities. When asked if strategies for teaching science to students with learning or cognitive dis/abilities are easy to identify or learn 55.5% of teachers *agreed*, 11.11% were *unsure*, and 33.33% *disagreed*.

Similarly, when asked if strategies are easy to implement, 55.55% *agreed* and 44.44% *disagreed*.

One teacher wrote:

I feel my chemistry classes are lacking. With this new curriculum, it's kind of hard to modify or find ways to make sure my students are actually learning especially with an inquiry method. I personally believe this method may be harder on students with any sort of dis/abilities as these are hard concepts to grasp factually and now they have to "explore" these topics on their own.

Teachers were asked to share strategies they used to support dis/abled learners in their classes. Between the nine teachers who responded, they listed 48 different strategies or teaching methods used. Strategies mentioned included: (a) breaking down directions and assignments, (b) video directions and notes, (c) written, audio, and visual directions, (e) one-on-one or small group instruction, and (f) multiple options for students to demonstrate their learning. During one interview, a teacher stated “I would like to be better at scaffolding. One assignment, many different ways of accessing that assignment. A method for all! Who has that kind of time?” Overall, staff felt they did not have adequate time or administrative and other personnel support to assist students with learning or cognitive dis/abilities (Figure 3).

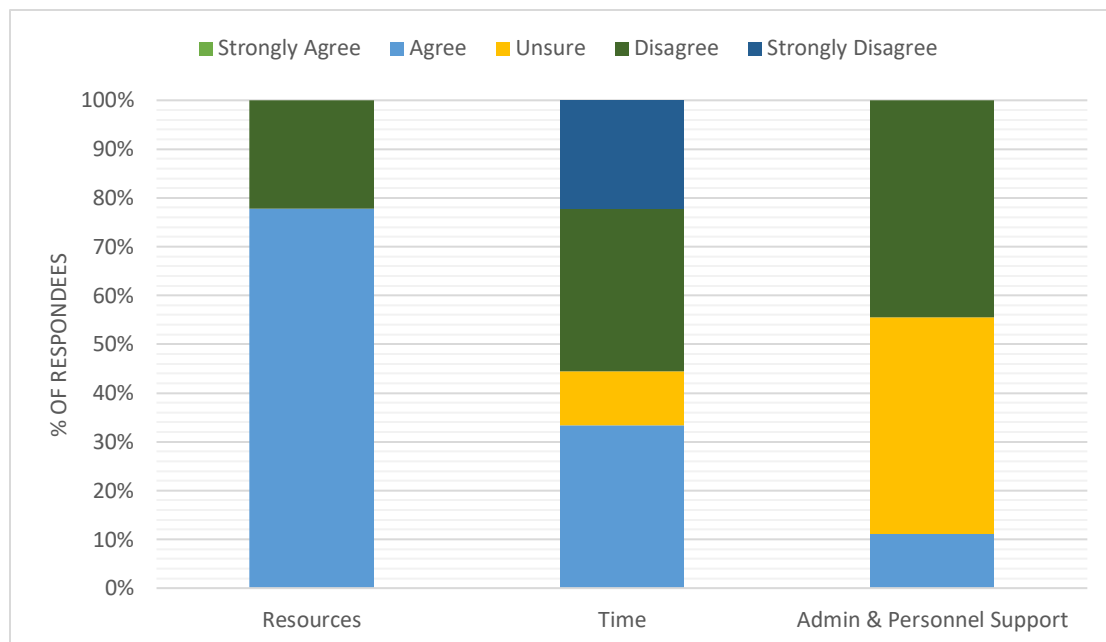


Figure 3. Likert responses from the staff survey ratings of “I have enough (resources, time, support from administration and other personnel) to implement best practices for teaching students with learning or cognitive dis/abilities,” (N=9).

When describing strategies and lessons that have worked and have been successful for students in the past, a few themes emerged. The first was having a small number of students per

teacher. One teacher shared “it works best when I work with one to five students at a time, otherwise kids get missed or left behind.” This could be done either with smaller class sizes, or with more teachers in the room to work with different groups. Next, they talked about hands-on and engaging activities. One explained “kids struggle when there’s nothing to be excited or care about.” Finally, they explained that students need to believe they can learn and be successful in a lesson. Another teacher shared, “it’s near impossible to get a kid to try, when every other time they tried, they got a bad grade, or still didn’t understand.”

The barriers preventing teachers from implementing best practices for students with learning or cognitive dis/abilities seems to come down to time. Half (55.55%) of teachers were *unsure* or *disagreed* that they knew what is considered best practices for teaching students with learning and cognitive dis/abilities. Many commented they would like more time and support in learning. Others felt they knew strategies or how to find them but lacked enough time to implement them as needed. One teacher stated “no strategy works for every kid, I have to know them, talk with them, and try things,” which is time consuming. Furthermore, there are many requirements outside of designing and facilitating lessons. The staff explained they don’t have the time to modify and adapt for individual student needs due to tasks like paperwork, meetings, attendance, and chronic behaviors, amongst others. Administration, similarly, doesn’t have the time and resources to prevent these extra tasks from becoming the teacher’s problem. For example, one teacher shared, “I have to do too many things that aren’t teaching, and then I barely have time to teach.”

CHAPTER FIVE

CLAIMS, EVIDENCE, REASONING

Claims From the StudyBest Practices

The first goal of this study was to determine the best practices for teaching science to students with learning and cognitive dis/abilities. While numerous strategies were compiled through both the literature review and from students and staff, the recurring theme was that a personal connection and individual support are the most impactful to students' learning. Seventy percent of the students with learning or cognitive dis/abilities felt their science teacher knew how to help them understand the science content, yet the majority felt their grade did not adequately reflect what they knew. While initially this would seem contradictory, when taken into consideration with the barriers the teachers cited; time, and support from other staff, it seems likely most teachers can help their students, when given the proper time and resources. Furthermore, a theme that kept recurring in student answers both in the short answer part of the survey and in the more in-depth interviews was individual and small group teacher help. It seems students know that their teacher can help explain science content to them and help them to be successful in science. It's not about one specific strategy, it's about a teacher being able to pick the strategy that will work.

Barriers

The second, and perhaps loftier goal of this study, was to determine some of the barriers teachers face that prevent them from implementing best practices for students with dis/abilities.

While it might seem obvious that teachers are spread too thin and not given enough resources, the data addressed the impact of a lack of personalized time with students. Sixty-seven percent of the teachers surveyed did not agree that they had enough time to adequately teach their dis/abled students, while 55% percent didn't feel confident that they knew what best practices were for teaching students with learning or cognitive dis/abilities. At the same time, the students asserted individual help is what will help them learn. When teachers don't have the time to teach to their students individual learning needs, and learn about strategies that will help, students with learning and cognitive dis/abilities are not able to reach equitable achievement levels.

Value of the Study and Consideration for Future Research

Studies have suggested that many strategies are considered best practices for teaching science to students with learning and cognitive dis/abilities, most can be summarized as increasing relevancy, engaging students, and giving hands on opportunities (Maciver et al., 2017). Furthermore, overarching philosophies like Universal Design for Learning (UDL) are widely researched as a best practice for including learning and cognitively dis/abled students within a general education setting (Cook & Rao, 2018; Cumming et al., 2021; Picard, 2015; Tosun, 2022). Centering students and actively engaging them in discovering what tools help their learning increases their academic success and provides learning tools and strategies they can use beyond the classroom (Cumming & Rose, 2021). Yet, few studies focused on student and teacher perspectives on teaching and instructional strategies; or on how these perspectives may vary between science and other content areas. My study focused on the student and teacher experience around students with learning or cognitive dis/abilities in the general education science classroom. This is clearly a first step, as the sample size was quite small, but I will continue to

evaluate my practices through this lens and engage my own students in reflection on what ways of learning are working and are not working for them.

I am in my seventh year of teaching and have cotaught at least two sections with a special education teacher each year. Throughout this time, I have learned numerous strategies for students as well as how dis/abilities affect student learning. Yet, I did not feel as though I could adequately serve all of my students' needs. In order for teachers to create an equal learning environment for students with dis/abilities, we need to not only know what strategies we can use, we also need to understand the challenges we face in implementing strategies. Hopefully, by identifying some of the barriers to implementing best practices I can continue to improve my teaching, so all learners in my classroom truly have an equal opportunity for academic success.

In the future, I would like to explore what kind of a class setup will best allow students with learning or cognitive dis/abilities to thrive. I cannot control the number of kids in any of my sections, but knowing how important individualized attention is, I can come up with ways to build in that time to work with all my students. I would continue this vein of research by investigating tools I can teach my students to help them evaluate their own learning. If a student can identify what types of activities and instruction are successful for them, then that removes one of the barriers I, as a teacher, face in trying to help my students learn.

Impact of Action Research on the Author

When I first came up with this topic I was thrilled. It was relevant, I was passionate about it, and I thought I might be able to uncover some secret to how I can help all of my dis/abled students learn, appreciate science, and pass their classes. However, I've realized there is no one easy answer. I suppose I naively assumed there was a specific trick I had yet to learn or uncover

that would make me a great teacher for my students with dis/abilities, but that is not the case. This research made me realize how complicated education, particularly special education, is. There is no particular method, strategy, or activity that will work for every student. While I think I always knew this, having the data in front of me made this realization even clearer. Although it is frustrating that I was unable to identify a strategy that would work for everyone, I've realized there are numerous strategies I can try. In the future, I am hoping to try designing more of my activities to be self-paced so I can work with individual students and small groups while everyone is actively learning. In my co-teaching classes, I can work to use both of us to provide multiple methods of learning as was suggested by Morehead and Grillo (2013). I'd also like to work on building reflective tools for my students to help them evaluate what it was about an activity or lesson that helped them learn, and what did not. By having my students learn to evaluate how they learn, it not only teaches them what they need to be successful in future classes, it guides me in what strategies and methods I should be using with that particular student or class. I also think I need to be confident in the wide variety of methods and strategies I am familiar with. By doubting my ability to find and use strategies to help students with learning and cognitive dis/abilities, I am not as capable of adequately implementing those strategies (Tosun, 2022).

I also have realized how nuanced a lot of education research is. The reality is, we are teaching individuals, so it is not empirical like the science data I am used to working with. We may be able to come to conclusions based on findings, but unless the study is incredibly large, it is likely there are a lot of cases where the study cannot be widely applied in a variety of schools and educational settings. Every study I reviewed mentioned the sample size in its limitations.

Some studies had multiple classes in one school like McGrath and Huges (2018), while others, such as Hunt et al. (2019) focused on the experiences of one student. Furthermore, so many factors beyond a student's dis/ability impact how they learn. Socioeconomic status, home life, and access to resources also play a major role in student learning and cannot be separated from a dis/ability for the sake of study. Therefore, all findings are helpful to indicate what worked for specific students, but there is no way to guarantee what worked for one student in one setting will work for another. This, I believe, is one of the biggest obstacles in teaching. I need to remember I am one individual teaching a class of individuals.

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APPENDICES

APPENDIX A

EXEMPTION BY MONTANA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD

Select Protocol For History

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5/29/2023 3:56:02 PM

Protocol #	Reference #	Version #	Principal Investigator	Protocol Type	Protocol Status	Title	Submission Date	Viability Date	Author	Modified Date	Expiration Date	Renewal Date	Approval Date	Status Date	Assigned Review Type	Parent Protocol #
2023-515-EXEMPT	515	1	Roll, Karl	Original	Approved	Examining Barriers to Implementing Best Practices for Teaching Science to Students with Learning and Cognitive Disabilities	1/27/2023		Roll, Karl	2/6/2023	2/6/2028	2/6/2028	2/6/2023	2/6/2023	Exempt Review	

APPENDIX B

SCIENCE LEARNING STUDENT SURVEY

Science Learning Student Survey

Name: _____

Before asking students to complete this survey the following phrase will be read: **Participation in this survey is completely your choice and your participation or non-participation will in no way impact your grade or standing in this class.**

For the following questions please read the statement and then circle how much you agree with it. Please think about past teachers and classes as well while completing this survey.

1. I feel like school is easy.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

2. I feel like science is easy.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

3. I feel like my science teachers know how to help me understand things in class.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

4. I feel like my non-science teachers know how to help me understand things in class.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

5. I get good grades in classes that aren't science

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

6. I get good grades in science.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

7. I think my grades in non-science classes show how much I actually know.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

8. I think my science grade shows how much I actually know.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

9. My non-science teachers are able to help me be successful.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

10. My science teachers are able to help me be successful.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

11. The activities and assignments in non-science classes help me learn.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

12. The activities and assignments in science classes help me learn.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

The following questions are short answer. Please give as much detail as you can.

13. What activities, assignments, or ways of learning have worked best for you?

14. What activities, assignments, or ways of learning have not worked for you?
15. What activities, assignments, or ways of learning would you like teachers to do?
16. How are science activities, assignments, or ways of learning different from other classes?
17. What can science teachers do to help you be more successful in science?
18. What can science teachers do to make you more interested in science?

APPENDIX C

STUDENT INTERVIEW QUESTIONS

Student Interview

Before asking students to participate in the interview the following phrase will be said:
Participation in this interview is completely your choice and your participation or non-participation will in no way impact your grade or standing in this class.

The following information will also be collected from our student management system Synergy about the students who agree to be interviewed. Current year in school, trimester 1 2022 grades, IEP or 504 plan dis/ability designation, gender and race designation.

1. Tell me about a class period where you remember learning a lot.
 1. What did your teacher do?
 2. Why do you think you learned a lot that day?
 3. Have other teachers or classes done similar things?
2. What is usually the hardest part about science classes for you?
 1. What makes that hard?
 2. What do you think would make it easier?
3. How do you think your dis/ability affects how well you do in science?
 1. Do you think your dis/ability affects your science performance differently than other classes?
4. What do you want teachers to do in classes to help you learn?
 1. What things have helped you before?

APPENDIX D

SCIENCE LEARNING STAFF SURVEY

Science Learning Staff Survey Questions

The following statement will accompany this survey: This survey is voluntary. The answers to your survey will not be shared with any identifying information. Kari Roll will be the only person with access to the identifying information and will only use it to identify potential staff to interview in more depth. The additional interview would also be completely voluntary.

1. Are you considered a special education teacher or a general education teacher?
2. What grades and subjects do you teach or co-teach?
3. If you are a general education teacher, have you or do you co-teach with a special education teacher?
4. If you answered “yes” to question number 3, what classes have you co-taught?
5. If you answered “yes” to question number 3, how many years have you co-taught?
6. What are strategies you implement to help students with learning or cognitive dis/abilities?
7. What are things you try to do in your classes to support students with learning or cognitive dis/abilities?
8. Are there strategies or methods to help students with learning or cognitive dis/abilities that you’ve learned about, and you’d like to try? If so, what strategies or methods?

For the following questions please circle the answer that best matches how you feel.

9. Strategies to teach students with learning or cognitive dis/abilities are the same across curricular areas.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

10. Strategies to teach students with learning or cognitive dis/abilities are easy to identify or learn about.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

11. Strategies to teach students with learning or cognitive dis/abilities are easy to implement.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

12. I feel like I do enough to support my students with learning or cognitive dis/abilities.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

13. I am confident I know what are considered best practices for teaching students with learning or cognitive dis/abilities.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

14. I have enough resources to implement best practices for teaching students with learning or cognitive dis/abilities.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

15. I have enough time to implement best practices for teaching students with learning or cognitive dis/abilities.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

16. I have enough support from other teachers to implement best practices for teaching students with learning or cognitive dis/abilities.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

17. I have enough support from administration and other personnel to implement best practices for teaching students with learning or cognitive dis/abilities.

Strongly Agree Agree Unsure Disagree Strongly Disagree

Comments:

APPENDIX E

STAFF INTERVIEW QUESTIONS

Staff Interview Questions

1. Describe a favorite lesson you've taught or witnessed.
 1. What was so special?
 2. What did you notice about the students?
 3. How did it impact the class going forward?
2. What methods or ideologies do you see working best for all students, but especially students with dis/abilities?
 1. Does one method work for all?
 2. What combination of methods might be best?
3. Describe the ideal lesson or activity for reaching all students, what would that look like?
 1. How could one lesson engage students struggling with the content and those who find it easy?
 2. What major characteristics do you imagine in this classroom?
4. What are barriers for teachers doing the best for SPED kids?
 1. What are some limitations within teachers' time or their own classroom?
 - a. What are some limitations on a building level?
 - a. On a district level?
 - a. State level?
 - a. National level?