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HOW CAN MIDDLE SCHOOL SCIENCE TEACHERS DIFFERENTIATE INSTRUCTION TO SUPPORT ALL LEARNERS IN AN INCLUSIVE CLASSROOM?

Jacqueline Barker

HOW CAN MIDDLE SCHOOL SCIENCE TEACHERS DIFFERENTIATE INSTRUCTION TO SUPPORT ALL LEARNERS IN AN INCLUSIVE CLASSROOM?

By Jacqueline L. Barker

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Capstone Project Facilitator: Melissa Erickson
Content Expert: Cathryn Peterson

This capstone is dedicated to the students who have graced my classroom with their presence. You have allowed me to grow alongside you. Each day you reminded me that teachers are never done learning. Every single one of you fueled my desire to be the best teacher I can be; you deserve it.

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The research question addressed in this capstone was, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom?* Research was compiled in regards to the composition of an inclusive classroom, the mindset of teachers, differentiation as a philosophy, and differentiation as a means to modifying instruction. The information obtained was utilized for a culminating project in the form of curriculum for an eighth grade science classroom. The curriculum was envisioned for use in a public middle school science classroom with 1:1 technology access, but the strategies and philosophies would be helpful in many other content areas and settings. A unit outline with differentiated learning activities was created utilizing the *Understanding by Design* framework (Wiggins & McTighe, 2005), as well as inspired by *Integrating Differentiated Instruction and Understanding by Design* (Tomlinson & McTighe, 2006). Ultimately, this project created a path for teachers to follow as they navigate how to differentiate their lessons to allow all of their learners to reach success.

CHAPTER ONE

Introduction

Introduction

"We can all do science!" You will hear me say iterations of this phrase daily in my eighth grade science classroom. To me, every student is a scientist just waiting to be discovered. Within a day's lesson there are moments of complete engagement by all students, but moments later I lose the high fliers or the low level readers. I frequently wonder how I can keep a high level of engagement and confidence within my students throughout each class period on a daily basis. I often find myself at a loss, yet find myself driven to find a way. I strive to determine how to support all learners within my inclusive classroom. This leads me to question, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom*?

In Chapter One, I will proceed by providing a background of my current motivation as a teacher, description of my placement within public schools, and insight on my future goals within the realm of daily differentiation for middle school science students. I will also lay the foundation for the remainder of my capstone project.

Teacher Behind the Goggles

As long as I can remember I have always had an insatiable need to understand and care for living things. In school, if given the opportunity to write a report, it would usually revolve around a biological topic, whether it be a goldfish or the Florida manatee. At home, during the day, I thrived on time in the garden growing plants with my mom and Papa, and at days end, I was fascinated by discovering the night sky with my

telescope. During highschool I was adamant that becoming a nurse was my calling, as my love for science and a need to help those around me had blossomed. Unfortunately, I would later find out that despite all my hopes, my stomach would not allow me much leeway in terms of watching and engaging in medical procedures. In hindsight, my reflexes were a blessing in disguise.

My love of science and the quest to learn more about living things remained, so I continued with science coursework and followed my curiosity into the realm of marine biology. I pursued the many opportunities that came my way, from volunteering as an educator for marine animals at an aquarium to educating visitors in a renowned zoo. During these interactions with park visitors, I was able to spark an intrigue in others through a simple conversation. I could provide them with a moment of science fascination, just the same as it did for me. Some days it was a curious first grader questioning why the elephants swayed to the music and some days it was intimate conversations with adults regarding their role in conserving natural resources and protecting wildlife. I held each interaction dear to my heart. These experiences culminated in an eye opening moment; I had found my calling. At my core, I was an educator.

In that pivotal teenage moment of deciding my career path, my memory failed me. I had somehow forgotten vital career developing moments. While I did love the curiosities of science as a youth, I had forgotten how frequently I played the role of a teacher. One of my fondest memories from highschool was being a teacher's assistant for my science teacher. Let me clarify, I was the type of student who needed to study and

participate and work very hard to learn content and in return I earned the grades I deserved. With that in mind, I fell in love with science through the simplest of tasks. I was trusted to mix solutions, even if as simple as a NaCl solution (salt water), I still felt pride in the trust my teacher placed in me. To do this day, I still smile with that same pride when I put on my safety goggles and pick up an erlenmeyer flask. Thinking farther back, my childhood memories are laced with play sessions where I acted as the teacher and prepared lessons for my friends and siblings. I persistently hand-wrote worksheets, dedicated to teach my so-called-students and push them to success. Teaching was in my blood before I could even recognize its role in my life. I will now fast forward and describe my current oasis, my science classroom.

Fast Forward

Decked out in ocean blue and sea turtle decor, my classroom welcomes roughly 140 middle school students seeking direction and engagement every day. I feel fortunate to have the opportunity to spark fascination within them and invoke their questioning of science phenomena Even though those zoo visitors of my past experiences were replaced with adolescent students, the core concepts of our interactions remain the same. As an educator, regardless of who participates in the conversation, the goal is always to teach about the world around us and to help others gain an understanding and appreciation for its complexity. Students in my classroom are coming into the course with a wide range of scientific mindsets and knowledge. Some of these students are planning their route to NASA careers, while some of them question why science even matters! Some are driven

to constantly know more, asking strong critical thinking questions, while others are trying with all their might to keep up with the modified lesson resources I provide them.

I currently teach within one of two public middle schools within a district that serves roughly 8900 students located in a large suburb of a metropolitan city. According to the district's strategic plan, 100% of students will accomplish their personalized learning plan. Of their initiatives, this is the objective that I find the greatest desire to foster as a contribution to the district's community. As with many middle schools, students within the core classes include a mixed range of current achievement levels. The school district has recently removed tracked and leveled courses for middle school science, which means there are no longer intervention and enriched science courses for students who qualify or choose those levels. This means that the students who are continually receiving below passing grades and test scores are in the same classroom as the students who continually exceed the expectations. In addition to these students, the majority of students within the special education program are spending their core classes with their general education peers. With this new initiative, middle school science teachers find themselves challenged to design lessons for all students. In my few years of experience, lesson planning is an extremely difficult task for this reason. I refuse to take short cuts, and I can't let these students down.

No two days of lessons are the same in eighth grade science. One day, students might be working through an inquiry lab where they design a set-up to purify water from pop in an effort to apply their knowledge of the water cycle. On a different day, students might be writing reading summaries from scientific articles and graphing the data they

gathered. Regardless of the learning activity, there are always students who want to take the lesson one step further, as well as students who struggle to keep up with the basic information. While I utilize the usual accommodations and modifications for these students, such as guided notes, copies of work with hints, fewer written requirements, audio or lower lexile readings, comprehension check-ins, etc., these students still appear to struggle.

I frequently find myself having to adapt in the moment in order to support individual students. With approximately 30 students in each class, it becomes challenging to adapt, observe, process, and implement personalized accommodations for a student who is not having their needs met by that specific lesson. As a third year teacher, I have wondered if my inexperience has caused this hardship. However, in conversations with other teachers, I have found that no one has attained an expert level status in the realm of differentiating their lessons for students' mixed achievement levels. Everyone seems to be fending for themself and trying to get by. If the challenge is widespread, then why is the solution not well known yet? Can someone actually become an expert? Is there no way to ensure you teach to the individuals, rather than teaching to the middle? With those questions in mind, I set out to determine the best route for teachers to take as they attempt to support all of the learners in their classroom.

Make it Our Mission

This year, my middle school has decided to plan for a focus on literacy for students at all achievement levels. Due to a decrease in scores within the middle school's state standardized testing, all students in sixth and seventh grade will receive additional

literacy courses in their daily schedule. This state assessment is given to students each year and is designed to measure student progress toward state standards and state or federal requirements (Minnesota Department of Education (MDE), 2019). As the school is reviewing and revamping their means of supporting all learners, the educators were also tasked with looking at how they are supporting students within the walls of their classroom. One of the most impactful moments in this process for me occurred during a collaboration session where eighth grade science teachers came together to review the recipients of below-passing letter grades of either an F or D. Our administration had analyzed data for these students, and they found many overlapping cases of students who are in math and/or reading intervention courses who were also not passing their science class. This realization allowed us to look at the system as a whole. What can we intentionally start doing to assist these students? Under the leadership of our principal, we brainstormed lesson structures, assessment ideas, and creative engineering challenges; we thought critically about every aspect of our future lessons. We then implemented these detailed plans during a unit on natural resources. The results came as a pleasant surprise; many students found they loved the structure of our broken down unit with frequent check-ins and hands on design opportunities. However, there were still students who did not pass. That hit hard. How were we still not supporting these students despite the attempts to create more inquiry based lessons? After thorough reflection, my belief is that we still designed a one-size-fits-all lesson. Each day there was one plan, and it was implemented for all students. The only changes were the legally binding modification and accommodations for students with a 504 or Individualized Education Plan (IEP). After

such effort and creativity was used for that curriculum, it was surprising that it was still lacking. I strive to find the factor that was amiss.

Goal

As a new educator, I find myself flexible and willing to try anything. With that said, I have attempted many different activities and strategies within my classroom. Through experience, I believe that hands-on inquiry activities lead to the greatest engagement for middle school science students. However, that is limiting considering the other important aspects of science, such as questioning, recording, interpreting, and collaborating. The lessons regarding these other science procedures doesn't always guarantee high engagement and comprehension, which can be due to differences in learning styles or current achievement level of students. These lessons need to be designed in a way that allows more students to feel they can succeed in science. Through my classroom experience, I have found that one of my strongest strategies is simply individual conversations with students that need that extra support. These small intervention conversations are helpful, but it's unrealistic to be able to talk to every single student in a classroom for even a few minutes. There are not enough minutes in the class period. There has to be a solution, and I am motivated and determined to find what that route looks like.

In this project, I will create a solution designed for middle school science classrooms, but the research and application can extend into the realm of any inclusive classroom. Different teachers have different ways of providing daily instruction, whether it be whole class, small group, individual technology based, etc. I strive to determine the

essential components that help each lesson meet each student at their level and how this can be done in a realistic manner, such as in a public school classroom with 30+ students in a 45 minute class each day.

As a science teacher, I find it important to continually experiment with new teaching methods while analyzing the results and reflecting on the effectiveness of the lessons. This is stated best by Tomlinson & McTighe (2006), "to be an expert teacher is to continually seek a deeper understanding of the essence of a subject, to increasingly grasp its wisdom" (p.12). In my current eighth grade science classroom, I find the need to discover and grasp the best method of teaching to the individual students who walk through my classroom door. There are mixed achievement levels, ranging from students who can read at a first grade level to students who borrow my college level geology book to read it at their leisure. I find the current use of a one-size-fits-all lesson lacking in support for all learners. In alignment with my school striving to have all students succeed and for teachers to assist in meeting the strategic plan, I find it my role to do my best to help every student be a successful scientist.

Coming Up

In Chapter Two I will review the research that has been completed regarding inclusive classrooms and differentiated instruction. Given my personal motivation, I will also include research on the role a teacher plays in the success of differentiation in inclusive classrooms. Regarding differentiation, there will be a focus on instruction and discussion of research based strategies. In Chapter Three I will lay out the capstone project by describing the curriculum and the frameworks that built it. In Chapter Four I

will reflect on the curriculum creation process and the future implications for this capstone project. Ultimately, my goal is to designate the path for teachers to ensure success for all their middle school science learners.

CHAPTER TWO

Literature Review

Introduction

In an effort to develop professionally and support my students, I am striving to solve the question, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom*? During research, I found myself especially connected to this quote by Salend and Whittaker (2017), "Educators are challenged to teach students with a range of learning differences. If these differences are not addressed, they can hinder students' learning and educators' instructional effectiveness" (p.63). I am a strong educator, but the lack of meeting students at their individual levels leads me to feel inept at times. Likewise, my students are strong and smart, but when I don't meet their individual needs, that confidence in them waivers. This project is for them and their learning differences. These learning differences on surface through an increasingly diverse student population within contemporary classrooms (Tomlinson & Imbeau, 2010). Within these contemporary classrooms, Green (2011) states that it is common knowledge that differentiation is an effective tool, but many studies find that it is not widely utilized (Green, 2011; Maeng & Bell, 2015; Phelan, 2018; Ricketts, 2014). This is best stated by Tomlinson and Imbeau (2010), "in spite of daily evidence that one-size-fits-all instruction fails many, if not most, students, it is extraordinarily difficult for us to pull away from [it]" (p. 8). There is a plethora of information on how to differentiate, but there is a lack of educators who can successfully complete the task. In this chapter I reviewed the literature that exists in regards to

inclusive classrooms, the role that teacher's play in the success of inclusive classrooms, differentiation as a philosophy, as well as differentiation of instruction. Each topic has subtopics that follow; each of which are vital to fully understanding and implementing differentiation in an inclusive middle school science classroom.

Inclusive Classrooms

In order to solve the burning question for this capstone project, the makeup of an inclusive classroom needs to first be defined. According to Phelan (2018), an inclusive classroom is one that "guarantee[s] students with disabilities are meaningfully included in general education classrooms" (p. 110). Tomlinson (1995) refers to these classrooms as a heterogenous setting in which there are academically diverse students. Throughout this capstone, the opposite of inclusive classrooms will be referred to as homogeneous classrooms, which, according to Burris and Garrity (2008), are where students are grouped based on skill or prior achievement. Following this introduction there will be a breakdown of the typical classifications of students. There will also be research provided with the rationale, both positive and negative, behind inclusive classrooms. Last, but not least, the concept of equity in terms of inclusive classrooms will be discussed. It is within this section that a picture is painted of the classrooms that this capstone project is designed for.

Types of Learners in Inclusive Classrooms

Teachers often find patterns and commonalities in the students they teach. Tomlinson and McTighe (2006) paint a picture of these recurring patterns by stating:

> … some students will inevitably need support with reading… Some students will inevitably need additional work with vocabulary. Some students will work too slowly (for our preferences) and others too fast (for our plans). Some students will be significantly ahead of the others in knowledge, understanding, and skill… Some students will like word problems, and some will be terrified of them. (p. 95)

This section of the capstone will discuss the different classifications of students that can be found in an inclusive classroom.

There are many ways in which a learner may differ from their peers, such as their culture, race, language, ability, interests, preferences, home economics, and support system (Tomlinson & McTighe, 2006). While all of those differences play a role in our learner's lives, for the purpose of this project, I will focus on the *ability* portion of this statement and use the following classifications of students: general education, special education or mild disabilities, and gifted. This is similar to Tomlinson (1995), who succinctly emphasized the following groups of students in a heterogenous setting as gifted, struggling, or SPED (special education). According to Burris and Garrity (2008) more common language amongst teachers in describing their classrooms is *low* students, *advanced* students, *regular* students, and *overachievers* (p. 18). Information on each group of students and their needs within an inclusive classroom will be provided.

Moving forward in this capstone, the research provided is stated in line with the initiative by Burris and Garrity (2008) to alter the language around descriptions of students, such as changing the word *ability* to *achievement* with the rationale that, "achievement is a measurable construct that describes what a student knows at a given

point in time; ability implies an innate quality that cannot change and that limits success" (p.19). Chapman et al. (2001) expands on the misguided use of *ability* to describe a student's place and potential, especially when using their so-called *ability* to determine their level of differentiation required. This section will classify students into three general categories for the sake of organization, but the ability level of these students will not be referenced, as their classification is not a *self-fulfilling prophecy* (Chapman et al., 2001).

Special Education. Students who generally have a harder time learning than the majority of their peers are considered to have special educational needs (Frederickson & Cline, 2009). The needs of these students can vary drastically. Sometimes, these students with disabilities can visually appear as similar to their general education peers, however, they may have learning or behavioral needs that differ. (Brownell et al., 2012). Some students have special educational needs that are related to particular barriers such as autistic spectrum disorder (ASD), dyslexia, attention deficit/hyperactivity disorder (ADD/ADHD), or physical disabilities (Frederickson & Cline, 2009).

When it comes to information processing, Kaldenberg et al. (2011) explains that students with learning disabilities frequently get overwhelmed with "novel and complex science terminology", thus benefiting from a lesson emphasizing big ideas (p. 37). Within lessons, some aspects like writing and reading can be challenging for students with special educational needs. Barabasz (2018) describes how "writing from students with LD (learning disabilities) [is] all over the place and often lack[s] organization" (p. 95). Along with the hardships of writing, students with learning disabilities can often have a

gap in their reading level of approximately three grade levels below their peers (Skylar et al., 2007).

After determining the students with specific needs, it's time to look at how else you can support the students. A teacher studied by Barabasz (2018) highlighted, "it [is] important to avoid painting all [students with LD] with the same brushstroke" (p. 78). Some disabilities can be physical, in which their access to curriculum can be inhibited by having lower self-esteem, increased fatigue, poor fine motor skills, less independence, potential pain or physical complications, to name a few considerations (Peterson et al., 2001). All of these differences need to be taken into account when designing a learning environment suited to students' needs.

Another classification of students who have special educational needs are English Language Learners (ELL). These are students who are developing their ability to read, write, and/or speak English. Depending on where they are in the program, they may have limited access to the curriculum. Differentiation of content and support is required for these students (Frederickson & Cline, 2009).

Gifted. Students that show evidence of being more able, frequently don't fit into the current curriculum because rather than swimming with their general education peers, they can be thought of as floating with little effort or challenge required (Brien, 2001). These students may commonly be referenced using phrases such as *more able*, *talented*, or *high achiever* (Brien, 2001). While some schools may declare their own definitions or use of these words, for the purpose of this capstone the term gifted will be used to refer to any of the previously stated possible phrases.

A classroom suitable for gifted learners provides enrichment opportunities; it is the difference in quality of opportunities, not quantity or speed of access to curriculum (Hymer & Michel, 2002). Brien (2001) explains that an interesting, high quality curriculum for a gifted student requires starting with application level knowledge and then pushing those students to proceed to analyzing, evaluating, and developing new ideas. While these students may be gifted in terms of understanding, they still need instructional support. Gifted students may have advancements in their reasoning, ability to pick up knowledge quickly, and awareness of their preferred learning styles, these students still need training on how to learn effectively and how to think (Brien, 2001). It also can be challenging because gifted learners may not appear gifted; if they are not being challenged then they may produce discipline problems or lose interest in learning (George, 2005).

General Education. If a student succeeds with little to no modifications then they are considered general education (Brownell et al., 2012). The general education population do not have Individualized Education Plans (IEPs) and are not considered gifted. Surprisingly, it was highlighted by a teacher that, "The greatest challenges in the class are not the kids with IEPS, but are the kids who are low, not on an IEP…" (Barabasz, 2018, p. 94). Due to the general nature of their learning demands, there is minimal research regarding this middle-of-the-road learner classification.

As society changes through time, our student population also changes, which will require much thought towards the makeup of our heterogeneous classrooms (Frederickson & Cline, 2009). Regardless of the type of learner previously discussed, it is

important to remember that all students deserve access to strong curriculum, have a range of educational opportunities available to them, and be met with value and high expectations (Peterson et al., 2001). With the idea that an inclusive classroom is made up of infinitely different types of students, it is only fitting that teachers find an appropriate method to help them each succeed. Differentiation is the approach that sees the students for who they are; it focuses on individuality and the importance of each of them as unique learners (Tomlinson & Imbeau, 2010).

Rationale for Inclusive Classrooms

A classroom with a variety of students can be referred to as a heterogeneous classroom, or an inclusive classroom, and according to George (2005), these classrooms should be favored. Phelan (2018) researched how "inclusion of students with disabilities in the content area of science results in positive outcomes for students" (p. 109), and found that all students benefited from the sharing of highly qualified teachers, access to higher order thinking, potential for ability grouping, and opportunities to participate in hands on learning. Another positive outcome as highlighted by George (2005) is the limit of labels and stigmas regarding high or low achieving students in a heterogeneous setting. Similarly, Phelan (2018) found that inclusive classrooms benefitted students in their increased self-esteem, and both acceptance and value of diversity.

In regards to access to curriculum, inclusive classrooms have benefits for all learners. According to Burris and Garrity (2008) the curriculum gap presented by non-inclusive homogeneous classrooms leads to an achievement gap, therefore the avoidance of homogeneous classrooms means the avoidance of increasing the

achievement gap. Inclusive classrooms can be beneficial for all involved, as concluded by Morcom and MacCallum (2011), "all students benefited when the teacher… promoted full student participation in classroom activities…" (p. 1324). George (2005) emphasizes the importance of inclusive classrooms, stating that they allow:

> a learning environment that may be more consistent with our nation's democratic goals, where students who will one day work, worship, and live together can learn together today…[by]...provid[ing] a real-life laboratory for the development of important interpersonal and social knowledge, skills, and attitudes… (p. 186)

The idea of an inclusive classroom representing an inclusive society is a large undertaking. For this reason, the concept is broken down even further to look at how the inclusive classroom provides equitable learning for all students. There is motivation in knowing that an inclusive classroom is more equitable for all students and that teaching students in this environment can help close the achievement gap for students.

Push for Equity. At the core of a school's initiative to form inclusive classrooms, there is a desire to be equitable in learning opportunities for all students. Burris and Garrity (2008) believe in this push for equity within inclusive classrooms by explaining that public schools need to replicate the democratic society we live in, where all students should succeed, not just the academic elite. This connection between classrooms and the larger society is also made by Peterson et al. (2001) when they claim that, "inclusive societies are built by people who have had the opportunity to live and work in inclusive schools; where they have observed the challenges; where they might have had the

opportunity to be a part of some of the solutions…" (p. 411). The National Research Council (2012) claims that equitable practices are providing all students with a quality environment, access to teachers that support their learning and engagement, and rigorous standards applied to them.

Within these inclusive classrooms, equity is also established within the learning opportunities that are provided. Tomlinson and Imbeau (2014) highlight that using *batch processing* on a group of diverse learners should no longer be overlooked (p.4). The learners within an inclusive classroom vary on many levels, so they should not be treated as if they are the same. Peterson et al. (2001) breaks this down using the social model of disability to see how systems and environments accommodate an individual with disabilities; they claim it is a matter of civil rights (pp. 397-398). Within the lens of equity, a teacher can portray *respectful teaching*, as a means of providing high-quality and meaningful instruction to all students, regardless of their differences as learners (Tomlinson & McTighe, 2006). Despite the differences in learners outlined in this capstone's research, Tomlinson and McTighe (2006) clarify that the basic needs of a learner, and a human being, remain the same. Peterson et al. (2001) agrees with this statement by explicitly stating, "Inclusion is a basic human right" (p. 392).

Skepticism of Inclusive Classrooms

Foreshadowing to a future concept discussed in this chapter, educators find they are lacking training on effective inclusive classrooms. General education teachers are not always prepared and knowledgeable about special needs, as highlighted by a teacher who has practiced for 19 years stating that it wasn't until the past few years she gained a

deeper understanding of learning disabilities to support the accommodations she had already been providing (Scanlon & Baker, 2012). For many years this teacher wasn't able to completely support her students due to the lack of knowledge in a specific facet of inclusive classrooms; that facet being learning disabilities. Without teachers acknowledging and knowing how to adapt to the special education needs of students, those learners cannot benefit from an inclusive classroom (Brownell et al., 2012). The same can be said of gifted students who require extension and challenges to the general education curriculum; frequently these students are provided *more* work instead of the *different* work so they are not having their needs met (Brien, 2001).

Not only is teacher preparation an inhibitor of successful inclusive classrooms, but there is also skepticism when it comes to the students and their current achievement levels in those classrooms. A teacher in a study completed by Scanlon and Baker (2012) anticipated that special education students feel there is a stigma with the regular education students and thus were less likely to ask for the teacher's support. There may also be concern regarding the self-outlook and confidence that lower achieving students will have when they struggle with a more rigorous course (Burris & Garrity, 2008). Unfortunately many secondary courses place an emphasis on content coverage, which can lead to a lack of clarity and all students except for the highest achieving will become confused and unengaged (Wiggins & McTighe, 2005). When it comes to curriculum, most texts are leveled similarly to standardized tests to represent on-grade-level material, however, students who score below grade level on those tests will not be able to access the information in the text provided to the class (Northey, 2005). There is first-hand

documentation of this challenge when Barabasz (2018) found a special education teacher reflecting,

> I have a hard time with the fact that these kids have severe reading and writing learning disabilities and they're in a push-in science class, which is even harder than the literacy class. They're pulled out for literacy, and then in a push-in science… They're not expected to perform at that level in a reading class. How can they be expected to perform at that level in a science… class?" (p. 112)

Students with special educational (SPED) needs are not the only group of students who may experience hardships in inclusive classrooms. A concern regarding the inclusion of gifted learners in a heterogeneous classroom is the likelihood that they are overlooked due to their lack of discipline problems, high grades, and good class performance (George, 2005). There are also instances where accelerated learning is utilized to provide gifted learners with the next level of a subject before their general education peers, however, this is difficult because the student may memorize the facts very quickly without learning the important key ideas (Brien, 2001). As a result of an ineffective inclusive classroom, gifted learners may actually fail to learn and develop appropriate skills and instead focus on high grades and work completion (George, 2005).

There are also concerns regarding the reality of inclusive classrooms and their traditional set-up of one teacher with a group of students. Many teachers indicate that co-teaching or having special education professionals within the classroom is the most appropriate way to support students with disabilities in inclusive classrooms (Barabasz, 2018), however this is not always an option. Given these challenges and skepticisms of

inclusive classrooms, it is the responsibility of the teacher to find a way to ensure all students succeed.

Teacher's Role

The research reviewed for this capstone holds a common factor of teachers and their role. This section will describe the importance of the teacher's mindset on the success of their students. Phelan (2018) claims there is a correlation between teachers having positive attitudes about inclusion and the resulting positive environment that is created for the students. Peterson et al. (2001) claim that, "it is vital for teachers to have an open mind, a flexible approach, a belief in human rights, patience and a sense of humour if inclusion is to succeed" (p. 392). Tomlinson and McTighe (2006) also discuss the importance of teachers becoming risk-takers, accepting the uneasiness of leaving their comfort zone, and reflecting to make adjustments to reach ultimate success. This section will discuss how a teacher's mindset on inclusion and student success plays a role in an inclusive classroom and what may be inhibiting teachers in this process.

Belief in Change

The initiative to be inclusive and support all learners relies heavily on the outlook held by the teacher. Burris and Garrity (2008) emphasize deep reflections by teachers, as they believe the process of inclusion starts with hard conversations questioning the existing state of classrooms. Teachers need not only believe that inclusive classrooms can work, but they need to act in a way that exemplifies the behavior expected of the students in a way that encourages acceptance of diverse learners (Phelan, 2018). In addition, Burris and Garrity (2008) claim that it helps when teachers of heterogeneous classes not

only believe in the change, but also have an understanding of the disadvantages of homogeneous classes.

When it comes down to it, standards need to be met by all students, so teachers should welcome any strategy that allows students to be successful (Birnie, 2015), even if that strategy is changing the makeup of a classroom. According to Burris and Garrity (2008), in order to be effective, you need to first create a "culture in which teachers believe that students learn best in detracked classes" (p. 49). These detracked classes are the focus of this capstone. According to Tomlinson and Imbeau (2010) there are 6 beliefs that teachers must hold in order to be proficient at differentiating; the most profound of which claims that teaching revolves around maximizing each student's capacity to learn. Tomlinson and McTighe (2006) believe that, "far more students would be successful in school if we understood it to be our jobs to craft circumstances that lead to success rather than letting circumstance take its course" (p. 18). For this capstone, differentiation is being emphasized as the crafted opportunities teachers can provide for their students success.

Hardships Faced by Teachers

The research made it very clear, teachers have endless reasons to not implement differentiation. One common setback for teacher implementation of differentiation is proper training (Kelley, 2002; Phelan, 2018; Ricketts, 2014). Surprisingly, differentiation is often taught later in one's career. As Tomlinson and Imbeau (2010) state, "if teachers were required to enter their first classroom with the philosophical tenets of differentiation fully in tow, we would have no teachers" (p. 26). Unsurprisingly, a study completed by

Phelan (2018) included a teacher who announced they never received professional development on proper inclusion practices for their classroom. For those teachers without training and without a supportive approach by administration, educators, and parents, it feels as though you are alone in fighting a battle (Ricketts, 2014). Northey (2005) states that, "differentiation of instruction is easy for superintendents, parents, and principals to require, but hard for teachers to do, especially new teachers" (p. xi). Frequently administrators will lay out academic expectations, but provide minimal guidance and support towards curriculum (Burris and Garrity, 2008). Contrary to some other studies, in a study completed by Maeng and Bell (2015), all of the participants had participated in professional development on differentiation, however only one of the teachers was properly implementing the differentiation strategies they had learned. The question then follows, what setbacks are causing teachers to not be able to implement differentiation even if they were fortunate enough to receive training?

Some other common hardships faced by teachers who manage inclusive classrooms include limited paraprofessional support, no access to resources, and large class sizes (Phelan, 2018). This is in addition to other common excuses by teachers, such as the requirement to cover standards, one-size-fits-all standardized testing, limited planning time, and too many students (Tomlinson & Imbeau, 2010). Similarly, in a study conducted by Ricketts (2014), "there were five different types of barriers: lack of time, lack of support, lack of knowledge and training, lack of resources, and student behavioral issues" (p. 94). Many teachers express the constraints that time has on their ability to plan and implement a lesson adapted to each student's academic level (Green, 2011; Lunsford,

2017, Phelan, 2018; Ricketts, 2014; Tomlinson & Imbeau, 2010). As you can see, there are many day to day challenges that inclusive classrooms inflict upon teachers.

On a larger scale, one of the inhibitors of differentiation, according to Badgett (2015), is the lack of information on the correlation between differentiation and standardized test scores, which may motivate teachers. Teachers need to see the bigger picture. The reality of an important initiative, such as differentiation, is crucial to teachers, but without solving the barriers, how will teachers be able to support the learners in their inclusive classrooms? One key method of supporting learners that this project focuses on is differentiation. Differentiation is a philosophy change that is rooted in the teacher's belief that all students can succeed (Tomlinson & Imbeau, 2010). The following section will explain differentiation in detail.

Differentiation

According to George (2005), "differentiating instruction, the heterogeneous classroom, and public education, are… all essential and inextricably linked…" (p. 186). Differentiation is a student-focused approach, in which there is altering of instruction to meet all students' needs (Northey, 2005; Tomlinson & Imbeau, 2010). Tomlinson and McTighe (2006) describe differentiated instruction as "ensuring academic success for the full spectrum of learners" (p.2). According to Lunsford (2017), the learners will experience the following benefits from successful differentiation:

The low-level learners could find more success in the classroom. On-level learners will be challenged to work towards the next level and increase their skill

> level… The gifted learners will also see a positive impact as DI [differentiated instruction] will challenge them by providing enrichment activities. (p.84)

In a non-differentiated classroom, everything is done in the same way; same topic, same method, same timing (Tomlinson, 1995; Tomlinson & Imbeau, 2010). In this classroom, the teacher often narrows in on the student who responds to their teaching methods, and then the others are neglected and fall behind or become disengaged from learning (Northey, 2005). This traditional one-size-fits-all classroom was commonly teacher-centered and utilized whole-class instruction with just one lesson strategy (George, 2005). Arguably one of the more challenging aspects of differentiation is that it requires shifting the instruction from being teacher centered to having students at the center of the classroom (Green, 2011). George (2005) goes on to clarify that the methods used in homogeneous, tracked classrooms are not effective in heterogeneous, inclusive classrooms. Breaking that traditional mold requires training and education on what and how to change. This chapter will provide the ways in which an educator can shift to a more differentiated classroom.

While this section will describe how to differentiate, it will not be a list of lesson ideas or strategies. Rather, there will be an overview of how to plan and implement differentiation within a classroom. This decision was made due to the idea that strategies are not helpful if there is no basis on the principles behind them (Tomlinson & Imbeau, 2010). This capstone contains both broad information regarding classroom differentiation, as well as specific information for middle school science. Further

strategies on differentiation of instruction can be found within Chapter Three and the curriculum that was created in alignment with this capstone project.

Steps to Achieving Differentiation

Many teachers, both novice and experienced, still believe that differentiation involves separate lessons for each student (Birnie, 2015). That is not the case. The idea of not changing the lesson in a different way for every single student aligns with Tomlinson and McTighe (2006) when they state that "differentiation does not advocate *individualization*" (p.19). Another key factor in differentiated classrooms is that attention needs to be on the teacher-student relationships, the learning environment, and students' backgrounds (Tomlinson & McTighe, 2006). Ricketts (2014) believes the focus needs to be on allowing accomodations for individual needs, opportunity for students to demonstrate learning, assessment of their learning, and strategies for intervention if their needs were not met (Ricketts, 2014). This section will discuss how to both plan and implement differentiation.

Planning. In order to reach successful differentiation, it first needs to be determined where to start, and where to go from there. A successful starting point for teachers would be to collaborate with subject-alike colleagues to differentiate existing instructional activities (Maeng & Bell, 2015). While collaboration is helpful, Tomlinson and Imbeau (2010) believe that planning the differentiation pathways from the beginning is the best method to differentiation, rather than adding on to the lessons after they exist. Upon initiating the planning stage of differentiation, one of the first steps is to review any Individual Education Plans (IEPs) to ensure the proper accommodations and

modifications are made for those specific students (Ricketts, 2014). While these plans are important, it should be kept in mind that, "the list of accommodations generated via the IEP process… is not sacrosanct… in-class observation is the best way to determine which [accommodations] are needed" (Scanlon & Baker, 2012, p. 219).

In terms of planning curriculum, a common approach was to look at the content concepts and break them down. Northey (2005) describes a method to planning differentiated instruction is to start with a Three-Circle Audit, in which material is categorized as critical understanding, critical concepts, and familiar information. Wiggins and McTighe (2005) utilize a similar concept in prioritizing content, which involves a three circle approach to clarify if content is worthy of being familiar with, important to know, or a big idea (p. 71). A participant in a study by Lunsford (2017) utilized a similar approach which allowed students to show understanding on the basic knowledge and then spend additional time on the big ideas and high level knowledge. These critical understanding points are referred to as *big ideas* by Kaldenberg et al. (2011) and they are important in the support of students with learning disabilities. Conderman and Hedin (2017) also utilize these 3 levels depending on whether all, most, or some students should access the information regarding the same core concept. Overall, there is no one way to plan for differentiation; it is up to the teacher and the route they wish to take.

Implementing. When it comes to implementing the differentiated lessons, there are different ways to accomplish this. Rather than singling out students, some teachers in a study completed by Scanlon and Baker (2012) preferred to provide accommodations to all students regardless of what their special education diagnosis stated. The idea of

providing accommodations for all students is supported by Barabasz' study (2018) which shows that many students, both regular ed or special ed, encounter challenges with reading textbooks and need support with that task. The same can be said about providing enriching learning opportunities for all students regardless of their giftedness or talented classification (Hymer & Michel, 2002). Northey (2005) believes that when a teacher supports a student in becoming advocates for their learning needs, they will in turn learn how to accurately choose opportunities that are best suited for them as individuals. Lunsford (2017) found that, "students are more receptive to… trying to learn the information if they feel they have a say in how they go about doing that" (p. 59). The idea of making differentiation known to the entire class is also discussed by Tomlinson and Imbeau (2010) when they clarify that teachers do not need to be sneaky and quiet in providing those differentiation opportunities. Similarly, a study by Scanlon and Baker (2012) found that many teachers scaffolded instruction and provided accommodations for all students, thus allowing the students to choose whether to utilize them. In an extension of this concept beyond education, providing support and differentiating instruction for all students is similar to universal design in architecture, where a design may have an intended audience and actually have benefits beyond the intended purpose. An example of such would be a ramp on a sidewalk intended to assist those who use wheelchairs, but in turn it is useful for other purposes such as pushing strollers and riding bikes. (Tomlinson & McTighe, 2006) Overall, much of the research highlighted the benefit of providing differentiation to the class as a whole, allowing support for all students to reach success.

This section on differentiation, and the following section on instruction, are the root of the research that will allow a teacher to successfully solve, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom*?

Differentiation of Instruction

Differentiation in a classroom is all about providing a route to success for all students (Morgan, 2014). The route taken can either be changing a core task to be extended for gifted learners and supported for special education, or the second route is to change the approaches all learners can take to account for their many differences (Chapman et al., 2001). Research provided within this section will encompass both of these routes while emphasizing differentiation of instruction and the strategies used. It is important to note that the information here pertains to proactive measures taken in lesson planning rather than reactive interventions. The application of these subtopics can be applied to any secondary course, though the intended subject is middle school science, of which there is a separate section for instruction that applies solely to this content area.

Instruction. Instruction is the portion of class in which the content and learners are connected by the mechanism that the teacher has prepared (Tomlinson & Imbeau, 2010). There is both planning and improvising involved in instruction, so it requires the teacher to be responsive and flexible (Tomlinson & McTighe, 2006). With differentiated instruction, George (2005) claims that the teacher is adapting the strategies to ensure that "all students experience challenge, success, and satisfaction" (p. 189).

Some common instruction differentiation strategies, as outlined by Ricketts (2014) were: technology, individual attention, work centers, peer tutoring, alternate assignments at differing levels, and visual aids. Similarly, teachers in a study completed by Lunsford (2017) also utilized leveled reading and group work, however it was also mentioned that student choice tasks, and allowing self paced work were successful differentiation techniques. Of the many factors within a classroom, Tomlinson and McTighe (2006) state that teachers could potentially adapt the amount of time, space, resources, grouping, and instruction strategies.

Differentiating instruction can affect different quantities of students at a time, such as either the whole class, small group, or individuals. Scanlon and Baker (2012) drew attention to the demands of providing differentiation to the whole class, as it requires the teacher staying responsive and keeping the unique needs of all individuals in mind. When it comes to assisting students who need support beyond the whole class it should be kept in mind that, "providing individual attention allows teachers to more effectively focus on the needs of the students; however, it is a time consuming strategy" (Ricketts, 2014, p. 88). Northey (2005) recommends that individualized attention should only be utilized if less than four students from a class have differing needs than the majority. Tomlinson and McTighe (2006) believe that after procedures and regularity form within the classroom, it becomes more accessible for a teacher to make time for students who need assistance or opportunities to be supported outside of a large group. This does not necessarily mean the support comes in a one-to-one setting, especially if there are multiple students who need the same support. George (2005) highly emphasizes

the importance of students interacting with peers in flexible grouping arrangements as a means of differentiating to support peer tutoring. It is recommended by Northey (2005) that group work should be utilized in every unit at least once, and these groups should have at least three levels of difficulty. A participant studied by Ricketts (2014) utilized work centers with different modalities to allow learners to find the right fit for them. While small groups can be beneficial, there can also be challenges. One teacher found that groups of students don't initiate the discussions independently, so they need guidance by a teacher and then they can follow using that momentum (Barabasz, 2018). There is research to support all methods of providing differentiation. Whether differentiation occurs to the whole class, small group, or individually, it comes down to providing support at the learners' level.

Middle School Science

"A rich science education has the potential to… spark their desire to continue learning about science throughout their lives" (National Research Council, 2012, p. 28). One way of sparking this desire is by embedding creativity and joy into science, by utilizing exploring and thoughtful experiments (Brien, 2001). In science there is an emphasis to utilize inquiry activities, but given the different learners within inclusive classrooms, there is potential for students to uncover different meanings. Therefore teachers need to be prepared to guide students in constructing many meanings, rather than just one correct answer (Tomlinson & McTighe, 2006).

A benefit of science classes is that there are many opportunities for hands-on instruction, to which a teacher in Barabasz' (2018) study stated was important for

students with specific learning disabilities because it builds their confidence. Unfortunately some middle school students find themselves struggling when the teacher plans engaging activities with no clear purpose or goal regarding learning (Tomlinson & McTighe, 2006). This over abundance of activities in a lesson is actually a sin; Wiggins and McTighe (2005) describe this instance as being "hands-on without being minds-on" (p. 16). This leads to an unfortunate balance that middle level sciences need to find between hands on engagement and fun activities with no clear goal.

One of the hardships about science is that students' performances in other subjects, such as literacy and mathematics, actually affects their achievement in science, thus requiring them to be supported so they don't fall further behind (National Research Council, 2012). In terms of content, learning science vocabulary is a challenge considering few science terms are utilized in cross-curricular or real-world connections; students usually don't hear scientific words like mitosis or meiosis outside of the science classroom (Barabasz, 2018). Despite these hardships, it's crucial to remember that, "all individuals… can engage in and learn complex subject matter… when supportive conditions… are in place" (National Research Council, 2012, p. 280). In other words, we can all do science.

Conclusion

In an effort to determine the answer to, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom*, research was gathered on learners in inclusive classrooms, teacher's role in differentiation, differentiation as a philosophy, and specifically differentiation of instruction. Given the

research, this capstone will look at the differences between students who are considered general education, special education, and gifted. The focus of the research provided, and on the capstone project itself, is on the means of differentiating to take into account the differences in learners. As so eloquently stated by Tomlinson and McTighe (2006), "to pretend those differences do not matter in the teaching/learning process is to live an illusion" (p.16). An overarching theme to much of the existing research is the idea that differentiation is flexible and different for every teacher even within the same state, school, subject, and even grade (Kelley, 2002). Within this chapter, it has been highlighted that inclusive classrooms require a teacher to change their method of instruction in order to allow students to be successful. However, there were many setbacks that were defined and the reality of incorporating differentiation is at the forefront of this project.

In the following chapters I will provide an overview of the methods which were taken to solve the burning question of, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom?* This project produced an 8th grade science curriculum that is rooted in differentiation of instruction that teachers can follow given the hardships they face. The research and rationale behind the curriculum will be explained. I will also clarify the setting in which this curriculum was designed for. It is a curriculum rooted in the reality of an inclusive classroom and how to best differentiate for all learners.

CHAPTER THREE

Project Description

Introduction

In Chapter Three, a thorough explanation of the capstone project is provided. In this project, a curriculum was produced which aligns to the burning question of, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom*? As said by Rock et al. (2008), "differentiating instruction is not a passing fad; it is a revolution - a fundamentally different way to teach…" (p. 39). It is the way that I strive to teach. In an effort to become successful at differentiating, I have started with one unit out of the school year to focus on. This chapter will lay out the chosen methods of designing the curriculum, who would most benefit from this curriculum, and the rationale behind this specific product.

The goal of this capstone project was to create a curriculum outline with supporting descriptions that allows any middle school science teacher to plan a plate tectonics unit and help each of their students to reach success within it. Our classrooms do not deserve a one-size-fits all curriculum, so this capstone utilized the philosophy of differentiation to design instructional strategies that are adapted to all learners. The content covered by this curriculum was designed to address the eighth grade science standards set forth by Minnesota State Science Standards, 2009 edition. In designing the curriculum, methodologies such as Wiggins and McTighe (2005) *Understanding by Design* and Tomlinson and McTighe (2006) *Integrating Differentiated Instruction and*

Understanding by Design were both utilized to ensure the creation of a successful curriculum.

Project Description

The curriculum designed in this capstone project satisfied a science standard as set forth by Minnesota Department of Education (2009) within the Earth Structure and Processes Substrand. The standard states that students can "understand that the movement of tectonic plates results from interactions among the lithosphere, mantle, and core" (MDE, 2009, p. 35). This standard is further broken down into three benchmarks as follows:

- 8.3.1.1.1 states that students can recognize that Earth is composed of layers, and describe the properties of the layers, including the lithosphere, mantle and core.
- 8.3.1.1.2 states that students can correlate the distribution of ocean trenches, mid-ocean ridges and mountain ranges to volcanic and seismic activity.
- 8.3.1.1.3 states that students can recognize that major geological events, such as earthquakes, volcanic eruptions and mountain building, result from the slow movement of tectonic plates. (MDE, 2009, pp. 34-35)

I created a unit plan that will help all students be successful in learning about Earth's geologic features and the theory of plate tectonics. In sequence of content, this unit follows a unit on rock types and is followed by a unit on Earth's changing surface

and landform creation. Keeping in mind where the students had gone and where they would soon be going, was important to keep in mind while planning scaffolds.

The unit plan consists of a sequential order of learning tasks. Each learning task provides a description of both the teacher's and students' roles. The learning tasks are generic enough that a teacher could adapt this plan to fit their needs. When necessary, the learning task was broken down into levels of support for students. As described previously, this capstone focuses on the three main classifications of students as general education, special education, or gifted. The support for these learners is identified in the curriculum as either *supported* for special education (SPED) students, English Language Learners (ELL) or students who find themselves needing additional support with that topic, and *general* or *extension* for general education students and/or gifted students who are at base level with the content or wish to go above and beyond the level of understanding required. For example, as students break away into groups to work through demonstration stations, there is a *support* description for students that allows for additional guidance for them, as well as a *general/extension* description for students who choose to not receive support before or during the activity.

Curriculum Research and Design

For this project, I utilized two strong curriculum frameworks, one focused on differentiation and one on high-quality units. I referenced Tomlinson and McTighe (2006) to understand how differentiated instruction fits within the realm of curriculum design. I then referenced Wiggins and McTighe (2005) to ensure my design provided a high-quality curriculum. As stated by Tomlinson and McTighe (2006), the curriculum

frameworks of *Understanding by Design* and *Differentiated Instruction* are perfect pairs so that "young people develop power of mind as well as accumulate an information base" (p. 1). The combination of these two resources allowed me to utilize both a curriculum design model and an instructional design model that align with the same philosophy. While these two go hand-in-hand, they also were two separate planning stages so they will now be described in independent sections.

Curriculum Planning

For planning the curriculum, I utilized the *Understanding by Design* backwards design planning template (Wiggins & McTighe, 2005, p. 22). When following this template, planning is broken down into three stages: *stage one* is identifying desired results, *stage two* is determining acceptable evidence, and *stage three* is planning learning experiences and instruction (Tomlinson & McTighe, 2006, pp. 27-28). During *stage one*, I utilized the essential question for Next Generation Science Standard ESS2.B as determined by McTighe (2016) to be, "Why do the continents move, and what causes earthquakes and volcanoes?" From there, I determined the important concepts using Wiggins and McTighe's (2005) breakdown of content into three categories: *worthy of being familiar with*, *important to know*, and *big ideas* or *core tasks* (p. 71). The breakdown for this unit can be found in Appendix A. During *stage two*, I decided what evidence students would need to show to be considered appropriate understanding of the standards. Then, it was time for *stage three*, which was to design the learning tasks that facilitate student's experience with the content and assess their understanding. It is within *stage three* of Understanding by Design, that differentiated instruction plays a large role

(Tomlinson & McTighe, 2006); the following section will describe this process.

Differentiated Instruction Planning

The *Understanding by Design* framework provides a backwards planning process that allows a teacher to determine the evidence they need to observe from students, and then make modifications within that framework (Tomlinson & McTighe, 2006). In planning *stage three*, learning tasks that allowed for understanding of big ideas and core tasks were identified. While keeping the evidence identified in *stage two* in the forefront of my mind, potential differentiation strategies were planned to assist students in showing evidence of understanding. Differentiation strategies were planned for a variety of learning needs. These strategies were planned in advance, with room to be flexible in implementation dependent on student demand for that support when the time comes. In summary, production of the curriculum required immense variety and intentionally placed opportunities for students to be supported in the areas they needed. When creating the lesson plans, I had to keep in mind Tomlinson and McTighe's (2006) advice to aim for the high end of understanding, therefore I could provide challenges while also building in support so that more students could achieve a high level of success. The tiered learning activities throughout the unit allow students to work toward the same content goals, but at the difficulty level that fits their needs (Tomlinson & McTighe, 2006).

The curriculum identified in the unit plan shows a variation of strategies in an effort to address each of their needs (Tomlinson & McTighe, 2006) and provide an access point for all students within the classroom. For students who need support with reading, the curriculum utilizes partner readings, recorded read-alouds, and marking the text

activities (Tomlinson & McTighe, 2006). Some of the common supports that were embedded for students with challenges in their fine motor skills were reduced writing amounts, use of pre-prepared diagrams, teacher prepared photocopies of non-essential work, and cutting and pasting information in an organized manner (Peterson et al., 2001). For those students who have memory deficits due to learning disabilities, supports such as word banks or multiple choice options were utilized (Barabasz, 2018). In an effort to support the growth of gifted students, the curriculum embeds opportunities for students to look for sources of error, organizing information, working through logic and connections between material, identifying their own strengths and weaknesses, and emphasizing cooperative learning with peers (Brien, 2001). Many of these strategies were built into the curriculum for all students, because oftentimes my preference is to provide distinct support within small groups to work through their current level. These small group opportunities were identified within the unit plan so that it was scheduled and all students had a proper use of their time to avoid any classroom management challenges.

Setting, Audience, and Timeline

This project was completed with the ultimate destination of being put to use in 8th grade science courses in a public school. The school, located in a large suburb in Minnesota, has a demographic consisting of 79.6% White, 6.4% Hispanic/Latino, 5.5% two or more races, 4.2% Asian, 3.8% Black or African-American, 0.5% American Indian/Alaska native, and 0.1% Pacific Islander. Of key importance to the learner types discussed in this project, 0.9% of our students are English Language Learners (ELL) and 13.4% are Special Education (SPED). Within our school district, learners can expect to

be in an average class size of 28 students. (MDE, 2018) All students in this middle school have the opportunity to work with Chromebooks on a daily basis, as it is a 1:1 school. For this reason, the curriculum utilizes the Google for Education suite of products for nearly every lesson.

Projected enrollment in science courses at this middle school is 1186 students for the 2020-2021 school year; this is across grades 6 through 8. 391 of those students will be 8th grade scientists. Nearly all students take a science course, of which they are in for approximately 45 minutes every day for 175 days. For the 2019-2020 school year, there were 386 total 8th grade students within our middle school, of which only 3 of those students were in programming that did not include science instruction (K. Orbell, personal communication, May 28, 2020). Science classrooms are heterogeneous with students in all learner classifications, such as general education, special education, enriched, remedial, etc. For this reason, I found it critical that this capstone project produced a curriculum that serves each of these students in the way that they deserve.

The curriculum in this project was designed around the science topic of tectonic plates. This topic falls within the first part of a school year for logical sequencing of standards. This is a topic that generally is covered early on in Earth Science. For this reason, I have already taught this unit this school year and will not be able to implement the created curriculum until next year. However, I will be using my students from this school year to help envision the students who will be participating in this curriculum next year. My classes this year are largely representative of the diversity of learners that make up an inclusive classroom, so I feel it is appropriate that they inspire my future work with

all students who come after them.

Conclusion

From the research that I gathered through creating this curriculum, the quote that resonated most was by Tomlinson and McTighe (2006), it is a reminder that "learning happens *within* students, not *to* them" (p. 22). This brings me back to the firehose analogy that I've so frequently heard; rather than firehosing students with information, we need to help navigate them to the water. In this capstone project, I strived to create a curriculum that allowed all students to find success within their science course. Through the use of existing curriculum frameworks and research regarding the philosophy of differentiation, I created a unit plan that will help eighth grade students learn about tectonic plates. Despite the varying types of learners in the inclusive classrooms and the hardships faced by teachers, I wanted to break the barriers and highlight that we can indeed meet the students where they are and push them to excel. In Chapter Four I will look back on the capstone project that I have created and reflect on it's effectiveness in solving the burning question of, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom*?

CHAPTER FOUR

Reflection

Introduction

At the completion of this capstone project, I find myself inspired to continue the work that I started. I set out on this journey to determine, *how can middle school science teachers differentiate instruction to support all learners in an inclusive classroom*? With the guidance of *Understanding by Design* (Wiggins & McTighe, 2005) and *Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids* (Tomlinson & McTighe, 2006), I feel confident that I have achieved this goal.

In Chapter Four, I will describe some of the key learning outcomes of this capstone project, as well as refer back to some critical literature that I encountered in the process. As always, there are both implications and limitations to the creation of this project and its use; both of which will be described. This chapter will also contain some hopes and goals for this capstone and it's meaning to professionals beyond myself. Lastly, I will look ahead at potential research and wonderings that stem from this capstone. I am a science teacher that never stops questioning, so I know that this project is just the beginning.

Takeaways

I have been a teacher for three years now, so my teacher preparation courses were not that long ago in reality, but it feels like ages since I have been reminded of proper curriculum creation methods. Designating time to revisit the proper method of backwards designing curriculum was invaluable (Wiggins & McTighe, 2005). Overall, using this

process of backwards planning was uncomfortable at first. However, I found myself with more inspiration to implement the learning tasks knowing that each of those tasks were directly aligned to the learning goals. Creating this curriculum reminded me of the importance of "form follow[ing] function" (Wiggins & McTighe, 2005, p. 14), meaning each task and assessment is driven to show evidence of understanding that was designated as a learning goal. In my short time as a teacher I have already fallen into the trap of utilizing outdated lesson plans from past teachers and using assessments that are convenient and easy to grade. This capstone changed the way I look at those assessments and their purpose. Rather than using past lessons, I really enjoyed designing learning tasks that accomplished a goal, and then analyzing those tasks to determine how they could be altered to fit the differing needs of the learners. This capstone provided me the opportunity to analyze the opportunities I provide to learners and pushed me to be more intentional with the support I plan to provide to each of them.

As I created the curriculum, I would frequently look back on the scientists in my classroom from this last school year, and I would question whether the curriculum had access points for each of those students. Thinking of the barriers that those students faced, and then addressing them in my curriculum, will hopefully lead to an open door of opportunity for future scientists in my classroom.

Review of Literature

Through the research process, I discovered that I was not alone in the hardships I faced with meeting the needs of all of my learners. I took a deep dive into inclusive classrooms and their composition, as well as their benefits and challenges. I was

reminded of the importance of equitable inclusive classrooms, as they replicate a society where learners work and live in inclusive settings (Peterson et al., 2001). After building a foundation of knowledge on the learners, inclusive classrooms, and the role of the teacher, I focused on differentiation as a philosophy and the necessary steps to accomplish it. There were a few key pieces of literature that I found myself drawn to while researching: *Leading and Managing a Differentiated Classroom* (Tomlinson & Imbeau, 2010), *Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids* (Tomlinson & McTighe, 2006), and *Understanding by Design* (Wiggins & McTighe, 2005). These pieces of literature allowed me to connect the dots between a strong curriculum and high-quality instruction for all levels of learners. The research ultimately led me to analyze my current method of curriculum creation, as well as provided me with support to create instructional opportunities that were better suited to my students.

Implications

While this project was intended to help me navigate an inclusive classroom and the strategies needed to help students succeed, I realized there are further implications. The focus on inclusive classrooms draws attention to the use of inclusive classrooms within our school. Inclusive classrooms can be beneficial to all students, but without proper teacher training they can be unsuccessful (Kelley, 2002; Maeng & Bell, 2015; Northey, 2005; Phelan, 2018; Ricketts, 2014; Tomlinson & Imbeau, 2010). This project highlights that potential disconnect. Even if a school helps teachers learn strategies to help students with reading, writing, language, social-emotional needs, etc., those

strategies are not enough if the school doesn't take time to help put all those pieces together. The hardest part of an inclusive classroom for me was that I knew how to help each student, but I didn't know how to help each student in a different way at the same time. This is where teachers need help, otherwise they can't help their students. It is my hope that this project sheds light on this missing piece of teacher development.

Limitations

I feel I have created a curriculum outline that is widely applicable with few limitations. Similar to most subjects, the content overload and stress of state mandated testing and standards for science weighed heavily on the planning of lessons. Given these constraints, some teachers may not have time to complete all of the learning tasks provided in the curriculum outline. Given this potential limitation, each concept has multiple paths to provide evidence. So if needed, some learning tasks could be shortened or modified and students would still have experience with the content and have other opportunities to show their understanding of that concept.

There is also a potential limitation in the ability to use technology. The curriculum created for this capstone was intended for my current position within a 1:1 school where each student has a Chromebook. Therefore, the learning tasks in the curriculum utilizes the Google Suite for Education applications. With that said, the curriculum is simply an outline of the learning tasks. This means that a teacher could easily transfer the ideas and utilize hard copies of materials as compared to the digital versions that are described in the curriculum outline. The goal of my curriculum was to allow for flexibility and responsiveness by the teacher in order to meet both the teachers' and students' needs.

Benefits to the Profession

While not the intended purpose of this capstone, I do hope that this capstone makes its way to the administration and curriculum developers within schools. I find it unacceptable that teachers are not receiving professional development on inclusive classroom best practices and methods of differentiation. Now that I have completed my second year within the same school, I have decided it's time to take matters into my own hands and provide myself with the training I feel is necessary to help my students. I have realized that all I can control is my own teaching, so I will do everything I can to make my teaching the best it can be.

Along with altering my own teaching mindset and methods, I also anticipate this project benefiting colleagues around me. I will absolutely take the process of backwards curriculum planning using *Understanding by Design* (Wiggins & McTighe, 2005) and differentiation to the science department meetings. Anecdotal stories through the years have highlighted that I am not the only science teacher who feels they are inadequately meeting the needs of all their students. It is my hope that my fellow science teachers meet this idea with the growth mindset and the positive outlook that is so important (Burris & Garrity, 2008; Tomlinson & Imbeau, 2010). I also anticipate the concept of differentiation within inclusive classrooms reaching beyond my department. Educators walking through the challenges of their school day is a frequent occurrence in the hallway after the closing bell. Rather than agreeing with those teachers as I've previously done, I now have a foundation to provide advice or ask critical questions. There is no reason that

we all need to struggle; when one person grows, we should all grow. After all, this isn't about us, it's about the students.

Looking Ahead

The concept of differentiation had so many facets to discover, therefore my focus on instructional time caused other important components to be set aside. A potential project that builds off of this capstone could focus on assessments and feedback. The learning tasks I outlined are assessments in nature, but they were not expanded on in terms of being a checkpoint of knowledge that students gain feedback on and grow from (Tomlinson & McTighe, 2006). From the research I completed, I have gathered the necessary basics regarding assessments, but this is an avenue that I feel inspired to grow with in the future. There was also a large piece of the inclusive classroom puzzle that was left out of this capstone project, and that was classroom management. This is an area of education that I feel comfortable with, but nonetheless have room for improvement in. With that said, as I implement differentiation from here on out, I am expecting that there will be management opportunities that I hadn't previously experienced and will need to continue to learn best practices for.

Within the classroom, this capstone project will reach much farther than me as the teacher. Looking ahead, I see potential changes I will make visible to the students. I no longer want to keep my curriculum planning a secret. Moving forward, I plan to be transparent with students by giving them insight on the levels of learners in our classroom and explaining how I will help meet their needs. This will be done in an effort to give students the independence and the responsibility of choosing learning tasks best suited to

their needs. Student agency in their learning path will require strong classroom management, as mentioned previously.

Looking ahead, there are so many potentials that this capstone project has uncovered. There are potential research projects that I have found an inspiration for, such as assessment and feedback. There is also room for growth as a teacher in the realm of classroom management. This capstone project also highlighted the potential for students to play a more active role in advocating for their learning needs and my ability to provide those opportunities to all students.

Conclusion

In this capstone project I have discussed my experiences and my goals as an educator. I discussed my motivation to differentiate instruction within my science classroom in an effort to help all students see their potential as scientists. Research was provided in regards to inclusive classrooms, types of learners, the role of the teacher in inclusive classrooms, and differentiation as a means to student success. The reasonings and the skepticism of inclusive classrooms was provided, as well as hindrances on successful inclusion and differentiation within a classroom.

I find myself drawn to a statement made by George (2005), “differentiating instruction, difficult as it may be, is the choice for teachers who will not accept a classroom where growing numbers of students are increasingly less successful” (p. 190). The classroom he describes, is the classroom that compelled me to choose this capstone project. Join me in implementing differentiation for your students. Start small with 1 lesson a week, and don’t give up if it's difficult in the beginning; it will soon be second

nature (Ricketts, 2014). I find this work important, and find motivation in the fact that my students will be the ones negatively affected if I don't leave my comfort zone and learn to properly differentiate (Northey, 2005). At the end of the day, the hardships faced by teachers are not always guaranteed to be solved. That leads us to make a choice. Do we continue to treat our inclusive classrooms as if they consist of identical students, because we aren't up to the challenge of trying to meet their individual needs? Or do we accept that the waters will be rough, but the destination of success for each student will be worth the hardships faced by us, the teacher? I accept the challenge, because my scientists deserve my support.

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Appendix A

Content Priorities for Plate Tectonics Unit