

EDI 792: Master's Thesis

Differentiated Instruction: Its effect on proximal development

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Chapter 1: Introduction

Vygotsky's Zone of Proximal Development (ZPD) has been shown in research as a valuable tool towards assisting students with successful problem solving outcomes through student-to-student interaction, and through student and teacher interaction (Goos, Galbraith & Renshaw, 2002). However, it is not well known what instructional practices teachers use to integrate collaboration in the classroom so that all students can learn. In the paradigm shift between the National Council for Teachers of Mathematics (NCTM) *Standards* and the new Common Core State Standards (CCSS) teachers have been faced with the challenge of instructing mathematical literacy. How instructional practices can be used to scaffold mathematical literacy so that all students can learn, i.e. they all work within their ZPD, can be analyzed through differentiated instruction. This would best be investigated when considering the collaboration between a mathematics teacher and a literacy expert. Differentiated instruction used during cooperative learning exercises has been shown in research to scaffold adolescents learning of mathematics while they work within the ZPD (Goos, Galbraith & Renshaw, 2002).

It has been implied that many instructors teach and assess every student in the same way using the same material without paying attention to learner variance (Joseph, Thomas, Simonette, & Ramscook, 2013.) Along with the research, there are numerous theories that support the position that teachers should consciously adjust curriculum and instruction in response to student interests, readiness, and learning profile (Joseph, Thomas, Simonette, & Ramscook, 2013.) For example, Vygotsky suggests that teachers should teach within a student's zone of proximal development (ZPD) - the difference between what a student can do without guidance and what they can do with scaffolding

and cooperative learning support (Joseph, Thomas, Simonette, & Ramscook, 2013.) Studies show that understanding student learning preferences may help students receive and /or process information more successfully (Joseph, Thomas, Simonette, & Ramscook, 2013.) If we can understand how students demonstrate their IQ level we may be able to meet the specific learning needs more appropriately and bridge their learning gaps using ZPD. One way to accomplish this is to emphasize differentiated instruction not only as an instructional strategy, but rather as a critical teaching and learning philosophy. Classroom visions called for by current educational reforms efforts may pose great challenges for mathematics teachers and the schools in which they work. Striving towards lessons that encourage tasks involving multiple representations as well as tasks that lend themselves to multiple solution strategies, and actively involving students in making conjectures, providing justifications and explanations, and drawing connections will address differentiated instruction in the classroom (Borko, Perssini, Romagnano, & Knuth , 2000).

The purpose of this research is to investigate how a mathematics teacher and a literacy expert co-teach to provide differentiated instruction in a general education setting within a heterogeneous classroom, i.e. instruction is tailored so that all students can work within their ZPD. Collaboration between a mathematics teacher and a literacy expert and how they differentiate instruction will be investigated through a case study. Creswell, Hanson, Clark, and Morales (2007) stated that case studies focus on a particular issue using an individual case, or one interviewee, with multiple artifacts that come together to provide a deep understanding of an issue. This research may also educate instructors on the benefits of differentiated instruction and explain what it means to have curriculum tailored to meet the needs of all students. Mathematics teachers are tasked with teaching so all

students can learn. The CCSS lays out a new set of expectations that are more cognitively demanding. Adopting these standards means that all, not just some, students should be on the pathway to college and career readiness (Common Core State Standards Initiative [CCSSI], 2010). With being expected to implement the CCSS and also use the method of differentiated instruction, one challenge that concerns teachers is the amount of time required for planning, organizing, and scheduling individuals and groups in larger classroom settings. However, with all of the new changes this is something that is already occurring in classrooms. Differentiated instruction will require investment and time, but the overall impact could be exceptional. A recent study conducted in 2013 measured the impact differentiated instruction had on student achievement. The study consisted of four hundred and thirty-four students in two education settings. Half of the student body experienced differentiated instruction while the other half was exposed to whole-class instructional approach. The results confirmed that students in differentiated instruction groups obtained higher grades than their counterparts in the traditional school setting, and also 90% of the students who were exposed to differentiated instruction stated their increased interest in the course (Joseph, Thomas, Simonette & Ramscook, 2013). Teachers may have the potential to revolutionize teaching and learning if the differentiated instructional approach is adopted more widely.

It has been well documented that the student population teachers are working with today is becoming more and more diverse (Santangelo, & Tomlinson, 2009). This diversity is related to race, ethnicity, gender, economic class, and nationality. There has also been a dramatic rise in enrollment amounts in students with disabilities which now comprises of 11.4% of the undergraduate population (Santangelo, & Tomlinson, 2009). From these

statistics, researchers have concluded that a student-centered learning atmosphere promotes learning, as where a teacher-centered environment inhibits learning (Santangelo, & Tomlinson, 2009). Santangelo and Tomlinson (2009) record the struggle one student faces while trying to process information:

I process information in a different way than it is taught or utilized...I learn to understand by putting [concepts] into my own language, not by memorizing and spitting out the words as I receive them. [The other students] were not attentively taking notes, computing problems along with the professor, or asking questions. Most appeared bored. ...I am not stimulated to think all this information through as I copy it into my notes. So, when a question or doubt arises in mind, I let it float on by... I insisted on studying to understand, not memorize and perform...I was weeded out...because the material never really captivated or stimulated me in ways that I am used to being stimulated (p. 307).

The above excerpt places the struggle of learning into perspective for a teacher. Just because a student is copying down key information and appropriate notes does not mean that the student understands the information being taught. The student above also mentions that even though she experiences doubts and has questions in her mind, they are not voiced. This is where differentiated instruction can really benefit mathematics education. For example, it can help expose student challenges perhaps through smaller group instruction where the teacher has time to pause and check in with students for clarification. Students may also feel more comfortable asking questions that they may have been afraid to ask in front of the whole class.

Aside from different learning styles, students also have different interests, experiences, and goals in life. Studies have shown that students strongly endorsed class-based activities and course assignments where tasks and topics were offered on a variety basis and students were able to select the assignment that worked best for them (Santangelo, & Tomlinson, 2009). For example one student explained:

My previous experiences stressed conformity as opposed to individuality. I feel that I learn best when I am able to freely explore alternatives and find answers on my own. By being able to do this, it allowed me to derive personal meaning from the material that I was studying and further explore information that would readily apply to my future.

With this type of feedback from students, teachers might be able to eliminate the dreaded questions “Why do I need to know this?” or “I’m never going to use this in real life” from student vocabulary. If students are learning the common core curriculum in a way that allows them to relate to their personal interests they may be more likely to retain the information. This may also cause students to become more prepared for life after high-school and also cause an increase in the number of students who seek postsecondary education.

As a result of this study teacher awareness may increase the impact differentiated instruction has on a single classroom. Differentiation, fully understood, is concerned with developing not only content mastery, but also student efficacy and ownership of learning (Tomlinson, 2008, p. 30). This is directly linked to the significance of teaching and learning mathematics at the adolescent level. Teachers who demonstrate this effectively are helping

students form their identity as learners. Educating our teachers can be just as important as educating our students because this way teachers are more likely to be able to relate to their students needs and present material in a reform-minded manner (Tomlinson et al., 2003). It is a reasonable hypothesis that due to the degree of academic diversity, differentiated instruction is something teachers can no longer ignore (Tomlinson et al., 2003).

According to Tomlinson and McTighe, differentiated teaching means a teacher is as attuned to students' varied learning needs as to the requirements of the required curriculum (Tomlinson, C., & McTighe, J., 2006). There are several reasons as to why this research is significant to the teaching and learning of mathematics. First, attending to the learning environment builds a context for learning (Tomlinson, & McTighe, 2006). Success and failure is a part of human growth and if a climate is established in the classroom that provides consistent partnership where students feel affirmation, a sense of contribution, accomplishment, and shared responsibility for the welfare of the group, teachers are going to see much more energy in their learning (Tomlinson, & McTighe, 2006). Second, differentiated instruction may provide a way for teachers to attend to students' backgrounds and needs (Tomlinson, & McTighe, 2006). This may help build bridges that connect learners and important content. These connections help students see why the content is relevant in their life and this helps promote engagement within the classroom (Tomlinson, & McTighe, 2006). Third, attending to student readiness promotes academic growth (Tomlinson, & McTighe, 2006). When a student is asked to complete a task that is a little too difficult for them, a proper support system needs to be in place to help those students work through those challenges. Student readiness to learn certain skills and ideas

will vary, but it is the responsibility of the teacher to make appropriate adjustments to enable consistent academic growth for each learner (Tomlinson, & McTighe, 2006). This also ties into the Zone of Proximal development because a teacher should be able to gauge how much work a student is able to do independently before needing assistance (Tomlinson, & McTighe, 2006). Fourth, attending to student interest enlists student motivation. It is very common to see learners drawn to and willing to invest in ideas that are of interest to them. It is important for the teacher to show students how important ideas and skills connect to their interests. This is because you may find that the students are far more eager and willing to learn than if they found content and skill to be remote from their interests. Last, attending to student learning profiles enables efficiency of learning (Tomlinson, & McTighe, 2006). In other words, if you are asking students to complete a task you know is going to be challenging to them, it is sensible to allow students to work in ways that best suit them. This allows students to work in a preferred learning mode and this also promotes discovery learning, which is essential to the modeling portion of the common core standards.

Teacher awareness of the need for differentiated instruction may be very different from the ability to actually implement such instruction. Part of the reason so many of us fall short with implementing these ideas is because we have very few models of how such classrooms would look and very little personal experience with the concept. We struggle with getting from where we are now to where we want to be. Tomlinson and McTighe (2006) present nine attributes that help teachers get from Point A, where they are now, to Point B, where they want to be. Some of these include establishment of clarity about curricular essentials, accepting responsibility for learner success, developing classroom

management routines that contribute to success, helping students become effective partners in their own success, and expanding on instructional strategies. Our students are likely to be much stronger learners, the stronger we are as teachers in the attributes mentioned previously. Additionally, the quality of curriculum and instruction must be attended to in order to be an effective teacher (Tomlinson, & McTighe, 2006). Research shows that a “key premise of differentiation is that virtually all students should have access to a curriculum rich with the ideas and skills valued by experts in a field (Tomlinson & McTighe, p. 39, 2006). It is intended that this research serves as a way for teachers to find enough ways to teach and enough ways to support learning so that what they teach works for each individual who needs to learn the essential content.

Chapter 2: Literature Review

For decade's researchers, teachers, and principals have been studying ways in which current and future educators can capitalize on student success in the classroom. The teaching world we live in today presents many daily challenges in our classrooms. It would be impossible to count the number of decisions a teacher has to make last minute in order to positively run the classroom. Education is a growth process that will continue to change and improve as time goes on. It is important that schools and teachers work hard to provide comfortable communities of learning built solidly on high-quality curriculum and instruction. Developing prestigious and academically responsive classrooms is something that most teachers may strive to do in order to achieve excellence.

This excellence that all teachers strive towards is a product of differentiated instruction. According to Rick Wormeli (2005):

Differentiated instruction is doing what's fair and developmentally appropriate for students. It's a collection of best practices strategically employed to maximize students' learning at every turn; including giving them the tools to handle anything that is undifferentiated. It requires us to do different things, for different students some, or a lot, of the time. It's whatever works to advance the student. It's highly effective teaching (p. 1).

The state and federal governments have already established the standards that teachers must follow, but it is how they teach those goals that may require a different path. The content must be taught based on student strengths, needs, and learning styles which will help students become focused, motivated, and independent learners. Something

important to consider is that teachers who intend to implement differentiated instruction in their classrooms must have clear learning goals that are rooted in the content standards but crafted to ensure student engagement and understanding (Tomlinson, 2008). Differentiation may cause teachers to go beyond the question, “How can I make sure my student masters this body of information?” to thinking about the real question, which is, “How can I help create a real learner?” (Tomlinson, 2008).

Students Take Charge of Their Own Learning

The task at hand is not an easy one, but the first step in achieving a differentiated instruction approach is to get to know your students. As an educator, it is virtually impossible to make content relevant for learners that you don't know. For many students academic failure may be a result of poor connection with the teacher. This is something that educators may not stop and think about because the amount of content that must be covered over the course of ten months weighs heavily, but really if the time is taken in the beginning of the year to invest in the students, the results at the end of the year are unparalleled. Carol Ann Tomlinson (2008), presents four ways in which teachers can help students take charge of their own learning. The first is building trust. When a student believes that a teacher sees them as having worth, believes in their capacity to succeed, and has their best interests at heart, then this kind of trust will lead to a partnership of striving for excellence. A few small positive exchanges with students that may only take a minute or two each day enable teachers to optimistically support their students. When people around us are pulling for us, we persevere (p. 28). The second element is ensuring fit. This allows for students to take ownership of their learning because the teacher takes the time to

ensure the learning fits the student. A student's willingness to persist in the face of difficulty diminishes if the task is too difficult or not challenging enough. Ensuring fit may be done by using small-group instruction, reading partners, text at varied reading levels, learning contracts, personalized workshops, independent studies, varied homework assignments, etc. (p. 29). The third element is strengthening voice. If students are unable to express their ideas, emotions, confusion, and ignorance then education does not have a chance to happen. Teachers need to honor the student voice by affirmation, encouragement, mentoring, and responding with honesty. Because differentiated instruction enables teachers to individualize so they can better respond to student needs, it provides a nurturing environment for student voice to grow (p. 29). The last element is developing awareness. Academic success is built on academic awareness. Instead of giving points for completed work, focus on communicating the quality of the work that was completed by handing out rubrics to show which areas those points were awarded. The students should be able to keep track of their own skill development, feedback, and grades. By demonstrating and communicating the skills necessary in order to complete an assignment, students will be put in a position where they may be successful. This may allow students to control their working conditions where they are aware of the skills they possess in order to complete the task presented. The goal of these four elements: building trust, ensuring fit, strengthening voice, and developing awareness, is to help students participate in the formation of their own identity as learners.

Classroom Norms

Another way to achieve differentiated instruction is by considering classroom norms. This can help teachers develop student efficacy in their class by structuring and fostering integrating curriculum and attitudes about learning that allow students to interact positively and pro-socially. The more students have the ability to know own another, and develop friendships as well as work towards a common goal, the more efficient the norms will be accepted and utilized. Julie-Ann Edwards (2007), she defines this classroom norm as social skills which are typically developed within friendships. Students need to have the ability to conform, cooperate, take risks, develop communication skills, resolve conflicts and many other things that will allow students to recognize the relationship of their own perspective to that of another. It will be realized that others are also aware of their perspectives and students will gain an even more developed social awareness of considering others. Social awareness will allow students to bond through shared experiences, as well as develop a higher respect for the multi-cultural experience of their peers and adults around them. It will challenge the ideas presented as well as accept ideas varied from their own (Edwards, 2007). By knowing your students and seeing the interaction among them through their friendships, you will be able to group the students in a way that will make them productive and will allow them to use each others' strengths and weaknesses. The familiarity of friends in the context of mathematics groupings is a mechanism by which tensions relating to mathematics are more easily addressed (p. 8). This also shows that the more students enjoy spending time in class developing their ideas the more they will be likely to enjoy the subject and their time in class. Students who have social difficulties may need more mentoring and guidance to develop skills for accepting

norms as a part of conducting class and as part of their behavior but to some level changes to these abilities are also fostered by the classroom as well as the overarching culture of the program.

Zone of Proximal Development

Lev Vygotsky developed the theory of *the Zone of Proximal Development* (ZPD) which is defined as “the distance between what a learner can demonstrate without assistance and what the learner can do with assistance” (McLeod, 2010). This idea views interaction with peers as an effective way of developing skills and strategies and focuses on teachers assessing intelligence by understanding student learning preferences because this may lead them to receiving and processing information more successfully. If teachers can understand their students’ intellectual capacities we may be able to meet the specific learning needs more appropriately and bridge their learning gaps by using ZPD (McLeod, 2010). Providing appropriate assistance will give students enough of a “boost” to achieve their goals. This may be implemented by modeling procedures, ideas, expectations, and solutions, which is also a means of differentiated instruction. When an activity is modeled this differs from the traditional approach to problem solving in at least two ways; the first being that students will need to use and interconnect mathematical concepts and operations. They may be able to make sense of the realistic situations that they need to mathematize. Second, in modeling activities, students will be able to generalize and extend their solutions because they will be encouraged to apply this to a range of similarly structured situations (Mousoulides, Christou, & Sriraman, 2008). The article states that “Communicating helped students to explain the solution of the problem, predict the behavior of similar problems, and to elaborate on and enrich their solution for more

complex problems” (p.9). The value of communicating to each other allows for different processes to self correct and to provide a justification and enhancement of learning for each participant. Often students without a clear answer will mull over the process until they are able to achieve a foundation, or may be influenced by others in interpreting the problems a different way. Communicating will also expose gaps and weaknesses students have in presenting their answer and provide a valuable assessment in itself. This assessment will allow teachers to determine what decisions need to be made about the curriculum and they will be able to adjust their instruction accordingly.

Differentiated Instruction

Carol Ann Tomlinson (1999), provided a way to look at two different classrooms and see the difference between differentiated instruction and just a traditional way of “doing school.” Mr. Appleton is teaching his kids about Rome. He has a very direct approach in which he lectures the class, has them read the chapter, and then has them answer questions at the end. He expects his students to take notes and he gives them a study guide so that they can know what to expect on their test. Mr. Appleton’s class is no example for a class that demonstrates differentiated instruction because he does not teach his lessons according to student differences. His lesson was teacher centered where students were expected to copy notes and do worksheets. They will most likely not retain the information he lectured (Tomlinson, 1999).

Next we take a look at Mrs. Baker’s classroom, where she is also teaching about Rome. She brings in pictures of art forms and architectures that were present in Rome during the time period they are studying. She also allows her students to watch movie clips, do word-search puzzles and choose one project out of ten different options. Mrs. Baker’s

classroom is an example of differentiated instruction because she is allowing students to be engaged in the lesson plan by creative and unique activities she has brainstormed (Tomlinson, 1999). This approach addresses learner variance by demonstrating flexible lesson planning. To make differentiation work, an alternative approach to instructional planning beyond “covering the text” will be required. For one lesson, a teacher had students indicate their learning preferences by responding to a questionnaire given at the beginning of the semester. Based on the responses the students would be placed into small groups of three or four in the following categories: verbal learners, visual learners, auditory learners, or kinesthetic learners. This turned out to be an excellent strategy with the exception of one or two isolated learners who were given the opportunity to join groups or work independently. The downside to this type of differentiation is that it is very time consuming and it requires very careful planning (Joseph, Thomas, Simonette, & Ramscook, 2013).

There are many signs that point to the need for teachers to develop the capacity to address differences in students’ readiness, interests, and learning preferences (Tomlinson, 2005). One being that the United States is no longer a nation in which we have a majority race and multiple minorities. Classrooms mirror the ethnic, cultural, and linguistic diversity of our melting-pot country and in order to be effective different background experiences and views of the world need to be embraced as things that effect a child’s learning. According to the U.S. Department of Education, about 96% of teachers have students in their classroom who have been identified with a learning disability (Tomlinson, 2005, p. 15). This results in an average of three to four students in each classroom with Individualized Education Plans (IEP). Similarly, most students who are identified as gifted

students spend most of their times in general education classrooms. Some students are being challenged too much and others not nearly enough. Students that fall into these categories require responsive instruction to develop their full potential (Tomlinson, 2005). Effective differentiated instruction is proactive rather than reactive. One-size-fits all lesson plans are thrown out the window and the teacher plans multiple routes for students to succeed, like in the above example with Mrs. Bakers classroom. Small, flexible learning groups are used for instruction with use of a variety of materials to address specific learner needs. These materials may include different ranges of reading material for students at different reading levels. Learner variance needs to be addressed by using flexible lesson pacing. Teachers should not assume that a good day of instruction will result in every student starting and ending a task in the same given day at the same time. Differentiated instruction is knowledge centered and learner-centered meaning that lessons are developed around what the teacher believes is essential in the study unit and teachers study learner traits to understand what each student brings to the task (Tomlinson, et al., 2003). This may be very challenging at times because teaching is a habit-bound profession. Part of managing a classroom means developing automatic classroom routines, especially to survive the early stages of becoming a teacher. While teachers may see the need to reach out to students who require more individualized instruction, the teachers may lack the skills to do so.

Challenges of Differentiated Instruction

Aside from lack of skill, there are numerous reasons as to why teachers fail to implement differentiated instruction. Many teachers hesitate to weave differentiated practices into their classroom methods because they believe that they lack time,

professional development resources, and administrative support (Carolan and Guinn, 2007, p.44). Many teachers are already burdened by their workload and they see this as another mandate they have to follow. Sometimes making these changes are way less dramatic than what teachers believe. For example, using a metaphor that matches a student's cognitive ability and personal interests is differentiating. Similarly, a teacher who is able to challenge a higher level thinker during a classroom discussion is also differentiating (Carolan and Guinn, 2007). For some lessons there may not be a lot of work associated with making differences in the learning community and most teachers already differentiate their instruction without even knowing they are doing it. When you know your students and they way in which they learn, it is hard not to direct your teaching style toward their strengths. For example, if a teacher knows his/her students he/she may be able to assemble pre-determined groups for students to work in for a particular lesson. Students could be grouped according to their personalities, strengths, weaknesses, and motivation so that time and instruction is not wasted. In one of the studies presented, teachers were able to observe how successful differentiators overcome common obstacles and seamlessly weave differentiation strategies into their practice while staying true to their personal style (Carolan and Guinn, 2007). For example, one of the teachers in the article *Differentiation: Lessons from master teachers* by Jennifer Carolan and Abigail Guinn, was introducing a math unit on probability to his class. He wrote a problem on the board, using the names of the students in the problem and then asked them to explain their thinking in words, diagrams, or arithmetic. The students had three different answers to choose from, and once they had chosen their answer and expressed it in one of the above forms, they had to go to the corner of the room in which their particular answer was represented. This then led to a

classroom debate on which answer is correct and why. The students were engaged, using evidence to prove a solution, and they were able to express their answers on paper and aloud. As each student presents the information on their solution, the whole class learns more about the topic in general (Joseph et al., 2013). This is a wonderful example of differentiating instruction and one of the best resources we can use to achieve this type of lesson planning, is by observing “master teachers” of this.

Overall differentiated instruction is something that requires time, strategy, and resources. Classroom instruction will offer a variety of learning options designed to tap into different readiness levels, interests, and learning profiles (Tomlinson, 1995). The teacher will use a variety of ways for students to explore curriculum content, a variety of sense-making activities or processes through which students can own information and ideas, and a variety of options through which students can demonstrate or exhibit what they have learned (Tomlinson, 1995). Contrary to teacher belief differentiated instruction does not cause students to be unprepared for standardized tests because if the goal is to master the content why does the way in which they do so matter? Differentiation does not equal individualization for every student. No one expects a teacher to take on that type of task and in some circumstances you may individualize a task for a specific student but that is up to the discretion of the teacher. Differentiation does not mean unbalanced workloads. For example if a student is a gifted reader then a teacher doesn't need to provide him with more books to read or else he will play dumb. The teacher can provide him with more challenging reading material but allow him to still read the same amount as everyone else. Lastly, another myth about differentiated instruction is that summative assessment leads to learning. Assessments are something that are done post-learning and the real

powerhouse is done in formative assessment when students are able to get regular feedback in timely manners that they can use (Wormeli, 2005). Contrary to other beliefs and myths, differentiated instruction has been proven as highly effective teaching and highly effective teaching leads to academic success and mastery of content material. Educators need to be thinking about what they are going to do to improve success for diversified learners in their classrooms.

Chapter 3: Method

This case study will investigate how two teachers worked together towards scaffolding differentiated instruction and how such instruction moved students along the continuum of learning. Differentiated instructional methods used during cooperative learning exercises have been shown in research to scaffold adolescents learning of mathematics while they work within the ZPD (Goos, Galbraith & Renshaw, 2002). Figure 1 shows how working in the ZPD with the support from someone more knowledgeable, which may be a student in a cooperative learning group or the teacher during whole class or small group instruction, can move students along the continuum of learning. Student performance data can show that students moved along the continuum of learning of the CCSS standards. Artifacts will include transcribed interviews with the mathematics teacher and the literacy expert, three lesson plans from a CCSS Algebra I unit on descriptive statistics from the mathematics teacher, three literacy support plans from the literacy expert and informal and formal assessments. All assessments analyzed will have students' names marked through so that no student identifiers will be present. The aforementioned artifacts will be analyzed through triangulation to better understand how a mathematics teacher and a literacy expert co-teach in a general education setting within a heterogeneous classroom, i.e. instruction is tailored so that all students can work within their ZPD.

The purpose of this research is to show that understanding student learning preferences may help students receive and /or process information more successfully. If we can understand how students demonstrate their intellectual

capacity we may be able to meet the specific learning needs more appropriately and bridge their learning gaps using the zone of proximal development (ZPD).

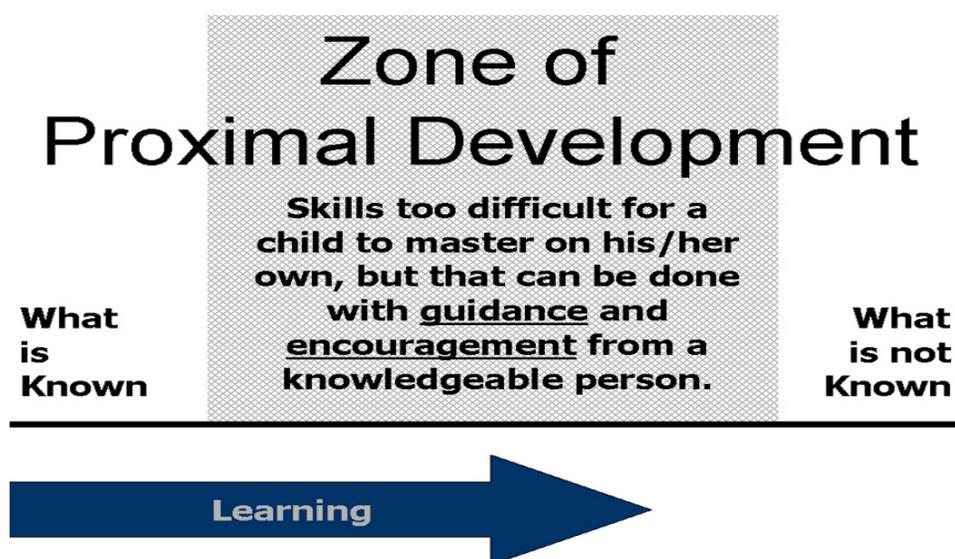


Figure 1: Zone of Proximal Development as related to the continuum of learning.

This qualitative research will help gain an in depth understanding of how differentiated instruction can impact a single classroom. All measures were taken to assure the identity of the participants is unknown. This case study provides the perspective of two 9th grade teachers; Kristen, which is a pseudonym to protect the identity of the participant, who is a general education Algebra teacher and Julia, also a pseudonym, a mathematical literacy expert. The students in this study attend a public school that consists of a diverse background of academic and family backgrounds. We will only be looking at the student performance on selected lesson plans for this study and the students will not be linked to this research in any way. Both the mathematics teacher and the literacy expert were chosen because they are experts in their field. There is no selection of students in this research since the main focus is on differentiated instruction used during co teaching. Data gathered from their students will be provided that includes one informal assessment

(homework) and one formal assessment (test). The assessments will not have the students' names on their work but they will be labeled as Student 1 HW, Student 1 Test, etc. All interviews were conducted at a high school in upstate New York and were transcribed. Open coding was used in the analysis of the interviews. All statements were considered as important; however, because the focus of this thesis is on how differentiated instruction can impact a single classroom, interview information that did not tie tightly to this topic was disregarded. The artifacts collected from this research allowed for a valid and deep understanding of a differentiated instruction approach in the classroom.

Positionality as the Researcher

The author who conducted this research was not currently teaching and thus chose to conduct research in a classroom where there were two experts working in a coteaching environment. The author believes that one of the best traits a teacher can have is to be a student oriented teacher. Student oriented teacher, in this research, means that the teacher alters his/her instruction based on the personalities and learning needs of their students. When teachers get to know their students on a personal level can create a positive and comfortable learning environment can develop which may allow for students to display their strengths and develop as learners. The role of the teacher is to create an environment in which students can learn on their own by guided reflection of their experiences. Giving students the opportunity to make individual choices gives students the chance to have control and take some responsibility in their learning. The more a student can take what they learn and use it in their everyday lifestyles, the more successful they will become.

Chapter 4: Results

Results gathered from the interview provided valuable insight on the effects of differentiated instruction in a single classroom. It was found that Kristen and Julia used numerous types of instructional strategies in their classroom that were used to engage all students. These strategies consist of repetition, guided notes, color coding/highlighting, frequent checking for understanding, visuals, TI-Nspire calculators and student participation. One strategy used in particular is called “Pair and Share” which Kristen describes:

Pair and Share is something Julia and I like to do to allow students to gather and share their thoughts on a particular assignment. Each student pairs with the student sitting next to them. For example, sometimes when students have completed a homework assignment, we allow them 5-10 minutes to ask their pair about one question they were excited about and/or something they struggled with in particular. We also like to implement this strategy after we have presented a new topic and given students several examples to work on independently. We then allow them to pair and share their findings.

Kristin and Julia found this strategy particularly helpful in the classroom and it also allows the students to become active for a few minutes and engage with their peers. Kristen also mentioned that this allowed her to walk around the room and observe the student interactions as well as monitor student understanding from listening to their conversations. Pair and Share is also beneficial because students get to interact with their

friends. According to Julie-Ann Edwards, there are many skills which are developed within friendships. Some of them include; taking risks, developing communication skills, developing negotiation skills and tact, resolving conflicts, and developing shared meanings for group interactions. These six skills are particularly relevant to the study of friendships in mathematics classrooms (Edwards, 2007). Julia then went on to further explain how she and Kristen engage students in the classroom,

Some strategies we have used are pulling small groups together either inside the classroom or moving to another classroom. At different times we are talking and/or working individually with a student while the other teacher is instructing the large group. We have used the Ti-Nspire navigator system to display what the students are doing on their calculator to quickly assess who needs help and to monitor their work.

The Ti-Nspire navigator system that is mentioned above allowed whatever the students had typed onto their calculator to project on a screen in front of the room. This was extremely helpful when students were expected to solve problems using the calculator alone for it provides the teacher with the opportunity to easily guide the student if he/she got stuck. Also, this kept students engaged and following along with the lesson, especially if they knew their work was being recorded and evaluated openly. This strategy allowed for accountability and ownership in the classroom.

Guarino (2005) states that tracking students by ability levels to address learner needs has not helped students achieve and has, in fact, resulted in lowered expectations for many students who could perform at a higher level if given appropriate opportunities to do

so (p.15). When asked, “What are some instructional practices that you have used to address the needs of students with different ethnic or cultural backgrounds relative to mathematical literacy?”, both responses from Julia and Kristen stated that the same literacy strategies were primarily used regardless of their ethnicity. The few ESOL students in the classroom are given individual attention to address learning gaps. Ethnicity and cultural differences can also result in stereotypes and bias’s to take place in a classroom. Julia mentioned that as a literacy expert, it is common for other teachers, she being guilty of this sometimes as well, to assume that low level kids cannot/will not be able to achieve what other students can. This may unintentionally influence classroom instruction. Kristen stated, “A bias may make you reluctant to push a student harder” and Julia stated “At times, teacher standards may not be high enough”. This is an extremely powerful statement and addresses one of the most common misconceptions about differentiated instruction. For example, if a teacher has a gifted student in his/her class it might seem reasonable to give that student more problems to work on incase he/she finishes early. Giving a student additional tasks may be considered punishment to that student and he/she will most likely learn to play dumb so that they are not getting additional work (Wormeli, 2005). This situation should instead be addressed by pushing that student and increasing the challenge in the problems you are asking him to do. He should be expected to do the same amount of problems but you could give him a challenging word problem that uses the same type of math, instead of having the equation already set up and ready to solve.

Kristen and Julia implemented several instructional methods in the classroom to tailor instruction to meet the needs for all students. In the beginning of class they would have “Bell Quizzes” where students would be asked to answer 2-3 questions based on the

homework they had completed the night before. This ensured that students had a task to complete the second they walked in the door, and therefore socialization with friends was minimized and productivity in the classroom could be maximized. The Bell Quizzes allowed Kristen and Julia to assess student recall and knowledge daily. Another strategy used in this classroom to design instruction so that it meets the needs of all students, is quiz/test corrections. Julia explained,

The point of an exam is to test what a student understood from the unit. If a student does poorly then this may cause them to fall behind in the succeeding unit. Test and quiz corrections allow students the opportunity to gain understanding from mistakes. They would only get half the number of points back for making corrections, but students are able to work through problems they struggled with and actually get the correct answer along with an explanation of why this is correct.

For this classroom specifically, students were exposed to working with a general education teacher and a literacy expert directly. Collaborating as a mathematics teacher and a literacy expert has allowed Kristen and Julia to support their students with learning the Common Core State Standards Content. This has permitted each of them to use their content strength to help students have specific procedures for answering questions. “The emphasis of breaking things down, solving problems multiple ways, and persevering are all necessary for our students to be successful” explained Kristen. She tries to stress the importance behind showing work when completing problems and students are rewarded when doing so. If the students continually practice the skills being taught to them, then Julia and Kristen are confident they will do their very best on the exam. Most students also meet

with Julia outside of the math classroom to strictly focus on literacy skills. Activities involve reading, grammar, and writing exercises. Since Julia is already familiar with the students, she is able to identify and reflect on their strengths and weaknesses, and focus more in depth on those specifics in her literacy classes. She incorporated the strategies implemented in these sessions into planning lessons with Kristen. Some of the strategies consist of pre teaching vocabulary, repeating and reviewing activities, and grouping students based on ability level.

Because of the constant collaboration in this classroom Julia and Kristen were able to identify the type of support needed for their students when teaching the CCSS relative to mathematical literacy. Their students seem to have a difficult time dissecting problems to get the actual math question that is being asked. Therefore, Kristen and Julia have their students use highlighting to extract information to help them understand problems. First, in the beginning of a problem, the variable is defined off to the side. The importance of vocabulary is stressed by highlighting terms in the notes and then at the end of each unit the students are tested on this vocabulary through a vocabulary quiz. Students are also asked to identify what the actual question is. This helped the teacher gauge the level of understanding and this really dissects and breaks apart the problem. They have also found that students do not like to spend a lot of time on one problem. Kristen and Julia are investing in their students, convincing them to persevere through each problem and not to give up if their first try doesn't work. This is monitored when students are given time at the end of the lesson to start some of their homework problems if there is time.

Kristen and Julia were very fortunate in that they had the autonomy to design instruction so that they could observe ways that students responded to co teaching differentiated instruction. Julia stated,

Students don't always appreciate the extra support they are receiving until the following year when that support isn't there. We have had many students return to say they wish they had two teachers again. Many return to say they learned how to stay organized with us.

When students walk into class they are expected to pick up their math binders from the side of the room. Each class has a separate crate where their binders are kept. By having students keep their binders in the classroom, it is guaranteed that they will always have the appropriate materials for class. The guided notes are essential for each lesson. Most of the students in the class are able to complete their homework in a math lab later during the day, or in a study hall which allows them to leave these supplies at school. For students who cannot complete the homework assignment in school, the homework and notes are posted online through the classroom website. This allows students and their parents to have access to school material whenever they need too, and also provides the students with accountability since their parents can log in at any time and see what their assignments are. What about students who don't have access to technology? They are able to clip out the notes from today's lesson and take that home with them. At the end of each unit, the students move their notes, tests, quizzes, and in class activities into a separate binder that contains each preceding unit. This way they are only dealing with one unit at a time in their

classroom binder. These are just a few ways routines and expectations can help increase organization in the classroom.

Co taught differentiated instruction also allowed students in class to be very receptive to calling over either Julia or Kristen to clarify a concept if they did not understand. The flexibility provided by having a general education teacher and a literacy expert in the classroom allowed for one teacher to float while the other was teaching. This allowed the students to open up more because there usually was always one teacher available. Students were also willing to stay 9th period for extra help because they knew there was a better chance they can have someone available to help them.

James Greeno (1998), conducted research on middle school mathematics through applications of project groups. He highlights several aspects of learning and teaching that are important. Representational forms, otherwise known as mathematical modeling, can be used in the class as a resource for collaborative sense-making and reasoning. Also, the variety of ways in which students participate in the practices of mathematical reasoning and discourse increases engagement and understanding of material. Julia claims that “students like being pulled into smaller groups for instruction because they realize they sometimes can accomplish more and understand the material more thoroughly.” One challenge this brings is that at first students may feel “dumb” because they are pulled aside to work on assignments separately, but they quickly learn to appreciate the small group instruction, sometimes even 1:1 instruction that they receive. This has caused many students to find success in math who have not experienced this before.

Analysis of Student Data

Unit 1 was taught on Descriptive Statistics. The entire unit was broken down into 16 different classroom lessons. Each lesson contained guided notes that were all combined into one unit packet. The guided notes packets allowed the students to concentrate on what was being presented, instead of worrying about copying down notes. Student data was obtained to measure the outcomes of three lessons selected throughout the unit.

The first lesson examined is on classifying data. Students were differentiated based on their learning style which resulted in the class being split into three different groups. Groups consisted of visual learners, auditory learners and kinesthetic learners. This type of differentiation encourages students to understand their own learning preferences (Tomlinson, 1995). There were about 8 students in each group. For the visual learners group, the students were given a worksheet based on the lesson to complete. The assignment consisted of charts and graphs and the students were confident enough to go through the worksheet together without receiving an explanation. The auditory group preferred to have the instructions explained to them instead of reading the directions on the assignment. Kristen provided direct instructions to this group of students and answered any questions they had out loud before having the students work on the assignment together. She was also responsible for floating around the room to assist with the visual learners groups as well. Julia pulled aside the kinesthetic learner group into a different classroom and worked through hands-on examples with the students. This provided opportunities for students to come up to the board and work through problems amongst themselves without being disruptive to their other classmates. Julia also had the

students bring colored highlighters with them and they were asked to highlight the different types of information they were given. The highlighting strategy is something most students were familiar with because it is a result of one of the mathematical literacy strategies implemented in the classroom.

At the end of the lesson students were asked to hand in the classroom activity for a grade. Data from one student in each group was obtained which resulted in the following; Student #1 (Visual) 76%, Student #2 (Auditory) 81%, and Student #3 (Kinesthetic) 89%. Results indicate that students work best when given the opportunity to become engaged in a lesson activity. These students were also given the opportunity to work apart from the rest of the class and they had the direct supervision and attention of a literacy expert. The highlighting strategy implemented by Julia proved to be successful in student understanding. Student #1 and Student #2 were in separate groups in the same classroom, and Kristen was able to float between groups, acting as a guide if questions aroused. Although results were not as high as Student #3, they were able to work within their Zone of Proximal Development (ZPD) for Kristen was able to measure how much the students could complete without her intervening. This shows that students retained over 75% of the information taught in the lesson while working within their ZPD. Differentiated instruction allowed for students to receive an increased amount of direct attention, which based on the results, they responded to successfully.

Data was also obtained from one of the review assignments in the Descriptive Statistics Unit. Kristen and Julia differentiated this lesson by splitting students up based on their ability levels. Five students were selected to work individually with Julia, and the rest

of the class was paired up by similar abilities. The students were provided a guide of where they could find information about each question. This guide gave specific instructions on where the information would be in their guided notes. For example, question 19 on the review packet aligned with question 19 on the review assignment guide. The guide states, "Use notes 1.1 (Don't forget to create a table in your calculator...it will help you find the mean and median)". This activity alone is something that Julia designed, incorporating mathematical literacy into the classroom, for students are now being held accountable for the notes they took throughout the unit in their guided notes packet. This provides engagement and the opportunity for Kristen to float around the room, available if questions aroused, while students relied on their classroom materials to persevere through the review packet.

Results from the Unit test, displayed in figure 1, show that the differentiated instruction unit design was highly effective. Students scored an average of 12% higher than students last year who took Integrated Algebra without strategies such as vocabulary integration, small group literacy instruction, highlighting strategies, grouping by ability, and many other ideas.

Overall, Kristen and Julia provided multiple opportunities for on-going assessment of student readiness and growth. They did not assume that all students need a given task or segment of study, but continuously assessed their students' readiness and interests, by providing support when students needed additional instruction and guidance, and by extending student exploration when indications are that a student or group of students is ready to move ahead. Flexible grouping is consistently used in a differentiated class

(Tomlinson, 1995). Students were given the opportunity to work in many patterns. Sometimes they were asked to work alone, sometimes in pairs, sometimes in groups. Tasks

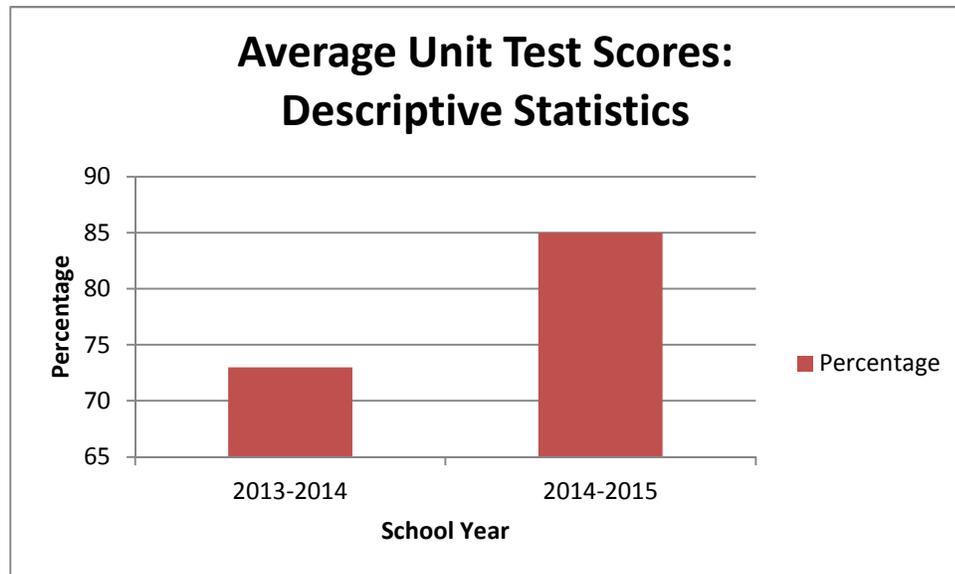


Figure 1

may be readiness-based, interest-based, constructed to match learning style, and sometimes a combination of all there. Whole group instruction is still used in a differentiated classroom especially when new ideas are introduced and in order to share learning outcomes. Kristen and Julia designed their classroom instruction so that their students could be active explorers and they were the guide to the exploration. This type of approach allowed this classroom to be a student-centered classroom where students were able to take more ownership of their learning, but it also facilitated the important adolescent learning goal of growing independence in thought, planning and evaluation.

Chapter 5: Discussion, Summary, Reflection

Overall it is important to keep in mind what research suggests is effective differentiation. This means instruction is proactive rather than reactive. Teachers can plan multiple routes for students to succeed rather than adapting to a one-size-fits-all lesson plan, especially when it becomes evident that the lessons are not working. It is important to use small, flexible learning groups for instruction. Teachers should plan to meet with various groupings of students based on a variety of needs throughout a learning cycle. Also, learner needs should be addressed by using a variety of materials. These materials may include a range of reading levels, or in Kristen and Julia's case providing students with the TI-Nspire calculators and guided notes. Learner variance should be addressed through flexible pacing. Teachers should not assume that a good day is one in which every student starts and finishes a task at the same time. Differentiated instruction is knowledge centered meaning lessons are based on the teachers clear understanding of what is essential in the study unit (Guarino, 2005, p. 16). The teacher is also responsible for helping each student build his or her own maps of understanding and skill encompassing the essentials. Finally, differentiated instruction is learner centered (Guarino, 2005, p. 16). It is so important that teachers systematically study learner traits to understand what each student brings to the task. Kristen and Julia were able to differentiate several activities based on student learning styles and abilities. This isn't something that you will know right away with your students, but it is important to get to know them personally as well as academically, so that you can address their individual needs as it pertains to the material. Sometimes having students fill out a "Getting to Know You" created worksheet on the first day of class can help you track what some of their learning preferences are. Of course students may not always be open

and honest with that they really need and in this case it is helpful to keep open communication with parents and guardians. The more support the students have the better. This may also allow teachers to see what support students need to succeed with the task.

Kristen and Julia have first ensured that clear learning goals guided their curricular decision making. They then used their related skills and specific content knowledge in mathematics and literacy to establish a curricular design that offered multiple ways for students to demonstrate what they know. Designing and facilitating multiple paths to reach defined learning goals is one of the hallmarks of successful differentiation (Carolan & Guinn, 2007, p. 45). Not only do Kristen and Julia know the landscape of their subject matter, but they also showed multiple ways to navigate it. Beyond possessing content knowledge, they understood how their learners come to know that subject, where their students might stumble, what preconceptions students might have, and how to match content with instructional method in a way that connects to different learning styles and levels.

As more school districts start supporting differentiated instruction, expert teachers within those districts are able to provide an invaluable resource for teacher learning. Being able to observe how real teachers practice differentiation can illuminate the complexity of addressing the needs of all students. Carolan and Guinn (2007) discuss two practical ways to integrate what we can learn from expert teachers who use differentiation in their classroom. First, pairing a novice teacher with an expert teacher in the same subject area may help enhance instruction. This mentoring relationship will allow the expert teachers to

reflect on their knowledge and think about their practice with fresh insight from a novice teacher. Julia, being a mathematical literacy expert, was able to adjust learning material to adhere to different student reading levels. Second, Carolan and Guinn (2007) declared that in order to master a strategy as complex as differentiation, teachers need concrete examples. Giving teachers the opportunity to view differentiated strategies through observations, videos, or professional development courses is a very practical way for teachers to learn from teacher experts.

Differentiation provides opportunity for student engagement and active learning (Santangelo & Tomlinson, 2009). Kristen stated,

Students indicated that using a variety of materials and activities was especially beneficial because it promoted engagement. This, in turn, led to improved comprehension of key ideas. Many students have noted the additive value of participating in collaborative learning opportunities and of having options for expression.

Kristen was able to reinforce that differentiation enables all students to find meaning and relevance in the course content and activities. Students who started the course demonstrating near mastery of some of the objectives, as well as those who sought out opportunities for accelerated and advanced learning, were able to experience a challenging and enriching curriculum. The strategies incorporated into this classroom such as using a wide variety of materials and activities, using flexible grouping strategies, providing options for expression, supporting text comprehension, offering choices, and being flexible with timelines were some of the strategies that proved to be most beneficial. It is the hope

that this case study will serve as an impetus for teachers to systematically and reflectively explore ways to ensure that all students have meaningful learning experiences through the use of differentiated instruction.

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Name: _____

School District: _____

Grade Level: _____

Topic: _____

Differentiated Instruction in the Classroom Interview

Interview Protocol: Interview the Mathematics Teacher and the Literacy Expert Separately first and together if needed.

1. What type of coteaching instructional strategies have you used to engage all students in instruction?
2. What type of support have you observed is needed when teaching the CCSS relative to mathematical literacy?
3. How has collaborating as a mathematics teacher and a literacy expert supported your students learning the CCSS content?
4. What are some instructional practices that you have used to address the needs of students with different ethnic or cultural backgrounds relative to mathematical literacy?
5. What are some instructional methods you use to tailor instruction to meet the needs of all of your students?
6. What are some ways that you have observed that students respond to coteaching differentiated instruction?
7. How can using differentiated instruction in the classroom prepare students for high stakes standardized tests?
8. What are some ways differentiated instruction can help prepare students for the real world?
9. What does it mean that differentiated instruction was implemented effectively?

10. What type of professional development have you participated in that focused specifically on differentiating instruction in a diverse setting?

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