

2021

Teacher Perceptions on Using Differentiated Instructional Strategies in Middle School

Akecia Owens-Cunningham
Walden University

Follow this and additional works at: <https://scholarworks.waldenu.edu/dissertations>



Part of the [Education Commons](#)

This Dissertation is brought to you for free and open access by the Walden Dissertations and Doctoral Studies Collection at ScholarWorks. It has been accepted for inclusion in Walden Dissertations and Doctoral Studies by an authorized administrator of ScholarWorks. For more information, please contact ScholarWorks@waldenu.edu.

Walden University

College of Education

This is to certify that the doctoral study by

Akecia Owens-Cunningham

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee

Dr. Timothy Lafferty, Committee Chairperson, Education Faculty

Dr. Mary Lou Morton, Committee Member, Education Faculty

Dr. Wade Fish, University Reviewer, Education Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2021

Abstract

Teacher Perceptions on Using Differentiated Instructional Strategies in Middle School

by

Akecia Owens-Cunningham

MA, Troy State University, 2002

BS, Georgia State University, 2000

Project Study Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Education

Walden University

June 2021

Abstract

Mathematics teachers at the local middle school located in a southeastern suburban community were struggling to implement differentiated instruction (DI) strategies in mathematics lessons as presented in professional development (PD) sessions and as directed by school administrators. The purpose of this study was to explore middle school mathematics teacher perceptions about using DI strategies in the classroom, about the problems they may encounter trying to use new strategies presented in PD sessions, and about teacher ideas for improving PD sessions about DI. This research study was guided by Tomlinson's framework for differentiation in instruction. The research questions examined teachers' perceptions on implementing DI strategies learned in PD sessions, the challenges teachers face with implementing DI, and the ideas teachers have for improving PD sessions about DI. A basic qualitative design was used to capture the insights of eight purposefully selected mathematics teachers through semistructured interviews. Themes were identified through open coding. The trustworthiness of the study was established through member checking, rich and detailed descriptions, and researcher reflexivity. The findings revealed that teachers use student data to plan for DI, but that many teachers need and want more training to organize DI experiences. A professional development project was created to provide teachers with strategies and approaches for implementing DI to address individual learning needs of students. This study has implications for positive social change by providing a PD plan to help teachers overcome the challenges they face with implementing DI, and by creating a differentiated learning experience for all students.

Teacher Perceptions on Using Differentiated Instructional Strategies in Middle School

by

Akecia Owens-Cunningham

MA, Troy State University, 2002

BS, Georgia State University, 2000

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

June 2021

Dedication

This page is dedicated to all my family and friends who have supported me throughout this educational experience. Your love and encouragement have been the driving force to reaching this momentous milestone. I dedicate this study to my children, Austin, and Aiden. I am grateful for your unwavering love as I persevered through this doctoral program. You are forever my greatest blessing. I also dedicate this journey to my late grandmothers, Rowena Perdue and Mary Ann Owens. You both were the epitome of grace and love, and the eternal wind beneath my wings.

Acknowledgments

As I reflect upon my doctoral journey, I must thank God first! With Him, all things are possible. I want to acknowledge and thank my husband, Terry, for believing that I am super woman. My sons, Austin and Aiden for reminding me that I can do it because I can do all things through Christ who strengthens me! My parents, Jimmy and Voncile, for their unconditional love and support. My brothers, Jerrod and Ehren, my sisters-in-love, Arnise, Shanteria, Samantha, and Nakeya, and my parents-in-love, Coach and Alma for always providing me with a word of encouragement and inspiration. I would also like to thank my grandparents, my aunts, my uncles, and my cousins who continuously prayed for me and believed that I could accomplish this goal. To my H.E.L.E.N.S., my Circle of Faith, my D.A.B.S., my G.A.A. Girls, and all my amazing family and friends, thank you for being the support system I needed to make it through some of the most challenging times. In addition, thank you to my beloved church family and school community for the support that you gave me while pursuing my doctoral degree. Additionally, I must say thank you to Dr. Timothy Lafferty for guiding me throughout this entire process. This study would not have been completed without your support. Thank you, Dr. Morton and Dr. Fish, for all of your feedback to ensure that I successfully completed this doctoral study. 1 Corinthians 2:9 states, "But as it is written, eyes hath not seen, nor ears heard, neither have entered into the heart of man, the things which God hath prepared for them that love him." I am excited to experience this next season in my life, and I am believing the best is yet to come. To God be the glory for the things He has done!

Table of Contents

List of Tables	v
Section 1: The Problem	1
The Local Problem	1
Rationale	5
Definition of Terms	9
Significance of the Study	9
Research Questions	11
Review of the Literature	11
Conceptual Framework	11
Review of Broader Problem	12
Differentiation Instruction	13
Strategies for Differentiated Instruction in Mathematics	17
Challenges of Implementing Differentiated Instruction	21
Overcoming Barriers to Professional Development Effectiveness	23
Implications	27
Summary	28
Section 2: The Methodology	30
Research Design and Approach	30
Justification for the Design	31
Participants	32
Criteria for Selecting Participants	32
Procedures for Gaining Access to Participants	33

Researcher-Participant Working Relationship	35
Protection of Participants	36
Data Collection	36
Semistructured Interviews	37
Keeping Track of Data	40
Role of the Researcher.....	40
Data Analysis Results.....	42
Coding Process	43
Research Accuracy and Credibility	43
Discrepant Cases	45
Findings	46
Theme 1: Utilizing Differentiated Instructional Strategies Based on	
Student Data	48
Theme 2: Challenges with Utilizing Differentiated Instructional Strategies	52
Theme 3: Ideas for Effective Professional Development.....	57
Discussion of the Findings	61
Conclusion	65
Section 3: The Project	68
Introduction	68
Description and Goals	69
Rationale.....	73
Review of the Literature	76
Professional Development.....	76

Collaboration in Professional Development.....	83
Instructional Approaches for Differentiation in Mathematics.....	84
Project Description	88
Potential Resources and Existing Supports	88
Potential Barriers	89
Proposal for Implementation and Timetable	90
My Roles and Responsibilities	91
Project Evaluation Plan	91
Formative and Summative Evaluation	92
Evaluation Goals	95
Key Stakeholders.....	95
Project Implications.....	97
Implications for Social Change	97
Importance of the Project in Larger Context.....	98
Conclusion.....	99
Section 4: Reflections and Conclusions	100
Project Strengths and Limitations	101
Recommendations for Alternative Approaches.....	103
Scholarship, Project Development and Evaluation, and Leadership and Change	107
Reflection on Importance of the Work.....	107
Implications, Applications, and Directions for Future Research	112
Conclusion.....	116

References	118
Appendix A: The Project.....	138
Appendix B: Interview Protocol.....	161

List of Tables

Table 1 *College and Career Content Mastery Scores for Middle School Students*...5
Table 2 *Perceptions of Middle School Mathematics Teachers – Themes*.....47
Table 3 *Proposed Professional Development Timeline*.....89

Section 1: The Problem

The Local Problem

Teachers are faced with the challenge of teaching students who vary in readiness, skills, interests, knowledge, and abilities (Tomlinson, 2014). Differentiation is based on the notion that in all classroom settings there are varied student learning patterns; thus, teachers are confronted with creating lessons that meet the diverse needs of every student (Valiandes, S., 2015). Tomlinson and Allen (2000) explained that “differentiation is simply attending to the learning needs of a particular student or small group of students rather than the more typical pattern of teaching the class as though all individuals in it were basically alike” (p.4). Accordingly, differentiation requires that teachers adapt instruction to create a learning environment that addresses student differences (Dack & Tomlinson, 2015).

The problem that prompted this study was that mathematics teachers at the local middle school were struggling to implement differentiated instructional (DI) strategies in mathematics lessons as presented in professional development (PD) meetings and as directed by school administrators. Although mathematics teachers understand they were to include DI strategies in their classrooms, some teachers implemented the strategies more successfully than others based on their knowledge and experience. To address the problem, school administrators implemented a professional learning calendar to support classroom instruction. A school-wide staff calendar indicated that teachers had been offered PD about DI strategies twice a month during the 2017-18 and 2018-19 school years. The professional development sessions focused on using DI strategies that

addressed the strengths and weaknesses of diverse learners and provided opportunities for teachers to improve their practices to meet the needs of all students.

In the State of Georgia, teachers are evaluated on their implementation of differentiated learning strategies through The Teacher Keys Effectiveness System (TKES). TKES is a “common evaluation system designed for building teacher effectiveness and ensuring consistency and comparability throughout the state” (Georgia Department of Education, 2018, p. 1). As a part of TKES, teachers are evaluated based on 10 performance standards. Performance standard three addresses instructional strategies and performance standard four addresses differentiated instruction (Georgia Department of Education, 2018). Teachers attended professional development sessions in an effort to refine their teaching practice and continuously improve the knowledge and skills that align with these standards (Georgia Department of Education, 2018). Hence, the teachers attended the PD sessions; however, according to the administrators, there was little to no evidence of the implementation of the PD presented DI strategies in mathematics classes (Principal, personal communication, October 2018). A seventh-grade teacher stated that there are benefits to using DI strategies, but there are other factors that limit her ability to properly use those strategies (Mathematics teacher, personal communication, November 2018). A special education teacher explained that the strategies presented could not be used effectively after one brief presentation (Special education teacher, personal communication, November 2018). An eighth-grade mathematics teacher stated that the resources used in PD for differentiated lessons were not available to classroom teachers; as a result, teachers cannot practice some of the strategies with students (Mathematics

teacher, personal communication, January 2019). Conversely, “while difficulties reported by teachers often focus on various institutional restrictions (such as time, lack of resources, heavy loaded curricula), the major challenge for the effective application of differentiation may be rooted in teachers’ mentality” (Valiandes & Neophytou, 2018, p. 124). According to Valiandes and Neophytou, to effectively implement DI, it is imperative that teachers understand the guiding principles of using this strategy in the mathematics classroom

According to Gulamhussein (2013), schools invest a significant amount of time and money into PD only to observe implementation at marginal levels. In addition, the Boston Consulting Group (2014) found that teachers believe that many current PD offerings in public schools are not relevant, effective, or connected to their core work of helping students learn. Similarly, Kaur and Debel (2019) asserted that teachers’ thoughts, ideas, and suggestions regarding PD have not been considered. Teachers reported that they received no choice in the design or type of PD offered to them for their professional growth (Garcia & Weiss, 2019). Hence, Brigandi et al. (2019) proposed a reexamination of traditional PD to determine its effectiveness as a sustained approach to teacher practice. Teachers reported that they did not receive adequate PD that focused on meeting the student needs at all ability levels (Brigandi et al., 2019). A review of a PD survey conducted by the local school administrator in 2018 identified that 75% of the local middle school teachers reported that they were hesitant, uncertain, and/or dissatisfied with the PD sessions. In the survey, teachers were asked about their experiences of implementing DI strategies after participating in PD. Thirty percent of the

surveyed teachers agreed that the PD was beneficial to students and strengthened their lessons; however, 70% of the teachers were less than satisfied, and they expressed interest in observing model lessons as part of the PD experience. Sixty-two percent of the teachers indicated that they had difficulty implementing these strategies. Despite the results of this survey, teachers continued to struggle (Principal, professional communication, October 2018). There was a gap in practice in the local middle school in understanding the practices of teachers who implemented DI strategies as presented in PD sessions.

Moosa and Shareefa (2019) found that there are variables that may influence teacher practices of implementing DI strategies. They suggested that in order for there to be sufficient utilization of DI, teachers should receive adequate PD that focuses on specific instructional strategies and provide teachers with the necessary support to incorporate DI in their classrooms. Providing effective PD is important for changing teacher practice (Gulamhussein, 2013). PD that changes teacher practice is not a one-size-fits-all model for school districts (Brigandi et al., 2019; Dufour, 2007).

Implementing DI strategies that influence student performance can be a complex process that may require PD opportunities that are longer than half-day sessions (Dixon et al., 2014). According to Brigandi et al., ongoing PD can alleviate the gaps in the skills and knowledge of teachers. Gregory and Chapman (2013) recommended utilizing DI strategies, but implementing the strategies requires a conscious and knowledgeable effort by teachers. Specialized training for teachers should be established to take into consideration the individual development of students, and to address each students'

differentiated learning needs (Ismajli & Imami-Morina, 2018). Thus, planning strategically requires school districts to ensure teachers are properly prepared to utilize the DI strategies presented and to effectively monitor the implementation of these strategies (Dixon et al., 2014).

Rationale

This study focused on a middle school that is situated in a southeastern suburban community and is staffed with 65 full-time teachers. The school serves a population of approximately 875 sixth, seventh, and eighth grade students. Of this population, 12.63% of the students are a part of the subgroup of students with disabilities and 4.52% are gifted students. In 2018, the local middle school received a mathematics content mastery score of 34.85 on the College and Career Ready Performance Index (CCRPI) which was 2.9% lower than the prior year. According to the 2018 CCRPI, student performance in the area of mathematics has not met the minimum state level requirement for the past 3 years (see Table 1).

Table 1

College and Career Content Mastery Scores for Middle School Students

2015	2016	2017	2018
41.1%	31.7%	37.7%	34.85%

Note. The Data from the Table from Georgia Department of Education. (2018). *College and Career Ready Performance Index.*

The CCRPI is Georgia's instrument for measuring how well schools are helping students meet their academic goals. The Georgia Department of Education requires

schools to make continuous improvements, and “decrease the gap between baseline performance on the state accountability system and 100% by 3% annually” (Georgia Department of Education, 2018). School level improvement targets are calculated using the baseline year of 2017. Improvement targets are categorized as a gain that incentivizes schools to focus on continuous and sustainable improvement (Georgia Department of Education, 2018). Each school has an individual improvement targets that is calculated for all students and all student subgroups (Georgia Department of Education, 2018). Schools are expected to meet their improvement targets based on the prior year’s performance. This goal encourages schools to maintain consistent student growth, close the gap in student achievement, and sustain increased levels of student success. These improvement targets are calculated based on the content mastery and achievement. The achievement section of the CCRPI encompasses Content Mastery, Post Readiness, and Graduation Rate. Content Mastery is worth 40% of the achievement section of the CCRPI and is based on the students’ performance on state assessments. Schools receive points based on each student’s proficiency level (e.g. beginning, developing, proficient, or distinguished). The Georgia Department of Education reports that beginning learners need substantial academic support, developing learners need additional support, proficient learners are prepared for the next grade level, and distinguished learners are well prepared and are on track for college and career readiness (Georgia Milestones Achievement Level Descriptors, n.d.). According to the Georgia Department of Education (2019), the CCRPI Report for the school in this study shows that 42.64% of the students are beginning learners, 46.07% are developing learners, 10.28% are

proficient learners, and 1.02% are distinguished learners (Gadoe, 2019). This content mastery report indicated that students are not performing at the required level for grade promotion.

Moreover, teachers are expected to ensure that all students meet the achievement standards as mandated by the state. Using DI strategies, teachers can help students meet the established standards and ultimately lead schools to a level of proficiency. Although implementing DI is essential to helping promote the learning of all students, teachers find it difficult to successfully utilize DI (Acosta-Tello & Shepherd, 2014). During a faculty meeting, administrators at the local school suggested there was a gap in the practice of effectively using DI strategies (Assistant Principal, personal communication, 2019). Some teachers continuously utilize traditional teaching instructions rather than utilizing DI strategies (Malacapay, 2019). Tomlinson and Imbeau (2012) suggested that most teachers believe that utilizing DI strategies is essential to meeting the needs of the students in the classroom; however, few teachers implement the DI strategies effectively or with fidelity. Ismajli and Imami-Morina (2018) affirmed that teachers do not have adequate knowledge of DI to successfully implement the strategies in their classrooms.

During mathematics department meetings, teachers meet to discuss the progress of their students. The teachers analyze their student's data to determine how students are performing based on the various subgroups and levels in each of their classes. In department meetings, teachers can address the various subgroups within the classroom by implementing DI as a strategy to help plan lessons that target students' varied skill levels while strategically addressing the assigned standards (Gregory & Chapman, 2013). At

one of the meetings, an 8th grade mathematics teacher identified a group of students with disabilities who were struggling to meet the standard, while some of her general education students were performing successfully. She expressed her frustration with understanding how to meet all of her students' needs (Eighth grade mathematics teacher, personal communication, 2019). According to Tobin and Tippett (2014), classroom teachers are challenged with meeting the diverse needs of their students due to an apparent lack of knowledge of how to adapt the curriculum and modify DI strategies to support instructional practices in the classroom.

The local middle school, which was the site of this study, offers teachers PD to learn about DI strategies that support teaching and learning; however, according to one of the administrators, there has been little evidence of teachers using the strategies presented (Principal, personal communication, 2018). Conversely, by implementing DI, teachers could meet the needs of individual students with differing learning levels in the classroom (Tomlinson & Imbeau, 2010). All students do not learn in the same way, so when DI is utilized, teachers are able to develop lessons that cater to the specific needs of their students and provide the remediation and/or extension that each student needs to meet the academic standard (Fitzgerald, 2016). Consequently, there is a need for greater understanding about teacher implementation of DI strategies, about the challenges encountered by teachers when implementing DI strategies, and about teachers' ideas for improved PD about DI strategies. The purpose of this study was to explore teachers' perceptions about using DI strategies in the classroom, about the problems they encounter

trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI.

Definition of Terms

According to Creswell (2018), in order to elucidate the language within a study, the researcher may provide definitions of terms. The following terms were used in this project study.

Differentiated instruction: Differentiated instruction is an instructional approach described as a student-centered teaching strategy that supports accommodations and modifications based on each student's distinctive learning needs (Gaitas & Martins, 2017).

Instructional strategies: Instructional strategies are the methods used to teach students the academic standard and improve their overall performance (Khan et al., 2016).

Professional development: Training opportunities to support the overall growth and development of teachers and to improve teachers' instructional practices so that their lesson will have a positive influence on student learning (Polly et al., 2018).

Significance of the Study

This study investigated middle school mathematics teachers' perceptions about using professional development learning of DI strategies in the classroom, about the problems they may encounter trying to use new strategies after a training session, and about suggestions for improving the effectiveness of translating professional development into practice. Addressing the problem in this study is significant because it

may provide insight as to how teachers are currently differentiating instruction in their classrooms and explore possible PD sessions needed to support teachers with utilizing DI strategies. This study may also fill the gap in practice by identifying the difficulties teachers are having with implementing the strategies that are introduced in the PD sessions. This study may also provide suggestions of effective DI strategies that may support the faculty and staff with improving the overall PD instructional program.

Tomlinson and Imbueau (2010) suggested that teachers are largely responsible for ensuring that their instruction meets the needs of their students. Teachers have a responsibility to adapt their instruction to meet each student's differentiated developmental need at each of their varying learning levels (Suprayogi et al., 2017). Consequently, this study may help teachers gain a greater understanding of DI strategies and provide students with improved instruction to enhance student performance. When teachers utilize differentiated instructional strategies, they can transform their classrooms to student-centered and culturally responsive learning environments that benefit all students (Santamaria, 2009). Thus, this study may support social change by identifying successful DI strategies and providing a PD to present those strategies to teachers to support DI in mathematics classrooms. By understanding teachers' perceptions about using and translating PD learning into practical application in classrooms, positive social change may result from improved DI practices of teachers and may contribute to an improvement in student performance.

Research Questions

The problem in this study was that mathematics teachers were struggling to implement DI strategies in mathematics lessons as presented in professional development PD meetings and as directed by school administrators. The purpose of this study was to explore teachers' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI. Merriam (2009) proposed that researchers should frequently follow their problem and purpose statements with research questions that will serve as a guide for their qualitative inquiry. In accordance with the research problem and purpose, this study addressed the following research questions:

RQ1: What are middle school teacher perceptions about implementing differentiated instructional strategies learned in a professional development workshop?

RQ2: What are middle school teacher perceptions about the challenges of implementing differentiated instructional strategies?

RQ3: What are middle school teacher ideas for improving professional development sessions about differentiated instructional strategies?

Review of the Literature

Conceptual Framework

A conceptual framework is the underlying frame or structure for the study (Merriam, 2009). This study was guided by Tomlinson's framework for differentiation. DI is an approach to teaching that is student-centered and used to engage students, based

on their varied interests, strengths, and weaknesses, to support how they learn best (Tomlinson, 2003). The framework of differentiation is important to the study because Tomlinson (2003) suggested that in order for instruction to be most effective, teachers must intentionally modify the learning content, process, product, or environment in response to students' interests, readiness, and learning profiles. Tomlinson (2001) explained that there are four elements of differentiated instruction: (a) content—which is associated with what students need to know, (b) process—which is the activities that students will participate in to understand the content, (c) product—which incorporates the artifact that will demonstrate the student's understanding, and (d) the learning environment—which involves the setting and circumstance for the assignment. Tomlinson's framework for differentiation concludes that teachers who include these elements when developing their lessons have the potential to maximize student success.

Furthermore, differentiation provides a frame of reference that connects the process of implementing effective instruction with student performance. Tomlinson's framework for differentiation will be used to align the research questions with the research design and method of the study. By using Tomlinson's framework for differentiation, I explored teachers' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI.

Review of Broader Problem

The purpose of this project study was to explore teachers' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new

strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI. In this section, I reviewed current research on differentiated instruction. This literature review helped to build an understanding of the significance of the study. In this section, I investigated the challenges of implementing DI and discussed what was needed to help teachers overcome the challenges with implementing DI strategies learned in PD sessions. I reviewed articles that discussed the definitions of DI, the strategies for DI in mathematics, the challenges of implementing DI, and the potential barriers associated with PD sessions. Sources for the literature review were found in the Walden University Library resources using the ERIC, SAGE, and Thoreau multiple databases. The sources reviewed came from peer-reviewed literature published from 2001-2020.

Differentiation Instruction

Tomlinson (2004a) defined differentiation as “a learned way of thinking about being that honors and contributes to the uniqueness and possibilities of each person in the group, as it honors and contributes to the success of the whole” (p. 189). DI compels teachers to be aware of the curriculum and each student's characteristics (Ismajli & Imami-Morina, 2018). DI not only focuses on their characteristics, but each student's individual differences of interest, readiness level, and learning profile are targeted to seek ways to authentically engage them in their learning (Senturk & Sari, 2018). Tomlinson (2017) described differentiated instruction as supporting students with various teaching strategies to produce optimal learning experiences. Suprayogi et al. (2017) proposed that DI is an approach that copes with the diversity, adopts teaching strategies, invokes learning activities, monitors student needs, and pursues learning outcomes. Senturk and

Sari suggested, “Differentiated instruction centralizes students and contributes to self-improvement and realization in the direction of individual characteristics of each student” (p. 201). DI is a teacher’s instructional plan for meeting the diverse needs of students in the classroom while focusing on the needs and interests of students through choice (Goddard et al., 2015). Teachers can differentiate their instruction by making the connections between the students’ interest and experiences, and the academic curriculum (Haymon & Wilson, 2020). This will support the basic principles of DI and solidify teachers’ efforts in meeting the diverse needs of the student.

Differentiation can be implemented by content, process, product, and environment. Each of these elements are interrelated and can be adjusted according to a student’s readiness, interest, and learning profile (Fitzgerald, 2016; Lang, 2019; Tomlinson, 2017). Content is based on what students learn, while process focuses on how students making sense of the information given, and product emphasizes how students showcase what they have learned (Tomlinson, 2017). Differentiating by content is when teachers focus on the most relevant concepts while increasing the rigor of learning. Typically, content is based on the academic standards that are set forth by the school district. Teachers may strategically select what standards will be taught and what resource they will use to differentiate the content; however, what the student learns remains constant.

Differentiating by process refers to the activities that are created to help students understand the concepts being taught (Tomlinson, 2017). Teachers may give students options for learning the assigned concept (Stone, 2018). For example, in a mathematics

classroom, some students may use manipulatives or hands-on activities to understand a problem while other students may use the math concept to solve real-world problems (Stone, 2018). Differentiating by process supports using tiered activities to provide support to students based on their individual interest and learning styles (Taylor, 2015). Tiered activities are utilized to ensure that students are evaluated on the same skill but are assessed on different target levels.

Differentiating by product is based on the culminating outcome of the learning experience. It provides students with a choice in how they showcase their learning and understanding of the academic standard (Taylor, 2015). For example, some students may write an essay or give an oral presentation while others may conduct a lab, prepare a report, make a video, or play a game to showcase their understanding of a given topic (Pourdana & Rad, 2017). Any one of these choices can be used to differentiate the varied target levels (Taylor, 2015). Differentiating product allows students to demonstrate what they know about the content they are learning.

Differentiating by environment allows for teachers to provide a classroom where students can work individually or collaboratively. Teachers can create a learning environment where students can move freely in a user-friendly environment based on their specific needs (Pourdana & Rad, 2017). A differentiated classroom provides an opportunity for teachers to create a physical environment that is free from distractions, has available space, adequate lighting, and is conducive to learning (Aljaser, 2019). Contrarily, an inadequate classroom environment can lead student to becoming inactive, lazy, and unmotivated (Aljaser, 2019). By applying differentiating instruction to the

content, process, product, and/or environment teachers have an opportunity to cultivate the learning experiences for their students.

In addition, differentiated instruction is designed in response to a students' interests, readiness, and learning profiles (Flannagan, 2019). A teacher who responds to a student's interest is able to take the curriculum and deliver instruction based on what the student loves to do, which provides the teacher an opportunity to capitalize on what motivates a student to expand their depth of knowledge (Loeser, 2018). Likewise, when a teacher responds to a student's readiness the teacher is able to gauge the student's understanding of a topic and match the learning task to the student's actual skill level to support the process of continual learning (Kaplan, 2019). Readiness is a student's knowledge, skill, and overall understanding of a given topic or concept (Tomlinson, 2003). A student's readiness determines whether he or she will need additional instruction, or whether a student is ready to move on to new a topic (Tomlinson, 2017). When teachers know their student's readiness, they are able to provide opportunities for remediation and/ or enrichment based on each student's identified achievement level (Prast et al., 2015).

The learning profile refers to the learning style, intelligence preference, gender and culture that influences a student's way of thinking (Loeser, 2018). Identifying the student's learning style enables the teacher to identify how the student learns (Malacapay, 2019). It provides the teacher an opportunity to have a clear perspective of how they should differentiate their teaching strategies to meet the specific needs of their students (Malacapay, 2019). Conversely, Gardner's (1983) research regarding multiple

intelligences helps to differentiate according to differences in how students learn. Aftab (2015) reported that there are eight intelligences that were identified by Howard Gardner which include: (a) verbal/linguistic, (b) logical/mathematical, (c) visual/spatial, (d) bodily/kinesthetic, (e) musical/rhythmical, (f) naturalist/environmental, (g) interpersonal, and (h) intrapersonal. These eight intelligences give insight into the preferred way students learn and provide support to the concept of DI (Moosa & Shareefa, 2019). Although each student possesses a distinctive blend of these multiple intelligences, researchers suggest that few teachers readily use them when planning their lessons (Aftab, 2015).

Strategies for Differentiated Instruction in Mathematics

Differentiated instructional strategies are designed to support teachers in implementing effective instruction that caters to students with varied levels of readiness. Taylor (2015) suggested that when students are provided instruction at their level of readiness and when teachers use targeted instructional strategies, there is progress in student achievement. According to Ismajli and Imami-Morina (2018), “differentiated instruction through interactive strategies provides opportunities for transition from traditional knowledge acquisition to active learning process” (p.216). This transition can lead to a progression in student success.

Students do learn and develop at differing levels; thus, teachers should use different strategies to be more effective (Ismajli & Imami- Morina, 2018). In a mathematics classroom, teachers must use multiple teaching strategies and representations to ensure the basic principles of DI are applied (Lai et al., 2020).

According to Baker and Harter (2015), mathematics teachers utilize DI strategies to guide students who struggle in their classes. Student-centered pacing, alternative forms of assessment, and teacher-scaffolding are necessary to differentiate mathematics instruction and provide support for individual students (Baker & Harter, 2015). Some specific strategies that have proven to be effective when implementing DI include tiered lessons, flexible grouping, small group instruction, student choice assignments, and stations (Loeser, 2018). These strategies provide teachers an opportunity to offer individualized instruction, observe students' engagement with the selected resources and materials, assign informal and formal assessments to assess students' strengths and weaknesses, and to design assignments for enrichment and/or remediation (Shepherd & Acosta-Tello, 2015).

Tiered lessons can be utilized to ensure effective implementation of DI. Tiering lessons is a process in which teachers adjust learning tasks to meet their student's level of readiness (Flannagan, 2019). Tiered lessons address the academic standard but offers students differing degrees of difficulty to guide them through their individualized levels of learning (Pourdana & Rad, 2017). Using tiered lessons can ensure that students with different academic needs can work on the same skills but at different levels of complexity (Wu & Chang, 2015). Students may be in one tier for one lesson but in another tier for a different lesson.

Another approach to implementing DI is by using flexible grouping where students are divided into groups based on their strengths and/or weaknesses (McKeen, 2019). Unlike traditional grouping practices where students get stuck in either a high

performing or low performing group (Loeser, 2018), flexible groups are usually changed based on the current data and students are reassigned to different groups based on their assessed growth or individual student interests (Benders & Craft, 2016). Flexible groups can also be assigned according to students' interests, readiness, and learning environment (Harshbarger, 2019). Flexible grouping provides an opportunity for like-minded peers to work together to complete learning tasks based on the current assessment data (Riley, 2016). These flexible groups often times offer teachers more flexibility to utilize instructional strategies and tailor their instruction to meet the specific needs of their students (McKeen, 2019). Teachers are able to adapt the amount of instruction, the content of instruction, and the type of tasks the students are instructed to complete (Prast et al., 2015). Flexible groups motivate students to work together by providing students various opportunities to work with different people throughout the year (Loeser, 2018). Students can also be assigned roles in flexible groups to help ensure students are progressing through the assigned learning task and to ensure all students are actively participating (Riley, 2016).

Small group instruction can be an effective way to implement DI (Cook, 2008). Small group instruction provides an opportunity for teachers to work closely with a small group of students to provide increased opportunities to practice skills and to help them meet the academic standards (Freeman-Green et al., 2018). Small groups consist of fewer than five students and supports a reduced teacher-student ratio to encourage student participation (Wilson et al., 2012). While the teacher is working with this small group of students, the other students who may be more advanced in the subject matter can work

independently on another assignment. According to Loeser (2018), "Students who are not quite ready to learn a given concept may need more one-on-one time with a teacher, more deliberate step-by-step instructions, varied activities and final products requiring different skill sets, and more opportunities for direct instruction" (p.2). Hence, small group instruction provides opportunities for teachers to observe their students, modify the direct instruction, clarify any misconceptions, and determined the specific needs of each student in the group (Wilson et al., 2012). Small group instruction provides this opportunity while encouraging other students to progress in their learning.

Another way to implement DI is by using student choice assignments. These assignments provide students with various options to showcase their understanding of the academic standard. Students are encouraged to make choices based on their interests, readiness, and learning style. Teachers can provide students with a choice in the strategy they use to solve problems, the order in which they choose to complete their assignments, the format in which their work is presented, the topics that are addressed in the assignment, and the way in which they decide to complete their work (Netcoh, 2017). When students are provided with an opportunity to choose their mode of learning, students feel invested in their learning and are more likely to make meaningful connections (Loeser, 2018).

Lastly, stations are another way to implement DI. Stations are often utilized when teachers prepare material for student to work on related to standards within the curriculums. Often times, students rotate to different locations in the classroom to complete assignments that serve as practice, remediation, and/or enrichment. Stations

could include the use of manipulatives, computerized games, hands-on activities, or a teacher-led station where student get specialized assistance (Perry, 2019). Accordingly, stations are an effective way to implement DI because it provides a balance between student choice and teacher choice (Loeser, 2018). By utilizing stations, teachers are able to be more intentional in designing tasks that meet the needs of their students.

Challenges of Implementing Differentiated Instruction

DI has become more important as the United States has become more diverse and students are widely varied (Hartwig & Schwabe, 2018; Morgan, 2014). Consequently, there is a need for teachers to adjust their teaching practice to accommodate the diversity in student populations (Hartwig & Schwabe, 2018). Understanding how to adapt instruction and teacher practices to meet the diverse needs of all students can be challenging (Smets, 2019). These challenges are often discussed when implementing DI in the classroom (Siam & Al-Natour, 2016). Some of these challenges include unfamiliarity of student characteristics, a deficiency in teacher knowledge, inadequate planning time, lack of learning resources and educational equipment, and weak administrative support (Aldossari, 2018; Siam & Al-Natour, 2016; Smets, 2019; Suprayogi et al., 2017). Considering the challenges in implementing DI can provide a clear picture of the struggle teachers face and provide a framework for improving the implementation of DI strategies.

Effectively implementing DI requires teachers to invest a considerable amount of time to identifying their student's individual characteristics (Smets, 2019). Highlighting the student's abilities and individual characteristics compels teachers to know their

students and implement DI based on what motivates their students to learn (Morgan, 2014). Teachers who do not know the individual characteristics or their students and do not understand differentiation struggle with implementing DI (Dixon et al., 2014). In order to effectively implement DI, teachers should be aware of their students' characteristics and abilities and familiarize themselves with the academic curriculum (Ismajli & Imami-Morina, 2018). Teachers should identify their student's individual characteristics and learning profile and apply their finding to their instructional practices of DI (Wu & Chang, 2015). In a study conducted by Smets (2019), "Teachers were often unfamiliar with individual students' characteristics, and unclear on which students would be categorised as well-performing" (p. 25). In another study, teachers found it difficult to implement DI that supported the individual characteristics of their students because they had to create lesson plans that met the tailored needs of each student (Aftab, 2015).

There is a strong correlation between teacher knowledge and effective implementation of DI (Moosa & Shareefa, 2019). Understanding strategies that support DI by content, process, product, and environment requires a higher level of instructional pedagogy. The lack of teacher knowledge oftentimes bears an inconsistent use of DI (Moosa & Shareefa, 2019). There is a disconnect between the teachers' understanding of DI and the implementation of DI (Suprayogi et al., 2017). Conversely, teachers who possess pedagogical knowledge must also have opportunities to practice DI in their classroom (Moosa & Shareefa, 2019). According to research, many of the teachers struggle when incorporating DI in their teaching practice (Smets, 2019). Ismajli & Imami-Morina (2018) affirmed, "Instructors do not have sufficient knowledge regarding

differentiated instruction to be able to implement it successfully in the classroom” (p 216). Lunsford and Treadwell (2016) confirmed that part of the challenge is that educators have not been taught about DI as a teaching philosophy and are not familiar with the approach. Moosa and Shareefa (2019) proposed that teachers’ lack of understanding of DI causes them to be hesitant in utilizing the strategies. Although many teachers understand that DI responds to the learning differences of students, some teachers pose concerns in the applicability of DI in practice (Kaplan, 2019).

Implementing DI requires teachers to have adequate time to plan, find, and collect materials and resources (Lunsford & Treadwell, 2016). Sufficient time is a challenge that affects the teachers’ ability to plan, assess, and reteach (Shepherd & Acosta-Tello, 2015). According to Aftab (2015) a shortage of time dedicated to content planning is one obstacle teachers face when implementing DI strategies. This obstacle makes it difficult to plan, design, and deliver lessons that support tailored instruction for students (Aftab, 2015).

Overcoming Barriers to Professional Development Effectiveness

According to researchers, teachers need to be educated on instructional strategies to expand their content knowledge and stay abreast on current pedagogical and research practices (Brigandi et al., 2019). However, there are potential barriers to PD that can impede teachers’ instructional practice and professional growth. Kaur and Debel (2019) suggested barriers to PD can be attributed to the inadequate competencies and skill gaps of teachers, the prevalence of conventional pedagogical teaching practices, and the overall attitude of teachers. Some other potential barriers include accessibility to quality

PD, allocated time for PD, teacher motivation to participate in PD, and financial constraints associated with PD (Badri, et al., 2016; Kaur & Debel, 2019; Powell & Bodur, 2019;). In addition, Garcia, Weiss, and the Economic Policy Institute (2019) proposed that one of the barriers to PD is that teachers feel unprepared due to the lack of training associated with the subjects that they teach. There is limited accessibility to content specific training in lesson plan development which can lead to a teachers' professional unpreparedness (Ismajli & Imami-Morina, 2018). Garcia et al. (2019) suggested that teachers are not receiving the support necessary to translate their PD learning into effective teacher practice. According to Suprayogi et al. (2017) "content of PD should be matched to the current context of a teacher's classroom reality" (p. 294) to ensure that the ideas from the PD are implemented in the classroom. Powell and Bodur (2019) proposed that the lack of opportunities for ongoing and follow-up PD proves to be a continued obstacle for teacher preparation. Teachers typically need to meet on a weekly or biweekly basis to develop lesson plans that ensure that the content curriculum is covered, and each of their students' misconceptions are addressed (Akiba & Wilkinson, 2016). By incorporating an ongoing and consistent PD schedule, schools can potentially mitigate gaps in teacher skills and instructional knowledge (Brigandi et al., 2019). Thus, a shift from a traditional to an unconventional approach is needed to further inform teacher practice and build teachers' professional capacity (Akiba & Wilkinson, 2016).

Another barrier to PD is the lack of time allotted for collaboration. Kaur and Debel (2019) affirmed that PD through teacher collaboration broadens a teacher's pedagogic knowledge to effectively implement various instructional strategies. However,

according to researchers, barriers such as time, working situations, lack of collaborative PD sessions, and personal issues can hamper collaboration and teacher practice (Kaur & Debel, 2019). Collaboration involves a long-term commitment which requires teacher availability and an increased level of participation in the PD (Badri, et al., 2016).

Nonetheless, a teacher's willingness and availability to participate in PD sessions can be hindered due to the lack of structured time centered around teacher learning (Cooc, 2019). Researchers suggested that one of the most significant challenges to participating in PD is finding the time within the teachers' work schedule to collaborate and share ideas with their colleagues (Badri, et al., 2016; Smith & Robinson, 2020). Akiba and Wilkinson (2016) affirmed that time set aside to provide teachers with an opportunity to collectively explore the curriculum is not commonly available in a teachers' work schedule because of their substantial workload. Hence, teachers are not provided the necessary time they need to prepare and practice what they have learned in PD (Garcia et al., 2019).

According to Akiba and Wilkinson (2016), it is essential that extra funding is allocated for teacher substitutes or teacher pay to give teachers the time needed to collectively and collaboratively engage in a PD models that supports continuous learning of the curriculum. Some researchers proposed utilizing an interdisciplinary PD model by providing collaborative planning time to produce modeled lessons, evidence-based practices, and discipline-specific curriculum (Hubbard et al., 2020). Another PD model suggested to support collaboration is a professional learning community (PLC). In a PLC, teachers are provided the time to work collaboratively on a collective purpose and

to achieve a common goal of student growth and development (Hubbard et al., 2020). In both PD models, teachers work schedule may need to be modified to ensure that teachers have adequate time and collaborative support.

Moreover, the lack of funding for travel, equipment, and literature can be a problem within school systems (Ward & Mars, 2020). Funding cost associated with PD can also consists of paid working time, substitutes for teacher coverage, conference registration fees, and teacher incentives and stipends. (Badri et al., 2016). However, when there is a lack of funding and teacher incentives are not available, there are greater chances for teachers to feel overburdened with the extra hours they have to devote to PD which can adversely affect their motivation to participate in the PD sessions (Akiba & Wilkinson, 2016). In addition, some PD sessions require advance registration that may not be fully covered (Ward & Mars, 2020). These registration fees are oftentimes allocated to the teacher, and some teachers are not willing or able to incur these expenses (Ward & Mars, 2020). According to Garcia et al., (2019) “although four in five teachers have scheduled time in their contracts for professional development, only half (50.9 percent) of teachers have released time from teaching to participate in professional development, less than a third are reimbursed for conferences or workshop fees (28.2 percent) or receive a stipend for activities that take place outside regular work hours (27.3 percent), and only one in 10 teachers (9.4 percent) receives full or partial reimbursement of college tuition” (p. 16). The lack of funding can adversely affect teacher’s opportunity to receive stipends for PD activities, reimbursements for travel and conference expense,

and credits towards certifications and advancement in their professional growth (Garcia et al., 2019).

Since schools have limited resources, alternative means for ensuring the growth of teacher practice is essential (Nelson & Bohanon, 2019). Thus, researchers have expressed the benefits of involving instructional coaches or teacher-leaders to share their knowledge as facilitators of PD sessions (Akiba & Wilkinson, 2016) rather than outsourcing this expense or paying for travel. Utilizing instructional coaches as teacher leaders to provide feedback, research-based strategies, and high-quality resource materials can provide opportunities to improve teachers' professional knowledge and development in their pedagogical teaching practices (Akiba & Wilkinson, 2016). In addition, utilizing online PD has presented itself as a benefit to providing instructional support. With online PD, an expert facilitator can support teacher and interact with them in a more timely and consistent manner as well as provide each teacher with the individualized support in a more cost-effective learning experience (Nelson & Bohanon, 2019). Hence, instructional coaches can be a valuable resource for facilitating online PD and provide support for teacher growth and development. Equally, both facets of utilizing instructional coaches and online PD can serve to be beneficial and cost-effective.

Implications

This project could have a positive impact because developing a PD plan based on the data collected from the study can possibly help teachers overcome the challenges, they face with implementing DI. According to Lang (2019), previous research suggested that some of the challenges that teachers face include lack of PD and administrative

support, time constraints, classroom management, equity in grading practices, instructional curriculum, teacher resistance to change, and misconceptions of DI strategies (p. 30). Ismajli and Imami-Morina (2018) proposed, “the main reason that differentiated instruction is not implemented efficaciously is instructors’ professional unpreparedness, lack of adequate conditions that school offers as well as the great number of learners in classes, especially in public schools” (p. 216). Acknowledging the challenges associated with effectively implementing DI could lead to solutions for teachers to overcome these challenges (Tobin & Tippett, 2014). By exploring teacher perceptions and identifying the specific challenges, a PD plan can be developed to help schools establish professional learning communities where teachers create model lessons that incorporate varied DI strategies. This PD plan can be developed for teachers based on the data collected in this project study. The social change that could happen based on the findings in this study is that teachers will create lessons that foster a personalized, motivating, and engaging learning experience which could result in improved student performance.

Summary

Exploring teachers’ perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers’ ideas for improving PD sessions about DI is the basis for this study. This qualitative study explored teacher perceptions on implementing DI and about ideas that support teachers in effectively using DI strategies in mathematics classrooms. By understanding the support teachers need, administrators can assist in improving the level

of training and PD teachers receive, which can ultimately lead to improving student performance and content mastery.

Section 2 included the research design and methodology that I followed to conduct this project study. Section 2 discussed the qualitative research design and approach, the participants, the data collection, and data analysis.

Section 2: The Methodology

This project study was designed to explore teachers' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI. In the methodology section, I described the research design and approach, selection of the participants, data collection methods, and the data analysis process for this study. The nature of this study was a basic qualitative design. Qualitative researchers explore participants' beliefs and perceptions, and the researcher gathers those beliefs and perceptions for analysis (Creswell, 2013). In qualitative research, the goal is to obtain a detailed understanding of a problem or phenomenon (Creswell, 2012). The research questions that guided this study were as follows:

RQ1: What are middle school teacher perceptions about implementing differentiated instructional strategies learned in a professional development workshop?

RQ2: What are middle school teacher perceptions about the challenges of implementing differentiated instructional strategies?

RQ3: What are middle school teacher ideas for improving professional development sessions about differentiated instructional strategies?

Research Design and Approach

One of the goals of a qualitative research study is to examine the experiences of individuals in a specific setting (Lodico et al., 2010). The premise supports the purpose of this study. Merriam and Tisdell (2016) identified four key characteristics of qualitative

studies: (a) they are focused on understanding, (b) the researcher is the primary instrument, (c) they use an inductive process, and (d) they involve gathering rich descriptions. This study incorporated all four characteristics.

I chose the basic qualitative design because I conducted an in-depth investigation of a single group of participants by collecting data from individual interviews. This allowed participants to share their perceptions and thoughts about implementing DI strategies. In a basic qualitative design, researchers explore the experiences and perspectives of the participants in the study (Merriam, 2002). Basic qualitative designs do not focus on developing a theory from the findings; but aims to identify the recurring patterns or themes in the study (Merriam, 2002). In a basic qualitative design there is no bounded system, and one data collection method can be used to understand the participants' responses and address the problem in the study (Merriam, 2002).

Justification for the Design

Selecting the appropriate qualitative design required that I understand the different qualitative research designs; therefore, it was necessary to research the varied possibilities. Grounded theory, ethnography, and narrative designs are not suitable for this study. In the grounded theory design, there is a focus on developing a theory from the data (Creswell & Creswell, 2018). I chose not to use grounded theory for this study because the goal is not to develop a theory involving teachers and their use of DI strategies in the mathematics classroom. The ethnographic design was not chosen because the study does not focus on a particular culture over a specific period of time (Lodico et al., 2010). According to Creswell (2012), an ethnography design focuses on

making an interpretation of beliefs, values, behaviors and immersion within the culture; thus, this design was excluded from my research. Lastly, the narrative approach is suitable for understanding the stories about the lives of the participants in their own words (Lodico et al., 2010). Since this study does not reflect stories of the participants, the narrative design was not employed. In a basic qualitative design, the researcher interprets the participants' perceptions and experiences to address a problem in the field of practice (Merriam, 2002). The basic qualitative design supported the exploration of teachers' thoughts and perceptions about using DI strategies in the classroom. Merriam (2002) affirmed that a basic qualitative design would be appropriate when the researcher seeks to "discover and understand a phenomenon, a process, or the perspectives and worldviews of the people involved" (p. 11) in the research study. After reviewing the various qualitative research designs, I chose the basic qualitative design because the format aligns with my plan for data collection.

Participants

Criteria for Selecting Participants

Prior to selecting study participants, I obtained approval from the Walden University Institutional Review Board (IRB) to ensure my research design adhered to U.S. federal regulations and the ethical standards presented by the university. To obtain approval, I applied to IRB at Walden University and the local school district in the study. The application consisted of an overview of the process for data collection and the informed consent that was provided to the participants. The purpose of the study,

procedures, risks and benefits of the study, contact information, and informed consent was included in the form.

The population for this study consisted of teachers from a local middle school that is located in a southeastern suburban community. I identified potential participants in the study using purposeful sampling. Maxwell (2013) proposed that a purposeful sampling emphasizes a selection of participants based on multiple criteria. Lodico et al. (2010) asserted, “a purposeful sampling is a procedure where the researcher identifies key informants: persons who have some specific knowledge about the topic being investigated” (p.140). Thus, a purposeful sampling allowed the selection of teachers who met the following criteria: (a) teachers must be certified to teach mathematics in middle school (b) teachers must have 2 or more years of teaching experience. Teachers acknowledged they met the above criteria by self-selecting and confirming their participation via email. For this study, there were 17 teachers who could be potential participants; eight teachers participated in the study. According to Leedy and Ormond (2015), purposeful sampling assures that there is an appropriate representation for the overall population. Hence, a sample size of eight to 12 is a sufficient representation to gather teachers’ perceptions to reach the point of data saturation.

Procedures for Gaining Access to Participants

According to Lodico et al. (2010), it is important to determine the process for obtaining approval to conduct the study. To gain access to potential participants, I sought the approval of the Walden IRB. I also completed an application to the Department of Research, Data, and Evaluation for the school district in the study. Once I received

approval from the school district, I secured approval from the principal and provided the principal with a letter from the district. Once the IRB, the designee from the school district, and the principal provided approvals, the potential participants were invited via email to participate in the study. The email included the informed consent to give ethical consideration for the study. The informed consent stipulated participants' rights to withdraw from the research study at any time, and protection of their confidentiality throughout the study. To begin the process of gaining access to potential participants, I executed the following:

1. Obtained school email addresses for teachers from the school website.
2. Sent an invitation and informed consent to potential participants at their school email addresses to participate in the study. The email included the purpose of the study, the participant's role, and the benefits of participating in the study. I also ensured that potential participants knew they did not have to participate in this study, but their time was appreciated. The invitation also stated that participants could stop participating at any time.
3. Teachers who expressed their interest in participating in the study were directed to reply and provide their personal email address. Teachers who confirmed were sent the consent form to their personal email address and asked to respond using the words respond with the words "I consent". Participants used their personal email address for further communication throughout the study.

4. The first 8 teachers who responded to the email invitation were noted as participants in the study.
5. Once the participants were confirmed, I contacted each of the participants who respond to the email invitation, and I began scheduling interviews.

Researcher-Participant Working Relationship

A researcher-participant working relationship was established between each participant and me by scheduling each interview at a date, time and place agreed upon with each participant. Accordingly, scheduled interviews did not interfere with participants' classroom instructional time and took place via Zoom. An audio recording was made of each interview. I reminded participants that the informed consent stipulates their rights to withdraw from the research study at any time as well as to have their identities kept confidential throughout the study. Participants in the study were not identified by their name, rather by a numerical code. This was done to ensure the privacy and confidentiality of the participants in the study.

I established a cordial researcher-participant working relationship with each of the participants as educators in the same school district and ensured they felt at ease with answering the interview questions. At the start of the interview, I eased them into the interview by reassuring them that I would protect their identities in the study, by reminding them that I was available to assist them throughout the study, and by engaging them in a brief ice-breaker activity using a personalized open-ended question. According to Merriam and Tisdell (2016), taking a respectful, nonjudgmental, and nonthreatening approach is essential to conducting effective interviews. Thus, I informed the participants

that as the researcher, I would monitor the interviewing environment and create an atmosphere where participants could feel free to express their thoughts and opinions and feel confident that they would not be judged while participating in the study.

Protection of Participants

The protection of the participants in the study was vital to the research. According to Lodico et al., (2010), ethical considerations are established to protect the rights of the participants in the study. Thus, to ensure research ethics were established, I confirmed that the participants had read the informed consent form. The informed consent included (a) the purpose for the research, (b) detailed description of the study (c) potential risk and benefits, (d) outlined procedures, and (e) privacy information. Additionally, I informed participants that their names would be kept confidential and participants could choose to disclose experiences during the interviewing process that they feel were pertinent to the study. I used a numerical code to identify participants in the study to ensure confidentiality. I will secure all data in locked filing cabinet for 5 years from the day of the completion of the study. I informed participants that after the 5 years have passed, I will destroy documents, flash-drives, interview transcripts, and audio recordings related to the research.

Data Collection

The qualitative data collection instrument that I used is face-to-face interviews using the Zoom platform. The interviews explored the participants' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about their ideas for improving PD sessions

about DI. According to Merriam and Tisdell (2016), interviews can be used to collect data from a wide range of participants with varying viewpoints so that the researcher can gain an in-depth understanding of the perceptions of the participants in the study.

Moreover, to further examine participants' individual perceptions on DI, I employed face-to-face interviews as the best qualitative method for collecting data. Once I received approvals from the IRB and the school district director for the Department of Research, Data, and Evaluation and signed informed consent form from the participants, I began collecting the data.

Semistructured Interviews

Interviews can be utilized to collect data for a wide range of ideas (Merriam & Tisdell, 2016). I conducted 8 semi-structured interviews of guided and open-ended questions to promote a conversational atmosphere. According to Merriam (2009), semi-structured interviews allow the researcher an opportunity to explore the problem and employ questions that allow participants to explain their answers. The interviews were scheduled after classroom instructional hours, and I arranged the date, time, and location for the sessions with each participant. In the event that there was a scheduling conflict, participants were instructed to email me to reschedule. The interviews took place via an online video conferencing tool; each interview lasted approximately 45-60 minutes. According to Merriam and Tisdell (2016), the Internet has increased the ways in which we can collect data. Online forums such as Skype can be used synchronously to include a video component for face-to-face interviews (Merriam & Tisdell, 2016). To collect meaningful data, I created an interview protocol and interview questions (see Appendix

D). The interview questions assured that the research questions were addressed. At the start of the interview for the research study, I assured participants of confidentiality and remind them that their responses are voluntary. I addressed any concerns participants may have had and provide opportunities for questions to be asked throughout the interview.

Recording the interactions that occur in an interview and reviewing that data at a later date can prove to be useful to the researcher (Lodico et al., 2010). Merriam and Tisdell (2016), propose that this is the most common practice to ensure that “everything said is preserved for analysis” (p. 131). Each interview was recorded using an electronic audio recording device, and fieldnotes were taken to ensure the accuracy of the data. For video conferencing interviewing, I used the internal audio recording mechanism within the platform. Throughout the interviews, I asked questions that encouraged conversations and created an atmosphere where participants could freely share their perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about their ideas for improving district operated PD sessions about DI. Merriam (2009) advised that questions posed should be clear and unbiased and that the researcher should avoid using convoluted words. Questions 1 through 3 addressed RQ1; questions 4 through 6 addressed RQ2; and questions 7 through 9 addressed RQ3. The face-to-face semi-structured interviews allowed participants an opportunity to address the interview questions and provide qualitative data that was used to answer the research questions.

Interview protocol. The interviews in this qualitative study were semi-structured

to provide open dialogue about the perceptions of teachers using DI in the classroom. The semi-structured interview consisted of 9 questions and addressed the research questions outlined in the study. The interview protocol (see Appendix D) contained my welcome statement and the interview questions that were used during each interview. Although, I recorded each interview, I kept a reflective journal to document each participant non-verbal responses that could not be captured through an audio recording. At the start of each interview, I reminded the participants of the purpose of the study.

According to Creswell (2014), the interview protocol needs to also include icebreaker questions, research questions, and probing questions to provide the participants an opportunity to explain their ideas. The interview protocol was divided into three sections: implementing DI, challenges of DI, and improving PD. The first section focused on the middle school teacher perceptions about implementing DI strategies learned in a PD workshop. This section aimed to shed light on the participants' experiences with utilizing DI strategies. I asked questions about the current DI strategies they are using and the experiences they have encountered in their classrooms. The second section focused on the challenges that middle school teachers face when implementing DI in the classroom. I asked the participants questions about the challenges they have faced with incorporating DI strategies in the classroom. The final section addressed middle school teacher ideas for improving PD sessions about DI. This section focused on PD that has been beneficial to effectively incorporating DI, and possible suggestions for further training. At the close of the interview, I thanked each participant for allowing me time to

speak with them. A summary of my initial findings was sent to each participant to review for accuracy.

Keeping Track of Data

I created an organized system to keep track of the data I collected and my emerging understandings. All Microsoft Word documents were kept in a folder on my personal computer with a password protection, and hard copies have been stored in a locked cabinet. A reflective journal was utilized to document and monitor my personal reactions to what I discovered through my research. According to Merriam (2009), researchers often record their experiences including questions, thoughts, ideas, and answers to any questions that may arise during the research process. I used the transcribed interview and reflective journal throughout the research to assist me with searching for patterns and themes in the study.

Role of the Researcher

Researchers must determine the degree of involvement that they will have with participants (Lodico et al., 2010). My role in this study was to function as the interviewer, data collector, and data analyst. According to Merriam (2009), the researcher is highly involved in the research. Hence, my role was to collect, decode, analyze, and report the findings of the study. I am currently an academic coach who has served as educator within the local school district for a total of 17 years. As an academic coach, I facilitate professional development for teachers by sharing instructional strategies to support student learning. I am employed in the school district that served as the setting for the study, and I am a colleague of the participants. I have developed a professional and

personal relationship with some of the teachers working in the district of the study. As an academic coach I do not hold any supervisory position over the teachers; however, I do have first-hand knowledge and experience with some of the teachers who implement DI. Because of this role, there could be potential biases; however, it is my goal to remain objective and receptive to the data. Merriam (2009) affirms, “rather than trying to eliminate these biases or “subjectivities,” (p. 15) it is important to identify them and monitor them as to how they may be shaping the collection and interpretation of data. According to Lodico et al., (2010), it is important for a qualitative researcher to manage researcher bias so that participants in the study are not influenced. Thus, I managed research biases by allowing participants to volunteer for interviews and by using semi-structured interviews to gain insight into the participants personal opinions and viewpoints.

To minimize biases, I stayed aware of sources of biases. I made myself aware of biases by answering my interview questions prior to conducting the interviews. I also asked open-ended interview questions and remained neutral throughout all interview sessions. Merriam (2009) proposed that it is important for the researcher to remain neutral, and refrain from imposing their personal beliefs and opinions to ensure that the participants have an opportunity to share their honest responses to the research questions. I reminded participants that their responses are confidential, and their identities would be notated by a numerical code. I approached the questioning in the interview session without any expectations of a particular outcome. I assured the participants that the purpose of the study was to explore teachers’ perceptions about using DI strategies in the

classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI.

Data Analysis Results

Creswell (2014) advised that there are six steps for analyzing data in qualitative research. The six steps include: (1) collecting data, (2) preparing data for analysis by transcribing notes, (3) reading through data to get a general sense of the information, (4) coding data and assigning labels, (5) coding text for descriptions, and (6) coding text for themes. Data analysis is the process of interpreting the data and this analysis may occur simultaneously while other interviews are being conducted (Creswell, 2014). Data analysis “involves consolidating, reducing, and interpreting what people have said” and it is the “process of making meaning” of the data (Merriam & Tisdell, 2016, p. 202).

To begin data analysis, I transcribed each interview from the audio recordings. Once the interviews were transcribed, I identified my initial findings. I used a member checking process to engage participants in reviewing my initial findings and providing responses to the findings. Member checking ensures that the researcher has accurately recorded the participants thoughts and ideas (Merriam, 2014). According to Creswell (2014), member checking involves providing the participants an opportunity to review the initial findings and to provide feedback about my interpretation of the data. Candela (2019) suggested, “Member checking provides a way for the researcher to ensure the accurate portrayal of participant voices by allowing participants the opportunity to confirm or deny the accuracy and interpretations of data, thus adding credibility to the qualitative study” (p. 620). Hence, I provided each participant an opportunity to review

and consider my initial findings and to provide comment; however no adjustments were needed.

Coding Process

Coding is a process of organizing the data collected into chunks and categorizing the data to form codes (Creswell, 2014). According to Merriam and Tisdell (2016), “coding is nothing more than assigning some sort of shorthand designation to various aspects of your data so that you can easily retrieve specific pieces of the data” (p. 199). In qualitative studies, the researcher assigns code words or phrases to explain the emerging themes in the study. The open coding process provided an opportunity for me to uncover commonalities within the data collected. I used a highlighting system to code the interviews and created a table assigning coding to each theme. I read the transcripts from the interviews and assigned a single code to the words or phrases from the interviews. I looked for patterns within the data collected. I used colored highlighters to note similarities in phrases used by each participant. I organized the coded data into emerging themes and linked the repetitive sentences, words, and phrases to each of the research questions. According to Creswell, (2012), themes may vary in sequential arrangement from basic to complex. I categorized the highlighted statements and organized them according to the research questions.

Research Accuracy and Credibility

Trustworthiness in a qualitative study is based on whether the findings are credible, dependable, transferable, and confirmable. To help ensure the trustworthiness of the study, credibility was established. Lodico et al. (2010), suggested, “credibility refers

to whether the participants' perceptions of the setting or events match up with the researcher's portrayal of them in the research report" (p. 273). Creswell (2014), affirmed that credibility refers to the trustworthiness of the data collected and analyzed. Trustworthiness refers to the authenticity of the research and is achieved through member checking (Creswell, 2014). Member checking was used to validate the credibility of my study. Meriam and Tisdell (2016), suggested that member checking provides the researcher an opportunity to take the preliminary analysis back to the participants in the study to ensure that their true perspectives are accurately captured. It is a way for the participants to verify their responses and evaluate the accuracy and credibility of the initial findings. I gave each participant a copy of the initial findings to ensure their responses were not prejudiced by any biases (Lodico et al., 2010). By performing the process of member checking, I ensured that each participant had an opportunity to correct any misunderstanding prior to coding their responses. This minimized any inaccuracy in the findings and enhanced the credibility of the study.

I also ensured that the thoughts and perceptions of the participants were accurately represented in the study by ensuring that the research were dependable and transferable. Dependability refers to the consistencies of the process used during data collection and analysis whereas transferability identifies the similarities of the research findings. Dependability is established when a research study can be repeated and the research findings would still be consistent. To establish dependability, I included a detailed description of my research process which would "show that, if the work were

repeated, in the same context, with the same methods and with the same participants, similar results would be obtained” (Shenton, 2004, p. 71).

Transferability is established when research findings can be transferred to the readers’ own setting (Korstjens & Moser, 2018). To determine transferability, I included specific details and vivid terms to show trustworthiness. I increased the potential for transferability by presenting rich and detailed descriptions of the setting and the participant’s work experiences and perceptions.

Confirmability was also established to assure accuracy and credibility. Confirmability was addressed in how I reflected on the data and connections were made during the coding process. According to Korstjens and Moser (2018), “as a qualitative researcher, you have to acknowledge the importance of being self-aware and reflexive about your own role in the process of collecting, analyzing and interpreting the data, and in the pre-conceived assumptions, you bring to your research” (p. 123). To strengthen confirmability, I used reflexivity during the research process by ensuring that the findings were grounded in data and based on participants’ responses and not any researcher biases (Korstjens & Moser, 2018).

Discrepant Cases

When conducting qualitative research, researchers should address the possibility of discrepant cases. The purpose of reporting discrepant cases is to ensure that the data are accurate and credible (Creswell, 2014). According to Merriam (2009), it is important to recognize that different viewpoints can provide discrepant information that are contradictory or may dispute your projected findings. I examined the data collected to

identify discrepant data. I reviewed the interviews to identify data that did not fit the emerging themes in the study. It is important to share contradictory information that is divergent to the thematic relationships to ensure the credibility of the research (Creswell, 2014). I looked for any conflicting explanations in the interviews. Patton (2015) proposed exploring alternate findings that may diverging interpretations. Any discrepant cases would have been included in the research findings to give other researchers a full account of the participant's responses and increase the trustworthiness of the study; however, there were no discrepancies reported.

Findings

The problem that prompted this study was that mathematics teachers at the local middle school were struggling to implement DI strategies in mathematics lessons as presented in PD meetings and as directed by school administrators. The purpose of this study was to explore teachers' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI. Eight participants were assigned a numerical code and were referred to by the assigned code in all interview documentation to ensure the privacy and confidentiality of the participants in the study. Based on the analysis of the data, the participants believed that they were using differentiated instructional strategies to engage students, but they shared that insufficient time and resources, at times limits their options for differentiation. The participants also revealed that hands-on, modeled professional development specifically related to mathematics instruction is needed on a consistent basis.

In this section, the themes that I obtained from the collected data are reported and discussed. The following themes were derived from the one-on-one interview sessions: (a) Middle school mathematics teachers utilize differentiated instructional strategies based on student data (b) Middle school mathematics teachers face challenges with time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies and (c) Middle school mathematics teachers desire to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. The themes mentioned were derived from coding the collected data. Based on the analysis of the data, categories of data were discovered, and from those data categories, themes emerged from the participants' statements that were aligned with the research questions in the study (see Table 2).

Table 2

Perceptions of Middle School Mathematics Teachers – Themes

Categories of Data	Themes
<p>Approaches to Differentiate Instruction</p> <ul style="list-style-type: none"> • Learning Styles Inventories • Teacher Observations • Informal / Formal Assessments 	<p>Middle school mathematics teachers utilize differentiated instructional strategies based on student data.</p>
<p>Challenges/Barriers</p> <ul style="list-style-type: none"> • Resources • Time • Student Behavior • Diverse Learning Needs 	<p>Middle school mathematics teachers face challenges with time, resources, and student behavior when employing the various differentiated instructional strategies</p>

Professional Development:

- Math-Centered PD
- Hands-On
- Modeled PD
- Teacher – Choice PD

Middle school mathematics teachers desire consistent, hands-on, and modeled professional development that is specific to their content.

Theme 1: Utilizing Differentiated Instructional Strategies Based on Student Data

Middle school mathematics teachers utilize various differentiated strategies during instruction. The data from which the first theme was derived showed that middle school mathematics teachers employed DI strategies based on student data. This theme was identified from the category as approaches for providing differentiated instruction. Approaches that were mentioned were based on student data including (a) Learning Styles Inventories, (b) Teacher Observations, and (c) Informal / Formal Assessments

Middle school mathematics teachers shared some of the approaches they use to differentiate instruction. I asked the study participants, “How do you decide which DI strategies to use in your classroom? Most of the participants gave similar responses by acknowledging that they differentiate based on the varied learning styles of their students.

Participant 1 stated:

I would ask the students questions or have some type of a learning style inventory assessment to see how they learn. Understanding how they learn, especially if it's class specific. For example, one student may learn more visually, while another student may learn more auditorily or may have need for more manipulatives. So, understanding that may help me when I prepare my lessons.

Participant 1 further shared knowing this information helps determine how to differentiate to meet the needs of the individual students. Participant 7 affirmed, “Every class of every school year I give students a learning styles survey that they keep in their portfolios and that helps me determine how I’ll differentiate throughout the year.” Similarly, participant 3, 5, and 6 mentioned that they utilize hands-on activities to differentiate based on their students’ learning styles. Participant 3 shared an assignment where students had to find the area and perimeter of shapes using yard sticks and floor models to support students’ varied learning styles. Participants mentioned that they use various forms of assessments to assist them in deciding which differentiated instructional strategy they will utilize. Participant 4 stated, “I differentiate based on my students needs and learning styles, but I also look at their data from classroom tests and standardized tests.” Participant 6 agreed, “I determine which differentiated instructional strategy I am using based on the various testing. For example, with our common assessments, I can see how students grew and based on what they do on these tests I can disaggregate the data and group them by their ability levels.” Similarly, participant 8 mentioned that the student data helps determine the next best step to take with instruction, remediation, and/or enrichment.

Participants also mentioned that they use student data from common assessments, state assessments, and teacher observations to differentiate their instruction and to create learning groups. Participant 7 stated, “I use frequent assessments, I don't necessarily take grades for the assessment, so it is basically informal, a lot of informal assessments, a lot of oral questioning, quick assessments, like one or two questions.” Participant 2 and 3

shared that it is important that the data is collected from various sources to create a clear plan of action for meeting the student's specific needs. Most of the participants stated that based on their assessment data they are able to determine the effectiveness of the DI strategies utilized. Participant 1 stated,

I measure the effectiveness of DI based off the data that comes back after students take their assessments. Whether it be benchmarks, whether it be quizzes, exit tickets etc.; anything that students are capable of turning in (which I may or may not take for a great work), but it's the only way that I know if any of the DI lessons are effective.

Participant 7 agreed,

Most of the time if I differentiate using a certain resource like an assignment...I can assess while I'm teaching. I'm doing this process to see if students are grasping the concept or not. And if I need to make some revisions or kind of go back to the drawing board and try to do something else if it's not working.

Similarly, Participant 4 stated, "looking at the common assessments and our exit slips and tickets out the door...I've been able to measure who's getting it, and who's not."

Participant 8 agreed, "I can see an increase in the number of students improving."

To gather more information, I also asked the study participants, "what are some DI strategies you use in the mathematics classroom?" Participants shared various data-driven approaches to differentiating instruction by content, process, product, and/or the learning environment. Participant 7 stated, "Personally, I like differentiating with the content. The actual materials that I use to deliver the instruction." Participant 1 shared an

example, “If I want to give some students one-step word problems, while others complete multi-step work problems then I am able to remediate and enrich based on each student’s needs.” Participant 6 stated, “everybody being able to dissect a word problem in different ways, whether it was color coded, whether it was outlined to provide support, they were able to dissect it based on their level of learning rather than just telling them to go solve the problem.” Participants shared that placing students in their assigned groups based on student data is essential to ensuring that students receive specific instruction for their individualized need. Participant 4 stated, “I have students in small groups or flexible groups by ability levels...” Participant 3 stated, “we may have a lower-level learner working with a high achiever” when students work in their groups. Participant 3 also shared that having different levels of learners in flexible groups based on their specific need at that time has been a strategy that has proven to be quite effective. Additionally, some participants mentioned that they use stations as a DI strategy to provide an opportunity for groups to work at differing academic levels. Participant 2 stated:

I like to use stations... a group of students actually working technology, then having a group of students working on another assignment independently, and then the other group of students can work in a small group where they're getting instructions directly from me so they're able to work while the other kids rotate. So, by them working independently on their own when they come to me, I can assess them and give them further instructions to help them understand what they're doing.

Participant 4 agreed, “stations is the most effective strategy for me, and I also feel like it is the easiest way for me to actually control the lesson without feeling like it is overwhelming and to get the kids to be able to understand the lesson.” Participant 3 mentioned that stations provide an opportunity to use data from assessments and informal observations to ensure students are reviewing the same standard while giving students the autonomy to share their work in different ways. Participant 1 shared a differentiated activity where students were grouped based on assessment data and given specific roles within the groups based on their learning styles. Participant 1 stated:

One of the projects that we had in a previous year dealt with finding the area and perimeter of cereal boxes, so breaking the students into teams based on student data in order to solve math problems was helpful because students had specific roles. There was a writer who would jot down information. There was a person who figured out the measurements. There was a person who was responsible for the actual computation. And then, overall, there was a person who asked questions, or would jot down questions that students had altogether. There were different types of learning styles which differentiated the learning in one project assignment.

Ultimately, all participants expressed the importance of using student data to provide the appropriate instruction and to maximize each student’s learning opportunities.

Theme 2: Challenges with Utilizing Differentiated Instructional Strategies

Participants expressed difficulties with implementing DI in a mathematics classroom. While most participants acknowledged the importance of engaging students in

DI strategies, participants also shared some reasons why they considered DI to be difficult to implement daily. The data from which the second theme was derived showed that middle school mathematics teachers face challenges when employing the various differentiated instructional strategies. This theme identified challenges and barriers associated with implementing DI. Challenges that were identified by the participants were (a) resources, (b) time, (c) diverse learning needs, and (d) student behavior.

Participants were asked questions related to the challenges they face when utilizing DI strategies in the mathematics classroom. The information that was provided was based on the brick-and-mortar environment and the virtual setting during COVID. I asked the study participants, “In what circumstances do you find that DI is challenging to use?” Participants expressed that the resources available to teachers and students in the brick-and-mortar and virtual environment are scarce. Some of the participants shared that the inadequacy of resources has been one of the biggest challenges with implementing DI. Participant 7 stated, “It’s hard to differentiate instruction in this current situation and it has become a little more challenging, simply because I’m not face to face with my students.” Participant 5 agreed, “the virtual setting has placed a major roadblock with differentiating instruction because everything is done on Microsoft Teams and there is not much hands-on activity.” While having the necessary resources in a virtual environment is a challenge, some participants shared the challenges of having adequate resources in the regular brick-and-mortar environment is a major concern as well. Participant 6 shared “sometimes the internet is not working, sometimes the students don’t have the resources at home, and sometimes teachers lack the resources to be able to

execute the activities.” Participant 1 shared, “Resources are limited in the sense that; especially for math, there's not many activities that we can do to differentiate.”

Participant 6 expressed challenges with having the resources and supplies to make real world connections with mathematics. Similarly, Participant 3 shared, “when we differentiate our instruction in small groups, we don’t always have enough books, computer, or materials...” Participant 8 stated, “if we had different resources, strategies, and materials it would give us more ways to position the class to meet the specific needs of the students”. Overall, most participants expressed their concern for lack of resources to effectively utilize DI strategies in the mathematics classroom. Some of the resources mentioned were curriculum materials, mathematic manipulatives, technological devices, mathematical computer programs, and everyday classroom supplies.

Although having resources was a shared concern of most of the participants, 4 of the 8 participants expressed concern with having time to effectively implement DI in the mathematics classroom. Participants expressed the benefits of DI, but shared that time was one of the greatest barriers. Participant 5 stated, “with differentiated instruction, a lot of planning is involved, and oftentimes, you know as the teacher, you're stressed for time.” Participant 8 stated, “the teacher is only one person”. Participant 3 shared that in order to implement DI with fidelity, time is needed to plan lessons to ensure it encompasses the standard and a level of rigor. Participant 7 stated,

It can be difficult and time-consuming when I am trying to make sure I give everybody what they need...making sure everybody gets the same quality time and the same quality of instruction, and not feeling like I'm watering down the

content for certain standards... trying to implement differentiated activities but still keep a certain level of rigor.

Some participants also shared that not only is more time needed for planning, but also more time is needed to review the foundational skills necessary for students to meet the mathematical standards. Participant 8 stated,

Time is an issue...the skill level of majority of the kids shows that they are not able to keep up with the pace. Students have a difficult time keeping up because they lack foundational skills...we could use more time to review foundational skills...really showing students how math is a part of their everyday life.

Other participants agreed and mentioned that it is difficult to differentiate when trying to keep up with the state curriculum and the pacing for the district while knowing that there are still numerous mathematical deficiencies that need to be addressed with the students.

Participants also expressed challenges with addressing the diverse learning needs of students in the mathematics classroom. Participant 2 stated, 'It is challenging when there is such a huge gap between the level of understanding...You have those who are high and then those who are really, really low.' Participants 5 and 6 agreed, that DI is difficult to implement when you have a great number of low performing students.

Participant 1 stated, "I may have three or four proficient students, and I may have 15 that have basic knowledge, and then another 5 that are below basic, and then trying to make sure that they're all getting the required information, or the necessary supports makes it quite difficult." Similarly, Participant 6 shared that trying to create a lesson that addresses students' prior knowledge and connects to the current mathematical standard is a

challenge when students don't have the prior knowledge to connect the concepts. All participants agreed that creating lessons to meet the individual learning needs of students is beneficial to their overall growth and development; however, there were some participants who shared their concerns as to how DI strategies would ultimately help students who are required to take state-standardized tests with a pass/fail outcome. If the state-standardized test requires mastery of grade-level content standards, yet some students are performing several grade levels below this requirement then most participants shared their struggle with how to differentiate the instruction to address their students' needs and meet the state-mandated expectations.

In addition to resources, time, and diverse learning needs, participants expressed that managing student behavior is a challenge. To gather more information, I asked the study participants, "Tell me about a time when you implemented DI and you experienced barriers with implementing DI in the mathematics classroom." Participants shared that one major barrier to implementing DI in the mathematics classroom is trying to keep middle school kids focused and on task while participating in various differentiated activities. Participant 1 stated,

I have had students who may sleep in class and no matter what I say, no matter what I do they feel the need to go to sleep in class, and it's one of those, even if I put you in a group, you're not going to participate as much, or I have students who have developed friendships and because of that it makes separating them into groups difficult because they'll always find a way to play around; no matter who I group them up with.

Participant 4 stated, “you have some students who just won’t work...so it becomes more of a challenge for me because I’m having to have multiple groups where I have to constantly go around and make sure everybody is on task.” Similarly, Participant 8 stated, “some students who exhibit off task behavior can make it difficult to work with one group while other students work on another assignment”. Participant 5 shared, “I probably could use a second teacher in the room...just somebody to patrol alongside myself...making sure the kids are staying on task.” Participants 3 and 6 mentioned that it can be a struggle to differentiate when students are disruptive during classroom instruction. Most participants shared that student behavior can interrupt the overall goal of trying to meet each student’s specific needs.

Theme 3: Ideas for Effective Professional Development

Participants shared similar views about the importance of participating in PD to positively influence a teachers’ ability to implement DI strategies. Conversely, participants expressed the need for PD that is specific to mathematics instruction. The data from which the third theme was derived showed that middle school mathematics teachers welcomed PD. This theme identified the need for effective PD related to DI strategies. PD opportunities that were identified by the participants were (a) Content-Specific PD, (b) Teacher Choice PD, (c) Hands-on PD, and (d) Modeled PD.

Participants were asked questions related to the PD sessions they have previously attended. Participant 8 stated, “DI strategies should be presented in relation to the specific content.” Four out of the 8 participants mentioned that although PD is offered at their school, it would be beneficial to have PD that is specifically geared to teaching

mathematics. Participant 7 shared that it would be more beneficial to mathematics instruction by “Showing more specific examples on the implementation of differentiated instruction...as it relates to certain standards or certain ability levels or certain learning styles, or certain personalities.” Participant 3 agreed that PD sessions related to the mathematics standards being taught would help with differentiating the mathematics instruction. Participant 4 stated, “I feel like you would get more buy in and more teachers engaged if they see how the strategy is working with their peers” who teach the same content. In addition, some participants shared the need for teacher input in choosing PDs that are relevant to their teacher practice. Participant 7 stated,

I really think the PD should provide an opportunity to get input from teachers beforehand on what we need versus assuming that we need more development on a certain thing. I think it would be more beneficial to just get teachers’ input and let teachers complete a survey on what it is we need...kind of differentiating the PD because one teacher may not need more development, whereas another teacher may be really struggling.

Some participants shared that there can be a disconnect when teachers are required to attend PD sessions that they feel are not necessary to their professional growth.

Participant 1 agreed, “I feel like there's a disconnect, just like with students who get disengaged with the lesson, there's a disconnect with teachers who have to go to a PD session that they are already familiar with.” Participant 5 stated, “oftentimes there will be chatter amongst my coworkers which can distract me while I'm trying to pay attention.” Participant 7 agreed,

A lot of times it can be a waste of time when you have certain teachers who have kind of mastered something, whereas you have other teachers who don't know hardly anything about it sitting in the same PD. So, I feel like the time should be spent, focusing on those teachers, helping them and having a PD for the teachers that actually need and can benefit from the strategy.

Participants 3 and 6 mentioned providing teachers an opportunity to register for PD relevant to their specific need would be more effective. Participant 2 agreed that having an opportunity to sign up for PD is most beneficial, "I think it's better because if the PD is not needed or relevant, then you don't have to attend, and if is something that you want to try it, then you could have the opportunity to go ahead and get that exposure." Participant 1 stated,

It would be nice if there were registration forms with different categories for teachers that were looking for a specific PD...For example, if I wanted to attend a PD specifically on flip charts. I can go to that PD that was assigned to get assistance on that specific topic. Then, I can attend PDs based on my need.

Similarly, Participant 4 shared, "at my school we have optional Pop-In PDs, and if I feel like it's something I need, then I attend, but if I feel like I don't need it, then I don't attend...it's optional." To gather further information, I asked the study participants, "How should PD sessions be structured to meet your needs as a teacher?" Most participants shared the need to participate in PD sessions that were hands-on. Participant 6 stated, "I am a hands-on learner...I like to touch it...see it...I am not somebody you can just give a paper to and think I will understand it." Participant 8 affirmed, "I need all

3 modalities...I don't want to just see it and hear it, but I want to do it." Participant 4 agreed, "we need some sort of visual and not just someone talking and lecturing...we need some sort of manipulatives to use alongside the presenter." Participant 7 mentioned that PD would be more effective if there were "more hands-on and one-on-one support." Participant 1 agreed, I am more of a hands-on teacher. I like manipulatives, I like actually doing the activities myself...I like to be a part of the learning experience." Participant 2 stated, "I like more hands-on PD because its more engagement...I'm actually seeing how it can work in my classroom." Correspondingly, most participants who shared their desire to have hands-on PD, also expressed the need for more modeling of DI strategies.

Participant 8 stated, "The most beneficial PD for teachers is for teachers to sit in the place of their students...Modeling, working together, looking at the snags, then teachers having time to see where students will have hiccups or snags." Participant 2 stated,

When a new strategy is being introduced, I don't mind if you were to come in and teach me something new. I'm okay with watching you implement the strategy in my classroom; so, you could implement it one period and then the next period I can implement it, and then I can see how to do it. Then, I can actually get feedback...for example, these are your glows, and these are your grows.

Participant 1 agreed, "I like the strategy to be shown to me, not necessarily like a PowerPoint, but if you show me what you're doing and actually go through the motions of what you're doing, then I could do it myself to prove that I am learning what has been taught." Participant 6 shared, with PD sessions, "there should be some type of demonstration...show me what I need to do and let me give it back to you." Participants

shared that a modeled PD provides an opportunity for the presenter to demonstrate the expectations on how to implement the DI strategies effectively. Participant 7 mentioned, the need for “seeing how they implement it.” Participant 3 stated. “it makes all the difference when teachers are able to see how to implement the strategy in their actual classroom”. Participants agreed that DI strategies are most effective when teachers know how to use them during classroom instruction.

Discussion of the Findings

In this section, the following themes are discussed in connection to the data of the study and the literature: (a) middle school mathematics teachers utilize differentiated instructional strategies based on student data, (b) middle school mathematics teachers face challenges with time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies, and (c) middle school mathematics teachers desire to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content.

Theme 1. The first theme revealed that middle school mathematics teachers employed various DI strategies based on student data. Participants believed that using learning style inventories provided them an opportunity to ensure favorable outcomes for their students. Alavinia and Sadeghi (2013) asserted “learning styles are among the major determiners of an individual’s success/failure in the course of learning” (p. 78). In addition, participants believed that it was vitally important to use assessment data as a foundation for employing the various DI strategies. Ongoing assessments are crucial and play an important role in providing teachers with the necessary information to create

lessons that best fit the needs of their students (Loeser, 2018). According to Goddard et al., (2019) “differentiated instruction is described as being most effective when teachers pre-assess students on content included in upcoming lessons or units, plan instruction based on assessment results, and allow flexibility for students in terms of process and product options” (p. 201). Participants identified small group instruction, stations, and flexible grouping as the common strategies used in their classrooms. Research literature confirmed that these strategies are valuable strategies to use when trying to meet the diverse needs of students (Loeser, 2018). The strategies shared were employed based on student data from learning styles inventories, teacher observations, and informal and formal assessments.

Theme 2. The second theme revealed that participants believed middle school mathematics teachers face various challenges when trying to utilize DI strategies in the mathematics classroom. Participants explained their challenges with implementing DI in their daily practice. Participants believed that the lack of resources posed a challenge when trying to implement DI effectively. According to Trinter (2016), many schools do not have the funds to offer sufficient resources to successfully implement DI strategies. In addition, participants believed that time is needed to effectively implement DI strategies. Smets (2017) suggested that teachers need time to collaborate with their colleagues to differentiate instruction effectively. According to a research study by Smith and Robinson (2020), “the most common need expressed by the participants was time to collaborate within a grade level and across grades both for planning and to share expertise among colleagues” (p. 64). Participants believed that managing DI with diverse

learning needs can also be difficult. Researchers suggested that teachers often times become overwhelmed with trying to address the diverse needs of students (Grierson & Woloshyn, 2013). Loeser (2018) affirmed that teachers “worry that if they are required to address all of the content and performance standards in order to ensure success on standardized tests, it is even more difficult to be responsive to all of the diverse learning needs and styles in a classroom” (p. 5). Participants reported that in addition to resources, time, and diverse learning needs, dealing with disruptive student behavior can be a barrier in implementing DI strategies in the mathematics classroom. There is evidence of the effectiveness of DI in decreasing events of misbehavior (Niño, 2014); however, participants believed that more support is needed to address how to keep students focused and engaged. The participants revealed that these challenges influence their ability to implement DI with fidelity.

Theme 3. The third theme revealed that middle school mathematics teachers believed that there is the need for effective PD related to DI strategies. According to Loeser (2018), “most teachers have been exposed to very few models of differentiated instruction throughout their own education and therefore find it difficult to transfer these instructional methodologies into their own classrooms” (p. 5). Participants believed that PD related to DI strategies should be content-specific. Middle school teachers are generally certified in a specific content area. Instructional supports for teachers need to be provided to ensure that students are given what is needed to help them understand their grade level mathematical standards (Ozkaya & Karaca, 2017). In addition, participants believed that teachers should have a choice and/or input in deciding which PD sessions

they attend. A teachers' voice needs to be heard (Bates & Morgan, 2018). Research suggested that the relevance of the PD session has a great influence on the teachers' acceptance what is offered during the PD (Smith & Robinson, 2020). Not only did participants believe that PD sessions should be content-specific and based on teacher choice, but participants believed that PD sessions related to DI strategies should be hands-on to create a more engaging training experience. According to Smith and Robinson (2020), "trainings are often ineffective because they lack interaction and do not consider nor adjust to the needs of teachers" (p. 58). Participants believed that these PD sessions would benefit from including opportunities for presenters in PD session to model the expectation. Modeled PD has the potential to provide teachers with a more robust understanding of the strategies presented during PD sessions (Wilkerson et al., 2016). Ultimately, participants expressed the need for PD; however, the importance of structuring the PD to meet the specific needs of the teachers who participate in the PD sessions.

The conceptual framework for this study was Tomlinson's framework for differentiation. Tomlinson (2003) suggested that DI is an approach to teaching that is student-centered and used to engage students, based on their varied interests, strengths, and weaknesses, to support how they learn best. This framework highlights the significance of teachers intentionally modifying the learning content, process, product, or environment in response to students' interests, readiness, and learning profiles. Moreover, this conceptual framework provided background knowledge of DI strategies, and the

need for equipping teachers with professional development related to DI strategies and mathematics instruction.

The three themes showed that teachers believed in the importance of utilizing DI strategies to meet the specific needs of students, and that despite the challenges, they wanted to participate in PD sessions that were structured to meet their specific needs as teachers. Participants discussed that they used data from learning styles inventories, teacher observations, and a variety of assessments to ensure that their instruction was differentiated based on students' needs. Participants described their use of small group instruction, stations, choice boards, and flexible grouping as strategies they most commonly use in their classrooms. Participants expressed some of the challenges they face when implementing DI such as resources, time, diverse student learning needs, and challenging student behavior. However, participants also shared the importance of utilizing DI strategies and the need for further PD related to DI. Participants shared that PD should be content-specific, teacher choice, hands-on, and modeled.

Conclusion

In exploring middle school mathematics teachers' perceptions about using professional development learning of DI strategies in the classroom, about the problems they may encounter trying to use new strategies after a training session, and about suggestions for improving the effectiveness of translating professional development into practice, I addressed the three research questions for the study. The research questions addressed teachers' perceptions about using DI strategies in the classroom, about the

problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI.

RQ1: What are middle school teacher perceptions about implementing differentiated instructional strategies learned in a professional development workshop?

Theme 1 indicated that middle school mathematics teachers recognize the need for utilizing DI strategies based on learning styles, teacher observations, and assessment data. Participants shared various approaches for providing the appropriate instruction for students. Participants described how students are grouped based on student data, and shared that the DI strategies learned in PD (i.e. small group instruction, stations, and flexible groups) have been beneficial in the mathematics classroom.

RQ2: What are middle school teacher perceptions about the challenges of implementing differentiated instructional strategies?

Themes 2 indicated that teachers are faced with varied challenges when implementing DI strategies in the mathematics classroom. Participants described their experiences with implementing DI strategies in their classrooms. Participants shared that resources, time, diverse learning needs, and student behavior can prove to be a challenge when trying to implement DI strategies effectively.

RQ3: What are middle school teacher ideas for improving professional development sessions about differentiated instructional strategies?

Theme 3 indicated that middle school mathematics teachers recognized the need for PD sessions; however, shared the need for improving PD. Participants described their

experiences with PD sessions related to DI. Participants shared that PD sessions should be specific to mathematic instruction, provide teachers with a choice and/or in put in the DI strategies needed, and offer hands-on modeled support for the proposed DI strategy.

Based on the findings, middle school mathematics teachers need resources, time, and strategies that address the diverse needs of students, and the possible disruptive behavior of students in the mathematics classroom. I propose that a mathematics professional development program be developed that provides teachers with DI strategies that are content specific, and that provides teachers with choice, hands-on activities, and DI strategies that can be modeled for mathematics instruction. In section 3, I will utilize the information from the findings to provide a project that will offer a plan for professional development for middle school mathematics teachers.

Section 3: The Project

Introduction

The project I developed consisted of a 3-day PD session to address the following three themes identified from the study: (a) Middle school mathematics teachers utilize differentiated instructional strategies based on student data (b) Middle school mathematics teachers face challenges with time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies (c) Middle school mathematics teachers desire to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. The interviews with teachers supported the need for PD session that is specific to mathematics instruction, that provides teachers with a choice and/or input in the DI strategies needed, and PD that offers hands-on modeled support for the proposed DI strategy.

The purpose of this study was to explore teachers' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI. Through my data collection, I examined the perceptions of middle school teachers about implementing DI in a mathematics classroom, the challenges associated with implementing DI, and the ways to overcome these challenges. The three themes revealed that participants understood the importance of DI but were having difficulty implementing the DI strategies effectively.

In this section, I discuss the project that was designed to address the need for utilizing DI strategies in the mathematics classroom. Teachers will have an opportunity to

develop a clear understanding of the components of DI and how the various DI strategies can align with mathematical standards. In addition, teachers will have time to collaborate with their colleagues to develop lessons that will maximize their use of the DI strategies that will be most beneficial for the lessons they have created. The goal of this project is to increase the effectiveness of utilizing DI strategies in the mathematics classroom by enhancing middle school teachers' knowledge and understanding of various DI strategies. Section 3 will provide a description of the plan which will include the goals, content, rationale, resources, implementation, and potential barriers. To develop a rich understanding of the themes identified in this study, I will provide a second review of the literature to support the project. This section concludes with an evaluation of the project and a summary of possible social change implications.

Description and Goals

In this study, I explored the perceptions of middle school mathematics teachers as they relate to DI. During interviews, some teachers struggled with what it means to differentiate instruction and what it actually could look like in a mathematics classroom. Teachers described the need to observe DI in action in conjunction with PD sessions. Thus, this project is a 3-day PD for teachers who want to enhance their knowledge about the various DI strategies and how they can be utilized in the mathematics classroom. This project is designed for teachers to come together three times over the course of 9 weeks to participate in the PD. This project was created based on the themes derived from the interviews with the participants. The themes revealed that participants (a) utilized differentiated instructional strategies based on student data (b) faced challenges with

time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies (c) desired to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content.

The goal of this PD will be to provide teachers with the resources, strategies, and tools to positively influence teaching and learning. The sessions will incorporate PowerPoint presentations, video clips, pre-recorded modeled DI lessons, hands-on learning, and peer-teacher observations. Prior to the session, teachers will be assigned groups based on the grade level they teach. Upon their arrival, teachers will be instructed to sign in, sit at their assigned table, and complete a tent-card name tag while they wait for the PD session to begin. At the start of the 3-day PD, I will welcome the participants and provide an overview of what teachers should expect throughout the course of the PD. I will provide an opportunity for teachers to ease into the learning process by beginning with an icebreaker activity that addresses each teacher's learning style. I will make the connection between this ice breaker activity and the concept of DI. Additionally, on the first day of the PD session, teachers will focus on establishing a clear understanding of DI and what strategies could be used in the mathematics classroom. This session will also focus on modeling so that teachers can see what DI looks like in a mathematics classroom, and how to employ the strategy in their lessons. Teachers will watch pre-recorded model lessons of different representations of DI and reflect after seeing other teacher using strategies aligned with the components of DI. At the close of Day 1, teachers will record a FlipGrid presentation showcasing their understanding of DI. These

Flipgrid presentations will be used during the icebreaker activity on Day 2 of the PD session.

On Day 2 of the 3-day PD session, the participants will sign in and return to their assigned groups from Day 1. Once seated, teachers will complete an ice-breaker activity where teachers will review the DI strategies presented on Day 1. At the start of this session, I will briefly review DI strategies and provide an overview of the session. Day 2 will focus on developing mathematics lessons that incorporate the components of DI and utilizing the various DI strategies presented during Day 1 of the PD. Throughout Day 2, teachers will work collaboratively with their colleagues to create lessons that they will deliver to their students prior to attending Day 3 of the PD sessions. Teachers will create a mathematics lesson that will be recorded and shared with their colleagues during Day 3 of the PD. The 3-Day PD session is scheduled over a 9-week period of time; thus, this will provide participants with the necessary time to record their DI lesson for future observation and feedback. During Day 2 of the PD, participants will engage in a peer-share activity where they will identify the learning targets, success criteria, and academic vocabulary for their selected grade-level mathematical standard. Participants will work collaboratively with their assigned grade level to use the Know-Understand- Do (KUD) method to identify the concepts, skills, and principles needed to meet the mathematical standard. Participants will be provided with a KUD template, the DI strategies guide presented on Day 1, and a graphic organizer for planning their lesson. The materials that will be provided for this activity are chart paper, sharpies, index cards, whiteboard, dry erase markers/erasers, the graphic organizers, post-it notes, scissors, highlighters, pencils

and pens. Participants will collaborate to create DI lessons that address their students' interest, readiness level, and/or learning profile. Participants will share DI strategies and mathematical practices that would best benefit their grade-level requirements and their use of the DI in the mathematics classroom. At the close of Day 2, teachers will share their responses from the peer-share activity. A random selector tool will be utilized to engage teachers in discussion. The participants will complete an exit ticket to share what they learned and liked from Day 2 of the PD session. Participants will be reminded of the expectations for their video recorded lesson that will be viewed during Day 3 of the PD sessions. In addition, participants will be asked to bring student artifacts from the recorded lesson.

On the final day of the 3-day PD session, the participants will sign in and return to their assigned groups from Day 1. I will start the session by reviewing information covered on Day 1 and 2. The Day 3 PD session will focus on peer observation where teachers will observe their colleague implementing DI in a mathematics classroom. Teachers will collaboratively work in their assigned groups and share their previously recorded video with their colleagues. The participants in the group will share the glows, grows, and discuss possible next steps. Each teacher will have an opportunity to showcase their model lesson, review student artifacts, and participate in a reflection activity. By the end of the PD sessions, teachers will have created a portfolio of PD handouts and shared artifacts comprising of DI lessons, hands-on activities, resource articles and templates, and classroom assessments. Teachers will complete a written evaluation form on the final day of the PD sessions.

Rationale

The problem that prompted this study was that mathematics teachers at the local middle school were struggling to implement DI strategies in mathematics lessons as presented in PD meetings and as directed by school administrators. The findings from the study revealed that participants (a) utilized differentiated instructional strategies based on student data (b) faced challenges with time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies (c) desired to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. Therefore, I created this project to meet the needs identified by the participants in the study.

According to Kohen and Borko (2019), the need for content-specific and practice-based PD sessions is crucial to minimizing instructional deficits and maximizing academic student performance. Chaudhuri et al. (2019) indicated that PD should (a) focus on content knowledge and student learning in the specific subject area taught (b) utilize an active learning model of instructions (c) include designing units of study (e.g., lessons) (d) require peer observation (e) provide adequate time for reflection (f) be sustained over at least one school year. Accordingly, Zein (2017) suggested that effective PD creates a learning environment where educators can collaborate, share resources and strategies, and develop lessons that can ultimately improve instruction and student achievement. The goal of a PD is to provide an opportunity for teachers to evaluate their current methodologies and practices (Althaus, 2015). The goals of this PD project addresses the study participants' needs that were revealed during the data collection phase of this study.

I created this project with the intention of addressing the participants shared desire to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. Through participation in the PD sessions, teachers will be provided with practical and hands-on experiences with DI strategies that they can use in their mathematics classrooms. Matherson and Windle (2017) affirmed that teachers desire PD experiences that provide them with opportunities to actively engage in hands-on practice with instructional strategies prior to implementing them with students.

The PD was designed based on the data analysis derived from one-on-one interviews. The data analysis highlighted categories of data and themes about DI strategies, challenges with implementation, and desired PD sessions. Each PD session is grounded in the study participants' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI. The participants in the study shared their desire to have PD is specific to mathematic instruction, provides teachers with a choice and/or in put in the DI strategies needed, and offers hands-on modeled support for the proposed DI strategy. Teachers desire PD programs that provide new skills and that can also be used instantaneously to deliver suitable instruction to students (Matherson & Windle, 2017). Thus, to maximize the benefits of the project study, the themes derived from the findings were used to create the project. The 3-day layout for the PD sessions incorporates a collaborative PD model. According to Hubbard et al. (2020), "Collaborative PD models for educators are

generally widespread and essential for taking teachers out of isolation to learn with and from colleagues” (p. 3). Collaborative models such as lesson studies, observation-assessments, open classrooms, study groups, and student work analysis provide teachers with time to work collaboratively, discuss state curriculum, address instructional strategies, and focus on learning (Hubbard et al., 2020). Althaus (2015) stated that in order to maximize positive changes in student performance, teachers should have collaborative PD opportunities where they are able to cultivate their knowledge in pedagogy, demonstrate their understanding of best practices, and develop standards-based lessons that meet the individual learning needs of their students.

I created a PowerPoint presentation for this study that outlines the learning objectives and outcomes of the 3-day PD. The PowerPoint presentation includes icebreaker activities, group brainstorming questions and activities, and possible resources. The presentation was developed to assist mathematics teachers with developing mathematics lessons that incorporate the components of DI and the various DI strategies beneficial to mathematics instruction. Throughout the 3-day PD session, each participant will be provided with the mathematics standards for their specific grade level, DI strategies and resources that correlate with the mathematics standards, and a PowerPoint presentation handout with space to record notes. On Day 1, the participants will focus on (a) developing a clear understanding of what DI is (b) outlining specific DI strategies that could be used in the mathematics classroom (c) observing a model teacher utilize a DI strategy in a mathematics classroom. On Day 2, the participants will (a) identify learning target and success criteria related to grade-level mathematical standards

(b) develop lessons that incorporate the DI strategies learned during the PD session. On Day 3, the participants will focus on observing their colleagues implementing various DI strategies, review student work samples, and reflect on their observations. By the end of the 3-Day PD session, the participants will have a portfolio of PD handouts and shared artifacts comprising of DI lessons, hands-on activities, resource articles and templates, and classroom assessments. The participants will complete an evaluation form providing their feedback from the 3-day PD sessions.

Review of the Literature

In the review of the literature, I conducted a search and analysis of peer-reviewed research studies using the Walden University library resources such as Education Research Complete, ERIC, Thoreau Multiple Databases, Education Source, ProQuest, and SAGE Journals. In addition, I used Google Scholar and Google. The following key words were searched: *DI, effective professional development for teachers, differentiated PD, content specific PD, teacher choice PD, modeling DI, peer observations, collaboration, modeled PD, hands-on learning, and mathematics instructional strategies*. The literature review supported a 3-day PD session as a framework for this project study, and the scholarly research presented connects the study themes with the PD activities developed.

Professional Development

PD is vitally important to instruction in the classroom. PD is an ongoing, continuous process that should be embedded in teachers' instructional practice (McElearney et al., 2019; Valiandes & Neophytou, 2018). According to Akiba and

Wilkinson (2016), “PD is a driving force for improvement of instruction and student achievement and one of the major agendas in federal educational reforms since the No Child Left Behind Act of 2001” (p. 74). Smets and Struyven (2020) proposed that teachers cannot be expected to implement DI without a well-designed and intensive teacher PD program. PD provides an opportunity to advance the effectiveness of teachers to support the overall success of student achievement and classroom instruction through a sustained, comprehensive and intensive approach (Williford et al., 2017). PD provides an opportunity for teachers to stay abreast of current trends in education and continually cultivate their instructional skills (Brigandi et al., 2019). Smets (2017) affirmed that teachers need intensive PD opportunities to collaborate with colleagues to differentiate instruction effectively. The project I created was a PD program that was designed to increase teachers understanding of the components of DI (content, process, product, and environment), while identifying DI strategies that can be implemented in the mathematics classroom and cultivating collaborative opportunities that support the enhancement of teaching practices.

According to Lindvall (2017) PD programs should not be designed as a one size fits all model. Tantawy (2020) agreed “PD cannot be considered a generic or a one-size-fits-all model; teachers’ needs, experience, career stage, beliefs, students, and school context should be taken into consideration” (p.183). A one-size-fits-all does not work with teachers just as it does not work with students so PD must be offered in varied forms (Hubbard et al., 2020). PD can be in the form of workshops, reflective practices, or teacher collaboration (Brown & Militello, 2016). PD should not merely take place in one

sitting; rather teachers should participate in training that consist of 20 hours or more (Desimone, & Garet, 2015). According to Brown and Militello (2016), PD can be seen as a one-time event merely scheduled to “fill-the-day” on a single day and is often viewed as being ineffective. Vangrieken et al. (2017) affirmed that the typical “one-shot workshops,” are considered inadequate for teacher collaboration and stimulating student achievement. To ensure that this project study is effective, this project was designed as a 3-day PD that spans over a 9-week period of time. Hubbard et al. (2020) shared eight common characteristics of effective PD: (a) content focused, (b) incorporates teachers’ active learning; (c) supports collaboration, often in job-embedded contexts; (d) models effective curricular and instructional practice; (e) provides coaching and expert support; (f) time for feedback and reflection; (g) sustained duration; and (h) provides teachers with adequate time to learn, practice, implement, and reflect upon new strategies (p. 3).

Valiandes and Neophytou (2018) examined a PD program that specifically focused on improving teacher practice with the application of DI strategies. The researchers found that teachers who participated in a well-planned and well-organized PD that connected the instructional strategy and everyday teacher practice had better results with differentiating instruction. In addition, this study found that teachers who participate in an efficient and effective PD had a positive impact on student achievement. Gheysens et al. (2020) suggested that PD is crucial when implementing DI efficiently. The research shows that there is a need for well-organized PDs that follows the growth and development of teachers and monitors their professional competence, skills and attitudes.

Accordingly, Yenen and Yontem (2020) proposed that PD can be classified into four dimensions (a) instructional development, (b) scientific field development, (c) personal development, and (d) organizational development. Instructional development refers to determining identified teaching practices, utilizing appropriate materials, incorporating valid assessments, and developing various teaching methods and strategies (Yenen & Yontem, 2020). Teachers need PD to develop their skills in classroom management, lesson planning, and material selection and adaptation (Zein, 2017). By engaging in PD that assists teachers in designing engaging materials and well-integrated lessons, they can receive training that equips them with selecting, adapting, and designing materials.

Scientific field development encompasses developing a teachers' research identity as relates to applying research techniques (Yenen & Yontem, 2020). Teachers need to learn various instructional approaches in order to effectively target their instruction to the diverse needs on their students (Zein, 2017). Tantawy (2020) affirmed, that teachers' PD can be a complex process that entails cognitive participation and requires engagement with exploring new research ideas and techniques, discovering varied instructional approaches, and improving pedagogical knowledge (Tantawy, 2020).

Personal development supports the advancement of a teacher's self-awareness (Yenen & Yontem, 2020). Tantawy (2020) suggested, PD can enhance a teachers' intelligence, self-confidence, and self-efficacy which can serve as a personal attempt to "examine one's convictions and beliefs and to explore the available alternatives for improvement" (p. 3). By understanding these areas of personal development, teachers are

able to experience self-satisfaction which can foster an instructional environment that is conducive to learning (Tantawy, 2020). Organizational development supports the idea of teachers identifying how they play a role in the schools they work in (Yenen & Yontem, 2020). According to Tantawy (2020), “School traditions, mission, vision, and administrative arrangements influence how teachers appreciate their work and how they interact professionally among themselves” (p. 4). Ultimately, creating an effective PD program can lend itself to being a catalyst to how teachers transform their knowledge into effective teaching practices that improve student performance (Avalos 2011; Lunsford, 2017; Tantawy, 2020).

Content Specific Professional Development. PD sessions that are relevant to teachers can increase teachers’ content knowledge and can enhance their instructional practices and their students’ performance (Tantawy, 2020). PD has often times been said to improve a teachers’ curricular knowledge and understanding in specific content areas which can foster an improvement in student learning (Tantawy, 2020). PD that is aligned with a teachers’ content lesson can make it easier to integrate their new knowledge into the classroom instruction (Desimone, & Garet, 2015). Brigandi et al. (2019) shared that “some studies suggest that sustained, content-focused PD can increase teacher knowledge and change teacher practice in ways that ultimately improve student learning” (p. 364). Another study found that teachers benefit most when there is practical application and resources that are relevant to the grade level they teach and that can be translated into their classroom practices (Chaudhuri et al., 2019). Chaudhuri et al. (2019) shared that teachers have reported that their PD experiences have not always been effective because

the PD did not focus on the content taught in their classrooms. Researchers concluded that PD is most beneficial when it is tailored to a specific content (Gheysens, et al., 2020). Content-specific PDs have proven to have a larger positive effect on student achievement outcomes (Zein, 2017).

Teacher Choice Professional Development. PD should be sustaining and relevant, and it should be tailored to meet the needs of teachers (Kazemi et al., 2016). Desimone and Garet (2015) affirmed PD should encompass the goals and interest of teachers, and should support active, focused, and collaborative participation. Researchers have suggested that PD is most successful when teachers have a voice in what and how instructional strategies are delivered (Gheysens, et al., 2020). Kaur and Debel (2019) revealed that the concerns that teachers face is that PD has been implemented and planned by leaders rather than including them in the decisions-making process for the development of PDs and future improvement. Chaudhuri et al.(2019) stated that teachers do not buy into PDs where instructional choices made by them are not supported. Tantawy (2020) proposed that allowing teachers the opportunity to choose the type of PD they need enhances their self-efficacy and pedagogical knowledge. Potolea and Toma (2015) conducted a study that suggested that teachers should have input when it comes to their individualized PD needs. The researchers determined that the success of implementation of the strategies were connected to teachers who were able to make instructional decisions with regards to their PD learning experiences (Potolea & Toma, 2015). This study further revealed that incorporating teachers in the planning and developing of PDs can positively influence the effectiveness of the sessions.

Modeled Professional Development. Researchers stress that without a concrete understanding of the instructional strategies learned during PD, teachers find it difficult to implement new strategies in their classrooms (Suprayogi et al., 2017). Slater (2017) affirmed that in order for teachers to understand and use DI in their classroom, these strategies should be modeled during PD sessions. Teachers need to model the knowledge gained from PD to support their instructional interactions with students (Zein, 2017). Modeling activities can become the catalyst for teacher discourse, innovative instructional delivery, and conceptual change in teacher practice (Biccard, 2019). A recent study showed that teachers felt that PD that offered a variety of development activities such as collaboration, observation, and reflection, met their instructional needs more than simply signing up for a course (McElearney et al., 2019). Biccard (2019) proposed that teachers should have the same learning experience they want their students to learn from. Modeling of an effective practice can provide teachers with a clear blueprint as to how their current practice can evolve (McElearney et al., 2019).

Hands-On Professional Development. PD that supports active learning among teachers by promoting engaging activities, reflective discussions, and collective practice and participation is considered to be an effective high-quality program (Zein, 2017). Teachers need opportunities to experience hands on PD that allows them opportunities to observe model-teachers, plan standards-based lessons, review student artifacts, and experience teaching strategies that can be utilized in their classrooms (Zein, 2017). PD sessions that is learner centered and has a variety of engaging learning activities have been most successful (Biccard, 2019).

Collaboration in Professional Development

Research suggested that in order for PD to be effective, teachers need to be open to new opportunities for collaborating with colleagues (Gheysens et al., 2020).

Collaborative PD provides an opportunity for teachers to work together to improve their content knowledge and instructional practice. Studies revealed that effective teacher collaboration significantly contributes to the improvement in instructional delivery and student performance (Kaur & Debel, 2019). Vangrieken et al. (2015) suggested that effective teacher collaboration can lead teachers to creating a collaborative environment where they can come together to consult each other on instructional designs, resources, activities, and standards-based lessons. Conversely, in a more extensive collaborative environment, teachers can create an atmosphere where they cooperatively work together to construct shared objectives, build assignment and assessment cohesiveness, and participate in a deeper-level examination of their teaching practices (Vangrieken et al., 2015).

Gheysens et al. (2020) conducted a study that affirmed that teachers reported positive experiences when having more opportunities to collaborate and discuss their learning practices related to DI implementation. Chaudhuri et al. (2019) stated that teachers felt that PDs that did not provide opportunities for teachers to collaborate with their colleagues was not effective. Tantawy (2020) affirmed, having increased opportunities for social interaction with teaching colleagues can have a strong influence on a teachers' learning progress. Thus, teachers should participate in PD that is job embedded, collegial, and collaborative (Zwart et al., 2015). According to Kaur and Debel

(2019), PD through teacher collaboration identified four types of collaborative practices in which teachers work together (a) establishing and promoting learning community (b) lesson study groups (c) community of practice (d) arranging teacher design teams. A professional learning community (PLC) provides an opportunity for professionals to work together with the collective purpose of enhancing student learning with supportive and shared leadership, values, visions, goals, practice, and conditions (Vangrieken et al., 2017). A community of practice is a partnership among professionals who find it beneficial to learn from one another, and often times find it useful to share their teaching knowledge to address challenges that teachers may be facing and to improve on current teaching practice (McElearney et al., 2019; Vangrieken, et al., 2017). Creating an effective learning community of practice enhances the communication and collaboration amongst teachers (Valiandes & Neophytou, 2018). Survey results from Teaching and Learning International revealed that teachers rated collaborative research as having the most influence on their professional practice (McElearney et al., 2019). Thus, teacher collaborative PD has the opportunity to have a positive effect on a teachers' confidence, motivation, and competence, and ultimately increases a teachers' exposure to varied teaching practices and pedagogical approaches (Kaur & Debel, 2019).

Instructional Approaches for Differentiation in Mathematics

Best practices and instructional approaches lay the groundwork for helping students learn and understand the concept of mathematics. According to Fonger and Altindis (2019), the complexity of strengthening a student's conceptual understanding has been a challenge in mathematics education. Meeting the instructional needs of all

students, particularly those students who struggle in the area of mathematics is primarily focused on the implementation of the various instructional designs and approaches (Clarke et al., 2015). Althausen (2018) affirmed having a “reform-based teaching will require teachers to have deep insights about mathematics, about students as learners of mathematics and about pedagogy that will support students’ learning” (p.66).

Explicit Instruction. Explicit instruction is an effective instructional approach for teaching a wide range of mathematics skills and concepts to students at varying levels (Morano et al., 2020). According to Satsangi et al. (2019), explicit instruction is an instructional approach where the teacher provides step-by-step strategies to solve a specific problem then that strategy is used to solve a specific set of problems, and then students are required to complete the same steps to solve problems independently. Explicit instruction requires teachers to have time plan lessons that encompass a clear outline of the structured and sequenced steps they will need to teach a specific skill. Explicit instruction involves the teacher modeling how to solve mathematical problems, guiding students as they practice solving problems, and supporting students as they solve problems independently. Research suggested that in the modeling stage of explicit instruction, the teachers’ delivery should be clear, concise, and consistent to avoid digression and classroom interruptions (Hughes et al., 2017). In the guided practice stage, teachers should provide instruction that is scaffolded through physical, visual, or verbal prompts (Hughes et al., 2017). At this stage, students often times work in pairs or groups, and are provided with instructional feedback as they venture to solve the problems presented. In the independent practice stage, students are prompted to work

individually on an assignment, and are assessed to determine their progress towards meeting the mathematical standard.

The “Give Me Five” Strategy. Multiple representation provides an opportunity for students to see the same mathematical ideas presented in more than one way. The “Give Me Five” strategy is an instructional strategy that helps students develop conceptual understanding through multiple representation. With this approach, there are five different representations that can be used to increase a student’s understanding of math concepts. Lesh et al. (1987) explored these five modes of representing knowledge (a) physical representations – concrete objects (e.g. cubes, counters, tiles) can be used to model math concepts and manipulate mathematical ideas (b) contextual representations – real world situations can be explored to engage students’ interest (c) verbal representations – words and phrases can be used to discuss, interpret, define, or describe mathematical ideas and make connections throughout the learning experience (d) Visual representations – diagrams, pictures, number lines, graphs, and other mathematical drawings can be used to represent a problem (d) symbolic representations – numerals, variables, tables, and other symbols can be used to showcase an understanding of mathematical ideas. According to Flores et al. (2015), multiple representations provide students an opportunity to develop a better sense of mathematics and a deeper conceptual understanding. Engaging student in mathematics through multiple representations helps students visualize, simplify, and make sense of abstract mathematical topics, and gives them a firm foundation in mathematical problem solving (Flores et al., 2015)

Concrete-Representational-Abstract. The Concrete-Representational-Abstract (CRA) instructional approach is a research-based strategy that embeds conceptual understanding and procedural fluency. Conceptual understanding supports the understanding of mathematical ideas, the transfer of knowledge to new situations, and the application of that knowledge to new contexts. Procedural fluency refers to how students apply procedures accurately, efficiently, and flexibly. According to Flores et al. (2015), the ability for students to solve complex mathematical problems and transfer their new skills to new situations is correlated to a students' procedural and conceptual knowledge. Hence, with the CRA approach, teachers are able to model and guide students through three instructional phases to ensure students are able to work independently to solve those complex mathematical problems. This three-phase instructional approach for teaching math concepts can be identified as (a) the concrete phase (b) the representational phase (c) the abstract stage. In the concrete phase, students can use manipulatives to solve mathematical problems. If students master the concrete phase, they are able to progress to the representation phase where they can use pictures and drawings to solve mathematical problems. Once students have mastered the representational phase, students can move to a more abstract way of thinking. Althausser (2018) affirmed that with the CRA approach, teachers can model with manipulatives and transition students from concrete objects to visual representation then to abstract notation. The CRA approach is commonly used in conjunction with DI strategies. Teachers can implement the CRA approach in small groups to ensure they are differentiating and meeting the specific needs of students. In doing so, teachers could begin with whole group instruction at the concrete phase and as

students demonstrate mastery at the concrete level, they could transition to the representational phase to work in pairs and/or groups. Once teachers assess their ability to meet the standards within the representational phase, students can move to the abstract phase for further enrichment and to progress through the problem-solving process.

Polya's Problem Solving Process. Polya's Problem Solving Process (PPSP) is a research-based strategy that focuses on mathematical reasoning, explaining, and procedural fluency. This mathematical strategy was developed by George Polya in 1945. Polya published a book entitled, *How to Solve It*, where he designed a four-step approach to problem solving: (a) understand the problem, (b) devise a plan, (c) carry out the plan, and (d) check the answer. According to Clarke et al. (2015), providing strategies and scaffolds for mathematics problem solving assists students in developing a critical thinking thought process needed to support their understanding of mathematical concepts. Thus, as teachers develop mathematical lessons to meet the individualized needs of their students it is essential for teachers to have an understanding of instructional approaches and develop continuous opportunities for students to improve their mathematical problem-solving skills (Althausen, 2018).

Project Description

Potential Resources and Existing Supports

A 3-day PD session will be offered to mathematics teachers in an effort to share DI strategies and resources that can influence teacher practices and student performance. A meeting will be scheduled with school administrators to discuss the findings of my study and to present the possibility of facilitating the 3-day PD session. During this

meeting, the daily agenda outline for the PD will be shared along with proposed PD timeline. Once approval is received, email invitations will be sent to the school administrators, and all of their mathematics teachers in Grades 6 through 8. The 3-day PD session will be held on the schools' premises in their instructional data/conference room. The school will provide Internet access, a Smartboard, and workshop resources (i.e. chart paper, post-it notes, highlighters, paperclips, index cards, scissors, poster markers, pencils, pens, and paper). The teachers will need a laptop, access to their content curriculum, and various instructional resources and materials. Teachers will be provided with various graphic organizers and handouts throughout the session. The presenter will need to make copies of all of these resources based on the participants' registration. The presenter will also provide a digital copy that can be opened on Microsoft Word and/or using Google Doc.

Potential Barriers

This project study has been created to be presented to mathematics teachers in grades sixth through eighth grade. One potential barrier may be limited funding for substitute teachers. Substitute teachers are needed to cover the teachers' classrooms, so they can attend the PD session. To address the barrier, I will schedule the PD session with assigned teacher – grade level cohorts so that all mathematics teachers are not out of the building on the same day. This solution will limit the number of substitutes needed for any given day. It will also address the need for individualized support in content-specific and grade specific PD.

A second potential barrier may be that teachers may be hesitant with their participation in the PD due to the need for collective participation, observation, and reflection. In order to address this barrier, I will inform teachers the training will be content-specific and will provide an opportunity to prepare lessons that can be used in their current practice. I will also remind teachers that they will have access to various mathematics resources, strategies, and lessons that will address their concerns as teachers and that can be utilized in their mathematics classrooms. I will be sure to create a collaborative environment that is conducive to learning.

Proposal for Implementation and Timetable

The proposed project is a 3-day PD session. This 3-day PD will extend over a 9-week period of time. The details of the proposed project are as follows (See Table 3):

Table 3

Proposed Professional Development Timeline

Date	Task	Person	Deliverable
July	<ul style="list-style-type: none"> Meet with school administrators 	Administrators Researcher	PowerPoint Presentation
August	<ul style="list-style-type: none"> Plan PD sessions based on school calendar Share PowerPoint Presentation with school administrators 	Administrators Researcher	Email
September	<ul style="list-style-type: none"> Send invitation to potential participants Send list of registered participants to school administrators 	Researcher	Email
October	<ul style="list-style-type: none"> Conduct Day 1 – PD 	Researcher	Face-to-Face or

	• Conduct Day 2 – PD	Researcher	Virtual Face-to-Face or Virtual
November	• Conduct Day 3 – PD	Researcher	Face-to-Face or Virtual

My Roles and Responsibilities

To ensure the success of the 3-day PD session, several roles and responsibilities will be established. My role and responsibility will be to (a) organize the meetings with school administrators and teachers, (b) formalize participant registration for 3-day PD, (c) ensure all resources, materials, equipment, and facility are secured, (d) facilitate PD sessions with teachers, and (e) review feedback from participants and make necessary changes. The school administrators will be asked to (a) provide written approval for conducting this 3-day PD, (b) offer available dates based on the schools PD calendar, and (c) encourage and support teachers with implementing the DI strategies presented throughout the 3-day PD. The teachers will be asked to (a) a willingness to learn and implement the DI strategies presented, (b) actively participate in the collaborative activities, instructional discourse, and reflection opportunities, and (c) provide constructive feedback for future improvements.

Project Evaluation Plan

The purpose in designing this 3-day PD session over a 9-week period of time was to address the expressed needs of participants of the study. This project was designed based on the findings from the research. The goal of the project evaluation plan is to determine the effectiveness of the PD sessions. The effectiveness of the PD session will be measured using exit tickets, surveys, and reflective feedback. At the close of each

session, the participants will be asked to complete exit tickets that will provide them an opportunity to share their reflections (Appendix A). I will provide participants with an opportunity to express any concerns using the “ticket out the door” method. The “ticket out the door” technique will be used to give teachers an opportunity to pose any questions, comment, and/ or concerns. I will adjust the PD delivery format based on the responses provided. Hardin and Koppenhaver (2016) suggested that effective PD should be modified based on teacher feedback, and that teachers need consistent follow-up support. Thus, based on teacher feedback, I will continuously monitor and adjust the PD sessions to create a learning environment that is most conducive to educators.

Formative and Summative Evaluation

Formative and summative assessments work in harmony and are distinguished by the characteristics of the channels of communication between teaching and learning (Houston & Thompson, 2017). Formative assessments can be described as any activities that provide feedback in which the data collected can be utilized to adjust, alter, or adapt instructional delivery in the classroom environment (Cagasan et al., 2020). In order to ensure active engagement through a positive learning experience, formative assessments will be embedded throughout each day of the 3-day PD session. These formative assessments will be used to gauge each participant’s understanding of DI, and how DI strategies can be employed in the mathematics classroom. Participants will be encouraged to reflect on their learning and their learning needs. Bakx et al. (2014) proposed that observations, questionnaires, interviews, and portfolios are powerful methods to assess teachers’ understanding and competencies, and to gain insight into

possible next steps in their instructional practices. Throughout the 3-day PD, participants will engage in various formative assessments such as structured question and answer activities, academic discourse, collaborative lesson planning, peer observations, and “ticket out the door” exit tickets. In addition, I will utilize a summative assessment to evaluate the overall effectiveness of the 3-day PD session. According to Forrest (2018), formative and summative assessments are needed to determine the effectiveness of PD and if there is need for change. At the end of the 3-day PD, the participants will complete a summative evaluation to determine if they found the information presented beneficial to their learning needs. The answers to the questions will be submitted anonymously, and the participants will provide real-time analytical feedback of the various aspects of the presentation. Furthermore, I will adjust the delivery of the 3-day PD session based on the participants’ feedback and determine next steps for improving future PD sessions.

On day 1, all participants will be assigned to their collaborative groups based on the grade level in which they teach. The participants will complete an opening learning profile activity that will assist in identifying their learning style. The opening learning styles activity will be used to ensure multiple opportunities for differentiation throughout the PD. The exit activity will be a Flip Grid presentation consisting of reflective questions. This assessment tool will be used to determine what the participants learned on the first day of the PD. The Flip Grid presentation will assist me with making any adjustments to the upcoming PD sessions. Teachers will record their responses to a series of questions and these presentations will be used during the opening activity of Day 2.

On Day 2, teachers will participate in the Flip Grid presentation review activity. The activity will involve a review of the previous session presentations and engaging questions to encourage academic discourse. The second activity will be a peer share activity where the participants will identify the learning targets, success criteria, and academic vocabulary for their selected grade-level mathematical standard. I will provide participants with the activity guidelines and assist teachers with resources to help identify the enduring understandings of the concepts in which they selected. I will also ask guiding questioning to promote mathematical discourse and encourage active participation. As a culminating activity for Day 2 of the PD, the participants will complete a Glow and Grow exit ticket. The exit ticket will be reflective questions that will be used as an assessment tool to guide Day 3 instruction and to assist with determining next steps.

On Day 3, teachers will complete a video reflection activity as they observe their colleagues pre-recorded modeled DI lesson in a mathematics classroom. Teachers will have an opportunity to answer guiding questions, provide constructive feedback, and modify and adjust their lessons as deemed necessary. At the end of the 3-day PD, all participants will complete a summative evaluation on the effectiveness of the content presented throughout the 3-day PD session and the overall effectiveness of the PD facilitator. The participants will answer questions regarding the content shared, how the information was presented, and how the information shared can possibly influence teaching and learning. I will use this information to determine the success of the 3-day PD session and assist with the enhancement and improvement of future PD opportunities.

Evaluation Goals

The evaluation methods that will be used for this study are aligned with a goal-based approach and support the objective of this 3-day PD session. The main goal of this 3-day PD is to provide mathematics teachers with the time to collaborate and reflect upon the various DI strategies that can be utilized during classroom instruction. Teachers need time to reflect upon their past experience and plan for future actions. According to Valiandes and Neophytou (2018) “reflective practice is an essential part of PD, since it enables teachers to gain self-awareness about their practice and its impact on their students,’ determining simultaneously their needs for more extensive and particularly focused PD” (p. 127). Hence, teachers will participate in hands-on, engaging, and diverse activities to ensure that they have a clearer understanding of differentiated instruction and how to incorporate the various DI strategies in the mathematics classroom. Formative assessments will be utilized throughout the 3-day PD. In addition, teachers will be asked to complete a summative evaluation at the close of Day 3. The participants will be encouraged to reflect on their learning experiences throughout the 9-week period of time. This summative evaluation will be an online survey which will give real-time feedback and provide reports for analyzing participant responses. This feedback will serve as beneficial data for designing future PD opportunities.

Key Stakeholders

The key stakeholders for this 3-day PD are teachers and school administrators. This 3-day PD session will provide teachers with the resources, strategies, and tools to positively influence teaching and learning. Participants will be asked to sign in for each

session, and administrators will be able to monitor teacher attendance for each session. School administrators will have an opportunity to monitor the PD and teacher participation. School administrators will be invited and encouraged to attend each PD session to be involved in the implementation process of the DI strategies presented. The stakeholders will receive information regarding this study to provide a clearer understanding of the purpose and goal of the 3-day PD session.

Mathematics Teachers in Grades 6-8. All mathematics teachers in grades 6-8 will be invited to participate in the 3-day PD session. The focus of the 3-day PD session will be to assist teachers in developing a clear understanding of the components of DI and how the various DI strategies can align with mathematical standards. Teachers will engage in developing lessons that maximize their use of DI strategies and best practices for mathematics instruction. The main goal of the 3-day PD will be to provide teachers with the time to collaborate and reflect upon the various DI strategies that can be utilized during classroom instruction.

School Administrators. The school principal and assistant principals will be invited to participate in the 3-day PD session. I will include each of these individuals in the planning and implementation process of the PD sessions. To support the success of the PD, I will invite school administrators to observe, monitor, and provide their input as to how the sessions are progressing, and to provide feedback on whether there is a need for further development. In addition, including the administrators in the PD sessions will provide an opportunity for collaboration between the teachers and the administrative staff in their building. It is my hope that administrators will explore the effectiveness of the PD

process and plan to provide future opportunities for the mathematics teachers to build upon this learning experience. Support from the school administrators can motivate teachers to actively utilize the newly learned DI strategies and mathematical approaches in their classrooms. At the close of the 3-day PD session, I will provide administrators an opportunity to express their expectations for future implementation of DI in the mathematics classroom.

Project Implications

Implications for Social Change

This project has potential to positively influence mathematics teachers, students and school at the local site because I will offer this 3-day PD based on the perspectives of the participants from the study. Mathematics teachers at the local middle school were struggling to implement DI strategies in mathematics lessons as presented in PD meetings and as directed by school administrators. Thus, the middle school mathematics teachers at the local site would benefit from the PD because it will enhance their knowledge and understanding of various DI strategies that could be utilized to positively influence student performance. According to Prast et al. (2018) PD about differentiation in mathematics has the potential to improve student achievement. Hence, this 3-day PD will provide teachers with an opportunity to develop a rich understanding of the components of DI and how the various DI strategies can align with each grade-level mathematical standards. Through their participation in this PD, teachers will have an opportunity to collaborate with their colleagues to develop instructional mathematics lessons that

incorporate the varied DI strategies discussed. Based on the findings of the study, the local school site could possibly benefit from their participation in this 3-day PD project.

Importance of the Project in Larger Context

In the broader context, this project has great potential to positively influence teachers, students, and schools. As stated in the literature, “Successful programs are those developed according to teachers’ needs and provide ongoing support and feedback by experts or mentors for sustainable change” (Valiandes & Neophytou, 2018). Therefore, it was my goal to create a project that supported the findings from various research studies. The project presented is designed to enhancing middle school teachers’ knowledge and understanding of various DI strategies in the mathematics classroom. Research suggested teachers become more effective teachers as their instructional practices improve (Valiandes & Neophytou, 2018). Thus, this 3-day PD session can also be adjusted to apply to elementary and high school teachers. In doing so, teachers would receive content-specific strategies that can be used to differentiate their instruction. The expansion of this project would also provide an opportunity to share research-based instructional strategies that can be employed with students in various grade-levels and contents within the school district. Lastly, I plan to share the findings of this doctoral study with educators at the local and state level in hopes of providing more support for educators and to promote academic discourse about effective DI strategies in the mathematics classroom.

Conclusion

This PD session was designed to help teachers deepen their knowledge and understanding differentiated instruction and determine how to incorporate DI strategies in the mathematics classroom. In section 3, the project plan for the 3-day PD session was outlined and described. A connection between the project and the research was established. I combined information gathered from both the research and the interviews and created a 3-day PD session for middle school mathematics teachers. Section 4 will offer a reflection for the development of the study and the project. The information will provide insight to the strengths, limitations, and implications of the project.

Section 4: Reflections and Conclusions

The problem that prompted this study was that mathematics teachers at the local middle school were struggling to implement DI strategies in mathematics lessons as presented in PD meetings and as directed by school administrators. In this qualitative study, I explored middle school mathematics teachers' perceptions about using professional development learning of DI strategies in the classroom, about the problems they may encounter trying to use new strategies after a training session, and about suggestions for improving the effectiveness of translating professional development into practice. Differentiated instructional strategies are methods that employ a student-centered teaching approach that supports accommodations and modifications based on each student's distinctive learning needs in an effort to improve their overall performance (Gaitas & Martins, 2017; Khan et al., 2016). The findings from this study revealed that participants (a) utilized differentiated instructional strategies based on student data (b) faced challenges with time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies (c) desired to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. As a result of the findings, I developed a 3-day PD focusing on DI in the mathematics classroom. This section centers on my reflections and conclusions about the project. In section 4, I concluded this study project with the project's strengths and limitations, recommendations for alternate approaches, the project development, reflections on the importance of the work, and the implications on social change and future research.

Project Strengths and Limitations

Projects Strengths

The strengths of this project are related to the research and analysis of the findings. Hubbard et al. (2020) proposed that PD should be “job-embedded, collaborative, included demonstration lessons that modeled instruction, centered on evidence-based practices and content, offered time for planning, curriculum implementation with students, reflection and focused on discipline-specific curriculum development” (p. 3). McNeill et al. (2016) discovered that professional development that incorporates peer support and provide participants with the time to effectively incorporate the information they receive into their instructional practices is most beneficial. Hence, as proposed in these studies, I designed a 3-day PD session that specifically addressed the findings of the study in which teachers shared the need for PD session that is specific to mathematic instruction, that provides teachers with a choice and/or input in the DI strategies needed, and PD that offers hands-on modeled support for the proposed DI strategy. Teachers who participate in these PD sessions will have an opportunity to collaborate with their colleagues to discuss DI strategies and best practices that are beneficial to teaching mathematics.

By engaging interacting, and collaborating with their peers, participants will have an opportunity to share instructional practices, create effective mathematics lessons, participate in academic discourse, model instructional practices, and engage in reflective feedback (Hubbard et al., 2020) These instructional encounters can help to create positive collaborative relationships, cultivate instructional delivery, and positively influence

teaching and learning (Vangrieken et al., 2015). Participants will engage in collaborative activities that encourage discussion, enhance instructional planning, and embolden collective reflection. Darling-Hammond et al. (2017) affirmed that when teachers engage in collaborative PD they are able to reflect upon their teaching practices and determine what strategies are effective for meeting the specific needs of their students. Thus, the strength of this project is that participants will have adequate time to learn, practice, implement, and reflect upon new strategies shared throughout the 3-day PD session.

Project Limitations

The major limitation of this project is the funding of the project. For teachers to participate in this 3-day PD, substitutes would be needed to cover teacher classrooms. Akiba and Wilkinson (2016) affirmed that it is essential that extra funding is allocated for teacher substitutes to give teachers the time needed to collectively and collaboratively engage in a PD models. To address this limitation in the most effective way, the PD could be scheduled on district designated PD days to eliminate the need for substitutes. Or, the PD could be designed to support a cohort of teachers to minimize the number or substitutes needed on each of the days.

Another limitation involves ensuring that collaboration continues among the teachers on a regular basis. Although I will offer the 3-day PD over a 9-week period of time, it may be a challenge for that collaboration to continue once the 3-day PD has ended. To support ongoing collaboration, a shared platform will be utilized to house various DI strategies, resources, and artifacts. In addition, I will suggest that administrators organize future PD sessions with the cohort of teachers who participated in

the 3-day PD session. According to McElearney et al. (2019), PD should be ongoing and continuous to engage teachers in instructional planning and to ensure the effectiveness of their instructional practices. Establishing a collaborative PD models that supports continuous learning of the curriculum supports the overall practice of effective teaching and learning (Akiba & Wilkinson, 2016).

Recommendations for Alternative Approaches

Alternate Approaches to the Problem

One alternate approach could be to explore the administrators' perceptions of DI in the mathematics classroom. An accompanying project would be to create a monitoring plan to assist administrators with monitoring and evaluating the teachers' effectiveness in implementing DI and the impact it has on student achievement. The guide could focus on (a) creating an observation protocol to guide classroom observations (b) providing teacher feedback tool that would support instructional discourse, probing questioning, and reflective insights (c) conducting data analysis to determine if future PD is needed to develop the teachers' expertise for differentiating instruction effectively. Results from the data could be used to create and implement an action plan for the successful implementation of DI strategies that meet the increasingly diverse needs of students in the mathematics classroom. Another approach to address this problem could be to begin with population selected. The project targeted middle school mathematics teachers in a local school in a southeastern community. The project could have encompassed several middles schools within the school district. This would increase the participation and allow data to be analyzed with a greater representation of the district at large. Lastly,

another alternative approach could be to conduct teacher observations. This study did not include teacher observation; hence, structured classroom visits could address how teachers perceive the implementation of DI strategies in the mathematics classroom. This data would provide insight as to how teachers engage with their students, and how their students react to their instructional delivery.

Alternate Definitions of the Problem

The problem that prompted this study was that mathematics teachers at the local middle school were struggling to implement DI strategies in mathematics lessons as presented in PD meetings and as directed by school administrators. I interviewed eight middle school mathematics teachers to explore their perceptions on implementing DI and about ideas that support teachers in effectively using DI strategies in mathematics classrooms. The data obtained from these one-on-one semi-structured interviews showed that teachers believed in the importance of utilizing DI strategies to meet the specific needs of students, and that despite the challenges, they wanted to participate in PD sessions that were structured to meet their specific needs as teachers. Thus, I designed a 3-Day PD project based on themes revealed from the study. The project supports fostering an environment where teachers can participate in hands-on, content-specific, and collaborative PD where they can increase their knowledge of DI strategies in the mathematics classroom. Nevertheless, I realize there will be some participants who choose not to employ the DI strategies presented; thus, two alternative definitions for the problem for this study are identified as follows:

1. Opportunities for teachers to collaboratively engage in content planning is needed to share DI strategies that will improve teaching and learning in the mathematics classroom.
2. Opportunities to create teacher cohorts across the school district is needed to develop collaborative relationships where teachers can share resources and strategies that will assist them in planning effective DI mathematics lessons.

These alternative definitions of the problem support the problem that prompted this study because each of them will provide teachers with an alternate path for exploring DI and the strategies necessary to meet the diverse needs of their students.

Alternate Solutions to the Local Problem

Alternate solutions may benefit teachers who work in schools where collaboration opportunities are not available. These alternate solutions are designed to assist teachers who would like to network and collaborate with each other to share instructional resources and strategies that can cultivate a differentiated learning environment.

Alternate solutions are a good way to provide teachers with additional support. To address ways in which teachers can collaboratively engage in content planning to share DI strategies that will improve teaching and learning in the mathematics classroom, a PLC could be organized. This PLC could provide an opportunity to formulate collaborative teams consisting of the school administrator, an academic coach, and the content and grade level teachers. This PLC could meet weekly to enable collaborative conversations that focus on employing DI strategies that meet the targeted needs of their

students. Teachers could engage in academic discourse, share instructional resources, and develop weekly DI lesson plans. When teachers are not provided the time to collaborate, they are not able to gain self-awareness about their instructional practices which can limit their ability to plan for future actions in their instructional delivery (Valiandes & Neophytou, 2018). According to Hubbard et al. (2020), teachers need a consistent and definite time to work collaboratively on a shared purpose to accomplish the common goal of student learning. Having weekly content planning sessions that is inclusive of administrative and instructional support can provide the positive reinforcement needed to positively influence teaching and learning.

In addition, to create teacher cohorts across the school district to develop collaborative relationships where teachers can share resources and strategies that will assist them in planning effective DI mathematics lessons, a community of practice could be established. A community of practice is a partnership among teachers who find it helpful to learn from one another and find it advantageous to share their teaching knowledge and improve their teaching practices (McElearney et al., 2019; Vangrieken, et al., 2017). With technological advances, this community of practice could be experienced via online platforms and social media outlets. Although teachers from various districts may not be available to participate in face-to-face meetings, teachers may find it more feasible to participate in virtual monthly meeting where they can engage in collaborative discussions, instructional discourse, and reflective practices related to DI. These meetings could be recorded and shared on online platforms and social media outlets to provide additional support for educators on a broader scale.

Scholarship, Project Development and Evaluation, and Leadership and Change

In this study, I investigated middle school mathematics teachers' perceptions about using professional development learning of DI strategies in the classroom, about the problems they may encounter trying to use new strategies after a training session, and about suggestions for improving the effectiveness of translating professional development into practice. Based on the analysis of the data, I found that that the participants believed that it was important to use DI strategies to engage students, but expressed that insufficient time, knowledge, and resources limited their options for implementing DI strategies.

As an academic coach in the middle school setting, I desired to see how teachers were currently differentiating instruction in their classrooms and I wanted to explore possible PD sessions that could be designed to support teachers with utilizing DI strategies in the mathematics classroom. According to Akiba and Wilkinson (2016), an academic coach can provide opportunities for teachers to improve their professional knowledge and development in their pedagogical teaching practices by providing feedback, research-based strategies, and high-quality resource materials (Akiba & Wilkinson, 2016). As I engaged in conversations with the participants, I learned that participants were eager to improve their professional knowledge and implement DI in their classrooms, but that they desired more opportunities where they are able to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. Nevertheless, as a scholar, I had to remove myself from the role of an academic coach and position myself as the researcher. Although this was a

challenge because I have had prior experiences with facilitating PD related to DI, it was essential that my research was free of any biases and opinions. To address this challenge, I remained objective and receptive and I didn't interject any personal biases. Merriam (2009) affirmed that it is important to identify biases and monitor throughout the research study. As a scholar, I was able to identify participants' perceptions on DI, and design a PD opportunity that addressed the needs that were revealed during the data collection phase of this study.

To investigate the perceptions of middle school mathematics teachers, I interviewed eight teacher participants at the local site. I was thrilled that teachers consented and that I was able to begin collecting data for the study. Soon after teachers consented to participate in my study, I began scheduling the one-on-one semi-structured interviews. Once the data was collected and analyzed I began designing my 3-Day PD session. During this phase, I discovered that my findings served to be a clear framework for the development of my project. I used my finding as a guide for creating a PD plan that met the identified needs of the participants in the study. The 3-Day PD session was developed to share DI strategies that could be utilized in the mathematics classroom. In my role as a researcher, I found that by exploring research-based strategies I can equip educators with the instructional practices needed to positively influence student performance. By developing this project, I was able to grow as a practitioner, as a project developer, and as a research scholar, committed to professional growth and development and being a life-long learner.

Growth as a Scholar

As I worked through my study, I deemed myself as a scholar. I started to demonstrate the qualities of a scholar through the research and analysis of my study. I was afforded opportunities to grow as a scholarly writer and to cultivate my knowledge of qualitative studies. Throughout the research process, I learned how to identify a problem, develop research questions, collect, and analyze data, and explore peer-reviewed research. In this study, participants engaged in one-on-one interviews that were recorded and transcribed. The transcription process cultivated my understanding as a scholar. I listened to the recording numerous times, typed each of the participants' responses, and devoted a great deal of time to coding the data. I identified the repeated words and phrases from the transcripts and searched for patterns and themes. This process was quite tedious; however, it was crucial for the research. Moreover, during the research process it was vitally important to ensure that I didn't interject any personal biases, and as a scholar, I was able to identify participants' perceptions on DI, and design a PD opportunity that addressed the needs that were revealed during the data collection phase of this study.

Growth as a Practitioner

As a practitioner engaging in the research for this study, I gained a greater understanding of DI, and how DI can be employed in the mathematics classroom. Conducting this study provided me an opportunity to reflect upon my experiences as a teacher and academic coach. The knowledge and experiences that I gained from this process has positively influenced my perspective on education. Through this research I

was able to be reflective as a former mathematics teacher in the classroom. As an academic coach, I was able to review and reflect on the importance of being a teacher leader who fosters an instructional environment that supports the cultivation of teaching practices. In my role, I have the opportunity to observe and support teachers; however, through this process, I have a deeper understanding of the need for continuous, collaborative, and content-specific PD. I gained a clear understanding of what teachers need, and how PD can be designed to meet their individualized needs. As a scholar, I had to remove myself from the role of academic coach which ultimately afforded me an opportunity to listen to the participants without bias. Hence, once the data was collected and analyzed, I was able to be more reflective as a practitioner. I was able to utilize the peer-reviewed research and the findings from the study to develop a project that could prove beneficial to the participants and the school district.

Growth as a Project Developer

As an academic coach, I plan and facilitate PD to support teacher development. Hence creating this project for this study has been a rewarding experience. I was able to develop a 3-day PD for middle school mathematics teachers. This 3-day PD session provided me an opportunity to share DI strategies that could positive influence student performance within the district in which I serve. By developing this PD, I was able to address the need for utilizing DI strategies in the mathematics classroom. From the findings, I learned that participants understood the importance of DI, but were having difficulty implementing the DI strategies effectively. In addition, the data revealed that participants desired to choose PDs that are hands-on, and that offer opportunities to

observe modeled strategies that are specific to their content. For this reason, I created a 3-day PD to share DI strategies that could be utilized in the mathematics classroom. I incorporated opportunities for peer collaboration, modeling, and academic discourse. In the process of developing my PD project, I learned that successful PD requires opportunities to actively engage in hands-on practice with instructional strategies prior to implementing them with students. PD involves intellectual contribution and requires engagement with exploring new research ideas and approaches, learning a wide-ranging instructional methodology, and improving knowledge in educational pedagogy (Tantawy, 2020). Thus, in my role as the project developer, I have been able to construct a project that aligns with the needs identified by the participants in this study.

Reflection on Importance of the Work

This research study provided me an opportunity to review and reflect upon the perceptions of middle school mathematics teachers on DI. The participants in this study possessed at least two years of experience and had an instructional background in the mathematics classroom. This project study was designed to provide a variety of instructional approaches to meet the diverse needs of students. As an educator, it is important to consistently engage in PD that defines and refines teaching practices and improves the quality of instructional delivery. This study could be beneficial in assisting teachers with developing a clear understanding of DI and how DI strategies can be utilized to create instructional lessons that align with their assigned mathematical standards. Thus, as I reflected upon this importance of this work, I realized how important it is for teachers to be provided with the time adequate time to work

collaboratively to plan lessons, discuss possible ideas and approaches, and collect materials and resources to effectively implement DI in the mathematics classroom. By engaging teachers in collaborative PD, I have the opportunity to contribute to the overall success of teaching and learning.

Implications, Applications, and Directions for Future Research

This study contributes to the literature on teachers' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about teachers' ideas for improving PD sessions about DI. By collecting data from eight mathematics teachers, I captured their perceptions, thoughts, and experiences about improving the effectiveness of translating professional development into practice. Three themes were derived from the analysis of the data. These themes were: (a) Middle school mathematics teachers utilize differentiated instructional strategies based on student data, (b) Middle school mathematics teachers face challenges with time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies, and (c) Middle school mathematics teachers desire to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. Each of themes served as the catalyst for creating a 3-Day PD project.

Potential Impact for Positive Social Change

Teachers serve as a crucial element to ensure the successful implementation of DI and the potential for social change. This study provides teachers with research-based strategies to equip them with the instructional practices needed to positively influence

student performance. The outcome of this study may have a potential impact for social change by providing insight into the participants' instructional practices. By identifying PD needs during the research, teachers, administrators, and school districts could adjust their PD practices based on the findings of this study. The 3-Day PD project developed for this study has the potential to positively impact social change by contributing a possible PD plan that can be adapted by other school districts in an effort to provide teachers with DI strategies that can possibly increase mathematics achievement. Throughout the 3-Day PD, participants are able to share their experiences and instructional expertise while collaborating and planning with one another to improve mathematics instruction at their local school. The project developed has the potential to increase teacher knowledge about DI and foster an environment where teachers can participate in hands-on, content-specific, and collaborative PD. According to Prast et al. (2018), PD about a systematic implementation of DI in mathematics has the potential to increase student achievement and support the varied diverse educational needs of students which can ultimately support a more effective learning environment. Hence, the PD project created for this study may potentially serve as a model for future PD programs.

Methodological, Theoretical, and Empirical Implications

This study has important methodological, theoretical, and empirical implications because the problem that prompted this study was that mathematics teachers at the local middle school were struggling to implement DI strategies in mathematics lessons as presented in PD meetings and as directed by school administrators. The probable

solutions to this problem were developed from real-life experiences and perceptions of middle school mathematics teachers and are supported by scholarly research. The methodology used for this study was a basic qualitative design. Utilizing this design was most appropriate because it allowed me an opportunity to conduct an in-depth investigation of a single group of participants by exploring the experiences and perspectives of the participants in the study (Merriam, 2002). The basic qualitative design allowed me an opportunity to identify the recurring patterns or themes in the study (Merriam, 2002), and to conduct individual interviews to understand the participants' responses and address the problem in the study (Merriam, 2002).

The conceptual framework of this study was based on Tomlinson's framework for differentiation. This framework focuses on the need for teachers to intentionally address and modify the learning content, process, product, or environment in response to students' interests, readiness, and learning profiles (Tomlinson, 2015) consistently and intentionally. Throughout the development of this project, I investigated ways to equip teachers with the PD needed to effectively employ DI strategies in the mathematics classroom. The theoretical implications from this study suggests that providing teachers with the DI strategies and scholarly research may improve the overall PD instructional program. The empirical implication of this study is that middle school mathematics teachers are reliable sources of information about their instructional practices and experiences. The data revealed that participants desired to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. To address the findings, I created a 3-Day PD project; however, there is a need

for future research studies to produce productive PD plans to enhance and enrich the overall professional growth and development of educators.

Recommendation for Practice and/or Future Research

The field of education offers numerous opportunities for future research on employing DI strategies in the mathematics classroom. The implications for future research depend on the teachers, administrators, and the school districts commitment to implement continuous, content-specific, and collaborative PD. The findings from the study revealed that participants (a) utilized differentiated instructional strategies based on student data (b) faced challenges with time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies (c) desired to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. The research focused on identifying successful DI strategies, providing a PD to present those strategies to teachers to support DI in mathematics classrooms, and to translate PD learning into practical application. The scope of this project addressed middle school teachers; however, further research could be examined to determine how teachers implement DI at the elementary and high school levels. Additional research that investigates how administrators can offer guidance, provision, and support as teachers navigate successfully implementing DI strategies in the mathematics classroom could be useful in the instructional environment. In addition, modifications can be made to the current 3-Day PD to address the specific needs of the teachers in the school. Administrators could create a teacher cohort to determine the success of the DI strategies implemented and the effect it has on student performance.

Conclusion

The problem that prompted this study was that mathematics teachers at the local middle school were struggling to implement DI strategies in mathematics lessons as presented in PD meetings and as directed by school administrators. As I examined this problem, I invited middle school mathematics teachers to share their perceptions about using professional development learning of DI strategies in the classroom, about the problems they may encounter trying to use new strategies after a training session, and about suggestions for improving the effectiveness of translating professional development into practice. In this basic qualitative design, I endeavored to discover the process and perceptions of the participants in the study (Merriam, 2002). As I obtained and analyzed the data, I committed myself to the learning how to conduct scholarly research and develop a project that can have a positive effect on educators and can positively influence social change in the field of education.

For this basic qualitative study, I conducted an in-depth investigation of a single group of participants by collecting data from individual interviews. The interviews explored the participants' perceptions about using DI strategies in the classroom, about the problems they encounter trying to use new strategies presented in PD sessions, and about their ideas for improving PD sessions about DI. interviews. In analyzing the data for my study, I ventured to answer the following research questions:

RQ1: What are middle school teacher perceptions about implementing differentiated instructional strategies learned in a professional development workshop?

RQ2: What are middle school teacher perceptions about the challenges of implementing differentiated instructional strategies?

RQ3: What are middle school teacher ideas for improving professional development sessions about differentiated instructional strategies?

The findings from the study revealed that participants (a) utilized differentiated instructional strategies based on student data (b) faced challenges with time, resources, diverse student needs, and student behavior when employing the various differentiated instructional strategies (c) desired to choose PDs that are hands-on, and that offer opportunities to observe modeled strategies that are specific to their content. This study is significant because it provided insight as to how teachers were differentiating instruction in their classrooms and identified the difficulties teachers were having with implementing the strategies introduced during PD sessions. This study also provided a possible 3-Day PD session that could be employed to support teachers with utilizing DI strategies in the mathematics classroom. The project developed provides a foundational framework for refining the overall instructional PD program to improve mathematics achievement and produce effective PD that positively influences the instructional environment. This study will inform stakeholders of the varied DI strategies implemented in mathematics classroom to enhance academic achievement and student performance on statewide assessments. Thus, because of this study, educators will have the opportunity to positively influence social change at their local schools, district levels, and ultimately within their communities.

References

- Acosta-Tello, E., & Shepherd, C. (2014). Equal access for all learners: Differentiation simplified. *Journal of Research in Innovative Teaching*, 7(1), 51-57.
<https://assets.nu.edu/assets/resources/pageResources/journal-of-research-in-innovative-teaching-volume-7.pdf>
- Aftab, J. (2015). Teachers' beliefs about differentiated instructions in mixed ability classrooms: A case of time limitation. *Journal of Education and Educational Development*, 2(2), 94–114. <https://files.eric.ed.gov/fulltext/EJ1161474.pdf>
- Akiba, M., & Wilkinson, B. (2016). Adopting an international innovation for teacher professional development: State and district approaches to lesson study in Florida. *Journal of Teacher Education*, 67(1), 74–93.
<http://dx.doi.org.ezp.waldenulibrary.org/10.1177/0022487115593603>
- Alavinia, P., & Sadeghi, T. (2013). The impact of differentiated task-based instruction via heeding learning styles on EFL learners' feasible proficiency gains. *3L: Southeast Asian Journal of English Language Studies*, 19(1), 75–91.
- Aldossari, A. T. (2018). The challenges of using the differentiated instruction strategy: A case study in the general education stages in Saudi Arabia. *International Education Studies*, 11(4), 74–83. <https://doi.org/10.5539/ies.v11n4p74>
- Aljaser, A. (2019). Examining the implications of differentiated instruction for high school students' self-actualization. *International Journal of Education and Practice*, 7(3), 184–199. doi:10.18488/journal.61.2019.73.184.199
- Althaus, K. (2015). Job-embedded professional development: Its impact on teacher

self-efficacy and student performance. *Teacher Development*, 19(2), 210-225.

doi:10.1080/13664530.2015.1011346

Althausen, K. L. (2018). The emphasis of inquiry instructional strategies: Impact on preservice teachers' mathematics efficacy. *Journal of Education and Learning*, 7(1), 53–70.

Badri, M., Alnuaimi, A., Mohaidat, J., Yang, G., & Al Rashedi, A. (2016). Perception of teachers' professional development needs, impacts, and barriers. *SAGE Open*, 6.

<https://doi-org.ezp.waldenulibrary.org/10.1177/2158244016662901>

Baker, K., & Harter, M. (2015). A living metaphor of differentiation: A meta-ethnography of cognitively guided instruction in the elementary classroom.

Journal of Mathematics Education at Teachers College, 6(2), 27-35. <https://doi-org.ezp.waldenulibrary.org/10.7916/jmetc.v6i2.616>

Bakx, A., Baartman, L., & Van Schilt-Mol, T. (2014). Development and evaluation of a summative assessment program for senior teacher competence. *Studies in Educational Evaluation*, 40, 50–62. [https://doi-](https://doi-org.ezp.waldenulibrary.org/10.1016/j.stueduc.2013.11.004)

[org.ezp.waldenulibrary.org/10.1016/j.stueduc.2013.11.004](https://doi-org.ezp.waldenulibrary.org/10.1016/j.stueduc.2013.11.004)

Bates, C. C., & Morgan, D. N. (2018). Literacy leadership: The importance of soft skills. *Literacy Coaching and Professional Development*, 72(3), 412–4.

Benders, D. S., & Craft, T. (2016). The effect of flexible small groups on math achievement in first grade. *Networks: An Online Journal for Teacher Research*,

18(1), 1. <https://dx.doi.org/10.4148/2470-6353.1022>

Biccard, P. (2019). The professional development of primary school mathematics

teachers through a design-based research methodology. *Pythagoras* (10122346), 40(1), 1–10.

Boston Consulting Group. (2014). *Teachers know best: Teachers' views on professional development*.

<http://k12education.gatesfoundation.org/download/?Num=2336&filename=Gates-PDMarketResearch-Dec5.pdf>

Brigandi, C. B., Gilson, C. M., & Miller, M. (2019). Professional development and differentiated instruction in an elementary school pullout program: A gifted education case study. *Journal for the Education of the Gifted*, 42(4), 362.

Brown, C., & Militello, M. (2016). Principal's perceptions of effective professional development in schools. *Journal of Educational Administration*, 54(6), 703–726.

<https://doi-org.ezp.waldenulibrary.org/10.1108/JEA-09-2014-0109>

Cagasan, L., Care, E., Robertson, P., & Luo, R. (2020). Developing a formative assessment protocol to examine formative assessment practices in the Philippines.

Educational Assessment, 25(4), 259–275. <https://doi-org.ezp.waldenulibrary.org/10.1080/10627197.2020.1766960>

Candela, A. G. (2019). Exploring the function of member checking. *The Qualitative Report*, 24 (3), 619-628. <https://doi.org/10.46743/2160-3715/2019.3726>

Chaudhuri, A., McCormick, B., & Lewis, R. (2019). Standards-based science institutes: Effective professional development that meets teacher and district needs. *Science Educator*, 27(1), 15–23.

Clarke, B., Doabler, C. T., Nelson, N. J., & Shanley, C. (2015). Effective instructional

strategies for kindergarten and first-grade students at risk in mathematics.

Intervention in School and Clinic, 50(5), 257–265. [https://doi-](https://doi-org.ezp.waldenulibrary.org/10.1177/1053451214560888)

[org.ezp.waldenulibrary.org/10.1177/1053451214560888](https://doi-org.ezp.waldenulibrary.org/10.1177/1053451214560888)

Cooc, N. (2019). Teaching students with special needs: International trends in school

capacity and the need for teacher professional development. *Teaching and*

Teacher Education, 83, 27–41. [https://doi-](https://doi-org.ezp.waldenulibrary.org/10.1016/j.tate.2019.03.021)

[org.ezp.waldenulibrary.org/10.1016/j.tate.2019.03.021](https://doi-org.ezp.waldenulibrary.org/10.1016/j.tate.2019.03.021)

Cook, R. (2008). ESSAY--Strategies for differentiated instruction. *Journal of the*

American Academy of Special Education Professionals, 92–95. Retrieved from

Creswell, J. W. (2012). *Educational research: Planning, conducting, and*

evaluating quantitative and qualitative research (Laureate custom ed.). Boston,

MA: Pearson Education, Inc.

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five*

approaches. Los Angeles, Calif: SAGE Publications.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods*

approaches. Thousand Oaks, CA: Sage.

Creswell, J. W. (2014). *Educational Research: Planning, conducting, and evaluating*

quantitative and qualitative research (5th Ed.). Boston, MA: Pearson.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and*

mixed methods approaches. Thousand Oaks, CA: Sage Publications.

Dack, H., & Tomlinson, C. A. (2015). Inviting all students to learn. *Educational*

Leadership, 72(6), 10–15.

- Darling-Hammond, L., Hyler, M., Gardner, M., & Learning Policy Institute. (2017).
Effective Teacher Professional Development. *Learning Policy Institute*.
- Desimone, L. M., & Garet, M. S. (2015). Best practices in teachers' professional
development in the United States. *Psychology Society and Education*, 7(3), 252–
263.
- Dixon, F., Yssel, N., McConnell, J. M., & Hardin, T. (2014). Differentiated instruction,
professional development, and teacher efficacy. *Journal for the Education of the
Gifted*, 37(2), 111-127. doi:10.1177/0162353214529042
- Dufour, R. (2007). What might be: Open the door to a better future. *Journal of Staff
Development*, 28(3), 27-30.
<http://www.nsd.org/news/issueDetails.cfm?issueID=210>
- Fitzgerald, P. (2016). Differentiation for all literacy levels in mainstream classrooms.
Literacy Learning: The Middle Years, 24(2), 17-25.
- Flannagan, J. S. (2019). Designing a tiered science lesson: Differentiation also helps
students who have already mastered a concept. *Science & Children*, 57(2), 42–48.
https://doi-org.ezp.waldenulibrary.org/10.2505/4/sc19_057_02_42
- Freeman-Green, S., Person, J., & O'Brien, C. (2018). Mathematics instruction for
secondary students with learning disabilities in the era of tiered instruction.
Insights into Learning Disabilities, 15(2), 175–194.
<https://eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ1203394>
- Flores, R., Koontz, E., Inan, F. A., & Alagic, M. (2015). Multiple representation
instruction first versus traditional algorithmic instruction first: Impact in middle

school mathematics classrooms. *Educational Studies in Mathematics*, 89(2), 267.

<https://doi-org.ezp.waldenulibrary.org/10.1007/s10649-015-9597-z>

Fonger, N. L., & Altindis, N. (2019). Meaningful mathematics: Networking theories on multiple representations and quantitative reasoning. *Conference Papers -- Psychology of Mathematics & Education of North America*, 1776–1786.

Forrest, S. (2018). Can CPD enhance student-centred teaching and encourage explicit instruction of international baccalaureate approaches to learning skills? A qualitative formative assessment and summative evaluation of an IB school's in-house CPD programme. *Journal of Research in International Education*, 17(3), 262–285.

Gaitas, S., & Martins, M. A. (2017). Teacher perceived difficulty in implementing DI strategies in primary school. *International Journal of Inclusive Education*, 21(5), 544–556. doi:10.1080/13603116.2016.1223180

Garcia, E., & Weiss, E. (2019). The role of early career supports, continuous professional development, and learning communities in the teacher shortage. The fifth report in “The perfect storm in the teacher labor market” series. *In Economic Policy Institute*. Economic Policy Institute.

<https://eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED598210>

Georgia Department of Education. (2018). *College and career ready performance index*.

Retrieved December 18, 2018, from <http://ccrpi.gadoe.org/2018>

Gadoe. (2019). *2019 College and Career Ready Performance Index (CCRPI) Reports*.

Retrieved January 17, 2020, from

http://ccrpi.gadoe.org/Reports/Views/Shared/_Layout.html

- Georgia Milestones Achievement Level Descriptors. (n.d.). Retrieved October 9, 2019, from <https://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-ALD.aspx>.
- Gheysens, E., Consuegra, E., Engels, N., & Struyven, K. (2020). Good things come to those who wait: The importance of professional development for the implementation of differentiated instruction. *Frontiers in Education*, 5. <https://doi-org.ezp.waldenulibrary.org/10.3389/feduc.2020.00096>
- Goddard, Y., Goddard, R., & Kim, M. (2015). School instructional climate and student achievement: An examination of group norms for differentiated instruction. *American Journal of Education*, 122(1), 111-131. <https://doi-org.ezp.waldenulibrary.org/10.1086/683293>
- Goddard, Y. L., Goddard, R. D., Bailes, L. P., & Nichols, R. (2019). From school leadership to differentiated instruction: A pathway to student learning in schools. *Elementary School Journal*, 120(2), 197–219. <https://doi-org.ezp.waldenulibrary.org/10.1086/705827>
- Gregory, G., & Chapman, C. M. (2013). *DI strategies. One size doesn't fit all*. Thousand Oaks, CA: Corwin.
- Grierson, A., & Woloshyn, V. E. (2013). Walking the talk: Supporting teachers' growth with differentiated professional development. *Professional Development in Education*, 39(3), 401-419. Doi: 10.1080/19415257.2012.763143
- Gulamhussein, A. (2013). Teaching the teachers: Effective professional development.

Retrieved from <http://www.centerforpubliceducation.org/research/teaching-teachers-effective-professional-development>

Hardin, B., & Koppenhaver, D. (2016). Flipped professional development: An innovation in response to teacher insights. *Journal of Adolescent & Adult Literacy*, 60(1), 45–54.

Harshbarger, D. (2019). Lightbulb moments for all learners. *Science and Children*, 57(2), 49-55.

Hartwig, S. J., & Schwabe, F. (2018). Teacher attitudes and motivation as mediators between teacher training, collaboration, and differentiated instruction. *Journal for Educational Research Online / Journal Für Bildungsforschung Online*, 10(1), 100–121. doi:10.1086/683293

Haymon, C., & Wilson, A. (2020). Differentiated reading instruction with technology for advanced middle school students' reading achievement. *Journal of Educational Research and Practice*, 10(1), 70-89. <https://doi.org/10.5590/JERAP.2020.10.1.05>

Houston, D., & Thompson, J. (2017). Blending formative and summative assessment in a capstone subject: 'It's not your tools, it's how you use them. *Journal of University Teaching & Learning Practice*, 14(3), 1–13.

Hubbard, J., Fowler, M., & Freeman, L. (2020). PreK–5 teacher views of professional development integrating common core language arts with science and social studies. *Journal of Educational Research and Practice*, 10, 1–25. <https://doi.org/10.5590/JERAP.2020.10.1.01>

Hughes, C., Morris, J., Therrien, W., & Benson, S. (2017). Explicit instruction: Historical

and contemporary contexts. *Learning Disabilities Research & Practice*, 32(3), 140-148

Ismajli, H., & Imami-Morina, I. (2018). Differentiated instruction: Understanding and applying interactive strategies to meet the needs of all the students. *International Journal of Instruction*, 11(3), 207–218.

<https://eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ1183415>

Kaplan, S. N. (2019). Advocacy differentiating differentiation. *Gifted Child Today*, 42(1), 58–59. doi:10.1177/1076217518805785

Kaur, J., & Debel, O. (2019). Teacher collaboration and professional development in secondary schools of Ethiopia: A literature review. *IAHRW International Journal of Social Sciences Review*, 75(5), 1031-1035.

Kazemi, E., Ghouseini, H., Cunard, A., & Turrou, A. C. (2016). Getting inside rehearsals: insights from teacher educators to support work on complex practice. *Journal of Teacher Education*, 67(1), 18. <https://doi-org.ezp.waldenulibrary.org/10.1177/0022487115615191>

Khan, S., Haider, S. Z., & Bukhari, A. A. (2016). Instruction strategies sort out by mathematics teachers: Evaluating the affect on bachelor of education. *European Journal of Science and Mathematics Education*, 4(1), 103–114.

Kohen, Z., & Borko, H. (2019). Classroom discourse in mathematics lessons: The effects of a hybrid practice-based professional development program. *Professional Development in Education*.

Korstjens, I., & Moser, A. (2018). Series: Practical guidance to qualitative research. Part

- 4: Trustworthiness and publishing. *European Journal of General Practice*, 24(1), 120–124. <https://doi-org.ezp.waldenulibrary.org/10.1080/13814788.2017.1375092>
- Lai, C. P., Zhang, W., & Chang, Y.-L. (2020). Differentiated instruction enhances sixth-grade students' mathematics self-efficacy, learning motives, and problem-solving skills. *Social Behavior & Personality: An International Journal*, 48(6), 1–13. <https://doi-org.ezp.waldenulibrary.org/10.2224/sbp.9094>
- Lang, M. L. (2019). Planning for differentiated instruction: Instructional leadership practices perceived by administrators and teacher in middle schools. *Educational Planning*, 26(2), 29–45. <https://files.eric.ed.gov/fulltext/EJ1217447.pdf>
- Leedy, P., & Ormond, J. (2015). *Practical research: Planning and design* (11th ed). Boston, MA: Pearson.
- Lesh, R., Post, T., & Behr, M. (1987). Representations and translation among representations in mathematics learning and problem solving. *Problems of representation in the teaching and learning of mathematics*, 33-40.
- Lindvall, J. (2017). Two large-scale professional development programs for mathematics teachers and their impact on student achievement. *International Journal of Science & Mathematics Education*, 15(7), 1281–1301. <https://doi-org.ezp.waldenulibrary.org/10.1007/s10763-016-9750-x>
- Lodico, M., Spaulding, D. T., & Voegtle, K. H. (2010). *Methods in educational research: From theory to practice* (Laureate Education, Inc., custom ed.). San Francisco, CA: John Wiley & Sons

- Loeser, J. W. (2018). Differentiated Instruction. *Differentiated Instruction -- Research Starters Education*, 1.
<http://connection.ebscohost.com/c/essays/27170109/differentiated-instruction>
- Lunsford, H., & Treadwell, G. (2016). Implementing differentiated instruction for online college writing courses: addressing challenges and developing best practices. *Distance Learning*, (3), 11.
- Malacapay, M. (2019). Differentiated instruction in relation to pupils' learning style. *International Journal of Instruction*, 12(4), 625–638.
<https://doi.org/10.29333/iji.2019.12440a>
- Matherson, L., & Windle, T. (2017). What do teachers want from their professional development? Four emerging themes. *Delta Kappa Gamma Bulletin*, 83(3), 28–32.
- McElearney, A., Murphy, C., & Radcliffe, D. (2019). Identifying teacher needs and preferences in accessing professional learning and support. *Professional Development in Education*, 45(3), 433–455.
- McFarland, J., Hussar, B., Zhang, J., Wang, X., Wang, K., Hein, S., Diliberti, M., Forrest Cataldi, E., Bullock Mann, F., & Barmer, A. (2019). *The Condition of Education 2019* (NCES 2019-144).
- McKeen, H. (2019). The impact of grade level flexible grouping on mathematics achievement scores. *Georgia Educational Researcher*, 16(1). <https://doi-org.ezp.waldenulibrary.org/10.20429/ger.2019.160105>
- Merriam, S. (2002). *Qualitative research in practice: Examples for discussion and*

analysis. San Francisco, CA: Jossey-Bass Inc Pub.

Merriam, S. (2009). *Qualitative research: A guide to design and implementation*. John Wiley & Sons

Merriam, S., & Tisdell, E. (2016). *Qualitative research: A guide to design and implementation*. San Francisco: Jossey-Bass Inc Pub.

Moosa, V., & Shareefa, M. (2019). Implementation of differentiated instruction: Conjoint effect of teachers' sense of efficacy, perception and knowledge. *Anatolian Journal of Education*, 4(1), 23–38. <https://doi.org/10.29333/aje.2019.413a>

Moosa, V., & Shareefa, M. (2019). The impact of teachers' experience and qualification on efficacy, knowledge and implementation of differentiated instruction. *International Journal of Instruction*, 12(2), 587–604. <https://doi.org/10.29333/iji.2019.12237a>

Morano, S., Randolph, K., Markelz, A. M., & Church, N. (2020). Combining explicit strategy instruction and mastery practice to build arithmetic fact fluency. *Teaching Exceptional Children*, 53(1), 60–69. <https://doi-org.ezp.waldenulibrary.org/10.1177/0040059920906455>

Morgan, H. (2014). Maximizing student success with differentiated learning. *Clearing House*, 87(1), 34–38. <https://doi-org.ezp.waldenulibrary.org/10.1080/00098655.2013.832130>

Nelson, J., & Bohanon, H. (2019). Blue ocean shift: Evidence-based practice in the professional development of teachers. *International Journal of Advanced Corporate Learning*, 12(2), 4–20. <https://doi->

org.ezp.waldenulibrary.org/10.3991/ijac.v12i2.10688

- Netcoh, S. (2017). Balancing freedom and limitations: A case study of choice provision in a personalized learning class. *Teaching and Teacher Education*, 66, 383–392. <https://doi-org.ezp.waldenulibrary.org/10.1016/j.tate.2017.05.010>
- Niño Santisteban, L. (2014). The effects of differentiated instruction on the literacy process of learners with interrupted schooling. *GIST Education and Learning Research Journal*, 9, 31–49.
- Ozkaya, A., & Karaca, S.Y. (2017). The effects of realistic mathematics education on students' math self-reports in fifth grades mathematics course. *International Journal of Curriculum and Instruction*, 9(1), 81-103.
- Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). Thousand Oaks, CA: Sage.
- Perry, R. (2019). Mathematics stations in a third grade classroom: Are they worth it? *Journal of Teacher Action Research*, 5(3), 38–60.
- Polly, D. D., Wang, C., Martin, C., Lambert, R., Pugalee, D., & Middleton, C. (2018). The influence of mathematics professional development, school-level, and teacher-level variables on primary students' mathematics achievement. *Early Childhood Education Journal*, 46(1), 31–45. doi:10.1007/s10643-017-0837-y
- Pololea, D., & Toma, S. (2015). The dynamic and multidimensional structure of the teachers professional development. *Procedia-Social and Behavioral Sciences*, 180, 113-118.
- Pourdana, N., & Rad, M. S. (2017). Differentiated instructions: Implementing tiered

- listening tasks in mixed-ability EFL context. *Journal of Modern Research in English Language Studies*, 4(1), 87–69. <https://doi-org.ezp.waldenulibrary.org/10.30479/jmrels.2017.1566>
- Powell, C. G., & Bodur, Y. (2019). Teachers' perceptions of an online professional development experience: Implications for a design and implementation framework. *Teaching and Teacher Education*, 77, 19–30. <https://doi-org.ezp.waldenulibrary.org/10.1016/j.tate.2018.09.004>
- Prast, E. J., Van de Weijer-Bergsma, E., Kroesbergen, E. H., & Van Luit, J. E. H. (2015). Readiness-based differentiation in primary school mathematics: Expert recommendations and teacher self-assessment. *Frontline Learning Research*, 3(2), 90–116. <http://dx.doi.org/10.14786/flr.v3i2.163>
- Prast, E. J., Van de Weijer-Bergsma, E., Kroesbergen, E. H., & Van Luit, J. E. H. (2018). Differentiated instruction in primary mathematics: Effects of teacher professional development on student achievement. *Learning and Instruction*, 54, 22–34. <https://doi-org.ezp.waldenulibrary.org/10.1016/j.learninstruc.2018.01.009>
- Riley, T. (2016). The importance of learning with like-minded peers through flexible grouping in inclusive educational settings. *International Journal of Learner Diversity & Identities*, 23(4), 33–47. doi:10.18848/2327-0128/cgp/v23i04/33-47
- Santamaria, L. (2009). Culturally responsive differentiated instruction: Narrowing gaps between best pedagogical practices benefitting all learners. *Teacher's College Record*, 1(111), 214-247. <http://www.tcrecord.org.ezp.waldenulibrary.org/Content.asp?ContentId=15210>

- Satsangi, R., Hammer, R., & Hogan, C. D. (2019). Video modeling and explicit instruction: A comparison of strategies for teaching mathematics to students with learning disabilities. *Learning Disabilities Research & Practice* (Wiley-Blackwell), 34(1), 35–46. <https://doi-org.ezp.waldenulibrary.org/10.1111/ldrp.12189>
- Senturk, C., & Sari, H. (2018). Investigation of the contribution of differentiated instruction into science literacy. *Qualitative Research in Education* (2014-6418), 7(2), 197–237. <https://doi-org.ezp.waldenulibrary.org/10.17583/qre.2018.3383>
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63–75. <https://doi-org.ezp.waldenulibrary.org/10.3233/EFI-2004-22201>
- Shepherd, C., & Acosta-Tello, E. (2015). Differentiating instruction: As easy as one, two, three. *Journal of College Teaching & Learning*, 12(2), 95–100. doi:10.19030/tlc.v12:2.9186
- Siam, K., & Al-Natour, M. (2016). Teacher's differentiated instruction practices and implementation challenges for learning disabilities in Jordan. *International Education Studies*, 9(12), 167–181. doi:10.5539/ies.v9n12p167
- Smets, W. (2017). High quality differentiated instruction—A checklist for teacher professional development on handling differences in the general education classroom, *Universal Journal of Educational Research*, 5(11), 2074-2080. doi:10.13189/ujer.2017.051124
- Smets, W. (2019). Challenges and checklists: Implementing differentiation: Pedagogy

provides a solid rationale for differentiated instruction in the History classroom, but this is not always an easy skill for teachers to acquire. *Agora*, 54(2), 22–26.

Smets, W., & Struyven, K. (2020). A teachers' professional development programme to implement differentiated instruction in secondary education: How far do teachers reach? *Cogent Education*, 7(1). <https://doi-org.ezp.waldenulibrary.org/10.1080/2331186X.2020.1742273>

Smith, O. L., & Robinson, R. (2020). Teacher perceptions and implementation of a content-area literacy professional development program. *Journal of Educational Research and Practice*, 10(1), 55-69.

<https://doi.org/10.5590/JERAP.2020.10.1.04>

Stone, S. J. (2018). Differentiated instruction: A band-aid approach for a flawed system. *International Journal of the Whole Child*, 3(1), 19–29.

<https://files.eric.ed.gov/fulltext/EJ1208881.pdf>

Suprayogi, M. N., Valcke, M., & Godwin, R. (2017). Teachers and their implementation of differentiated instruction in the classroom. *Teaching and Teacher Education*, 67, 291–301. <https://doi-org.ezp.waldenulibrary.org/10.1016/j.tate.2017.06.020>

Tantawy, N. (2020). Investigating teachers' perceptions of the influence of professional development on teachers' performance and career progression. *Arab World English Journal*, 11(1), 181–194. <https://doi-org.ezp.waldenulibrary.org/10.24093/awej/vol11no1.15>

<https://doi-org.ezp.waldenulibrary.org/10.24093/awej/vol11no1.15>

Taylor, B. K. (2015). Content, process, and product: Modeling differentiated instruction. *Kappa Delta Pi Record*, 51(1), 13–17.

<http://dx.doi.org.ezp.waldenulibrary.org/10.1080/00228958.2015.988559>

Tomlinson, C. (2001). *How to differentiate instruction in mixed ability classrooms*.

Upper Saddle River, N. J.: Pearson Education

Tomlinson, C. (2003). *Fulfilling the promise of the differentiated classroom: Strategies and tools for responsive teaching*. Alexandria, VA: Association for Supervision and Curriculum Development

Tomlinson, C. A. (2004a). Sharing responsibility for differentiating instruction. *Roeper Review*, 26(4), 188-190. doi:10.1080/02783190409554268

Tomlinson, C. A. (2014). *The Differentiated Classroom: Responding to the Needs of All Learners* (Vol. 2nd ed). Alexandria: ASCD.

Tomlinson, C. (2015). Teaching for excellence in academically diverse classrooms. *Society*, 52(3) 203–209. <https://doi.org/10.1007/s12115-015-9888-0>

Tomlinson, C. (2017). *How to differentiate instruction in academically diverse classrooms*. Alexandria, VA: ASCD.

Tomlinson, C. A., & Allan, S. D. (2000). *Leadership for Differentiating Schools & Classrooms*. Alexandria, VA: ASCD.

Tomlinson, C., & Imbeau, M. (2010). *Leading and managing a differentiated classroom*. Alexandria, VA: ASCD

Tomlinson, C. A., & Imbeau, M. B. (2012). Common sticking points about differentiation. *School Administrator*, 69(5), 18–22.
<http://www.aasa.org/content.aspx?id=23118>

Tobin, R., & Tippett, C. (2014). Possibilities and potential barriers: Learning to plan for

- differentiated instruction in elementary science. *International Journal of Science & Mathematics Education*, 12(2), 423–443. <https://doi-org.ezp.waldenulibrary.org/10.1007/s10763-013-9414-z>
- U.S. Department of Education, (2019). Washington, DC: National Center for Education Statistics. <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019144>.
- Valiandes, S. (2015). Evaluating the impact of differentiated instruction on literacy and reading in mixed ability classrooms: Quality and equity dimensions of education effectiveness. *Studies in Education of Evaluation*, 45, 17–26.
doi:10.1016/j.stueduc.2015.02.005
- Valiandes, S., & Neophytou, L. (2018). Teachers' professional development for differentiated instruction in mixed-ability classrooms: investigating the impact of a development program on teachers' professional learning and on students' achievement. *Teacher Development*, 22(1), 123–138.
doi:10.1080/13664530.2017.1338196
- Vangrieken, K., Dochy, F., Raes, E., & Kyndt, E. (2015). Teacher collaboration: A systematic review. *Educational Research Review*, 15, 17–40. <https://doi-org.ezp.waldenulibrary.org/10.1016/j.edurev.2015.04.002>
- Vangrieken, K., Grosemans, I., Dochy, F., & Kyndt, E. (2017). Teacher autonomy and collaboration: A paradox? Conceptualising and measuring teachers' autonomy and collaborative attitude. *Teaching and Teacher Education* 67, 302-315.
- Ward, P., & Mars, H. (2020). Confronting the challenge of continuous professional development for physical education teachers. *JOPERD: The Journal of Physical*

Education, Recreation & Dance, 91(1), 7-13.

<http://dx.doi.org.ezp.waldenulibrary.org/10.1080/07303084.2020.1683376>

Wilkerson, M. H., Andrews, C., Shaban, Y., Laina, V., & Gravel, B. E. (2016). What's the technology for? Teacher attention and pedagogical goals in a modeling-focused professional development workshop. *Journal of Science Teacher Education, 27(1), 11–33.*

Williford, A., Carter, L., Maier, M., Hamre, B., Cash, A., Pianta, R., & Downera, J. (2017). Teacher engagement in core components of an effective, early childhood professional development course: Links to changes in teacher–child interactions. *Journal of Early Childhood Teacher Education, 38(1), 102–118.* <https://doi-org.ezp.waldenulibrary.org/10.1080/10901027.2016.1269028>

Wilson, T., Nabors, D., Berg, H., Simpson, C., & Timme, K. (2012). Small-group reading instruction: Lessons from the field. *Dimensions of Early Childhood, 40(3), 30.*

Wu, S. -C., (Angel), & Chang, Y.-L. (Aldy). (2015). Advancing kindergarten teachers' knowledge and capabilities of differentiated instruction associated with implementation of thematic integrated curriculum. *Procedia - Social and Behavioral Sciences, 177, 246–250.* <https://doi-org.ezp.waldenulibrary.org/10.1016/j.sbspro.2015.02.404>

Yenen, T., & Yontem, K. (2020). Teachers' professional development needs: A Q method analysis. *Discourse and Communication for Sustainable Education, 11(2), 159–176.* <https://doi-org.ezp.waldenulibrary.org/10.2478/dcse-2020-0024>

Zein, M. S. (2017). Professional development needs of primary EFL teachers:

perspectives of teachers and teacher educators. *Professional Development in Education*, 43(2), 293–313. <https://doi-org.ezp.waldenulibrary.org/10.1080/19415257.2016.1156013>

Zwart, R. C., Korthagen, F. A. J., & Attema-Noordewier, S. (2015). A strength-based approach to teacher professional development. *Professional Development in Education*, 41(3), 579–596. <https://doi:10.1080/19415257.2014.919341>

Appendix A: The Project

The PD sessions and activities were outlined using a PowerPoint slide presentation and facilitator notes. The 3-Day PD is outlined as follows:

PD Session Schedule - Day 1

Time	Activity	Method
8:30am – 9:00am	Sign-in, PD material pick-up, group assignment, and continental breakfast	Sign-in at table in the front of the designated room, and pick-up PD materials, table assignment for groups, and continental breakfast
9:00am – 9:15am	Welcome, Introductions, Overview of 3-day PD, and Goals and Learning Outcomes	Led by PD facilitator using PowerPoint slide presentation
9:15am – 9:45am	Ice Breaker – Learning Styles Homerun Activity	Review group Ice-breaker activity with participants
9:45am – 10:15am	Brainstorming Activity	Led by PD facilitator
10:15am – 11:00 am	What is DI? What does it look like?	Led by PD facilitator using PowerPoint slide presentation and handouts
	10 MINUTE BREAK	
11:15am – 12:00pm	What is DI? What does it look like? Part II	Led by PD facilitator using PowerPoint slide presentation and handouts
12:00pm – 1:00pm	Lunch	On your own
1:00pm – 2:30pm	Differentiated Instructional Strategies	Led by PD facilitator using PowerPoint slide presentation and handouts
	10 MINUTE BREAK	
2:45pm – 3:30pm	Closing Activity	Reflection: Exit Ticket

PD Facilitator Notes for Day 1

- Participants names will be organized alphabetically and grouped based on their identified grade level.
- Participants will receive a name tag and a packet that includes their group assignments and all PD handouts for Day 1.
- Each table will have a resource box. This resource box will contain items that will be utilized throughout the workshop. Items will consist of workshop supplies such as sharpies, index cards, whiteboard, dry erase markers/erasers, post-it notes, scissors, highlighters, pencils, and pens.
- The PD Facilitator will share all pertinent PD information with the participants using a PowerPoint presentation, providing them with a copy of the PowerPoint slides with note lines, and handouts.
- The participants will be provided with breaks during the sessions.
- Workshop Norms will be posted in the room to ensure they are easily visible throughout the session.
- The PD facilitator will address the following:
 - Welcome the participants to the 3-Day PD
 - Introduction of the PD facilitator
 - Introduce any administrators that are present
 - Provide an overview of the 3-day PD schedule of activities.
 - Review the goals, learning outcomes, and essential questions


- Confirm that teachers are in their assigned groups and at their designated tables.
- Review the meeting norms group discussions and activities
- Begin session activities
 - Lead the Learning Styles Activity to identify participant learning styles and create Base-Style groups.
 - Lead the Brainstorming Activity by engaging the participants in a visual literacy activity – One Size Fits All?
 - Provide an overview of DI, and discuss what it is, what it isn't, and what it looks like. Share a video clip of a differentiated math lesson, and discuss what we saw, what we heard, and what we think. Have participants engage in a sorting activity to show what they have learned about DI.
 - Give participants a 10-minute break
 - Provide an overview of the components of DI. Discuss how to differentiate by content, process, product, and environment. Discuss how you can differentiate according to a students' interest, readiness, and learning profile. Share a video clip of one of the various instructional strategies that can be used to differentiate. Have participants complete the I See, I Hear, I Wonder protocol.
 - Give participant a 1-hour lunch break
 - Provide an overview of the various differentiated instructional strategies. Discuss how tiered lessons, flexible grouping, small group instruction,

student choice, and stations can be used to differentiate lessons. Have participants work with the people at their table to complete the work session activity. Participants will be provided with pre-recorded modeled lessons where they are to discuss what the strategy is, how it works, and what you think the pros & cons of the strategy are.

- Give participants a 10-minute break
- Finish day 1 with the Closing Session, which will involve teachers completing a Flip Grid presentation as a reflection activity. Participants will be instructed to answer closing reflection questions and record their responses. Participants will work collaboratively to share what they have learned about DI and how these strategies can be used in their mathematics classroom. Participants will have a graphic organizer to record their thoughts and use this summary to record their Flip Grid presentations. These responses will be utilized at the start of Day 2.
- Facilitator will provide teachers with the online platform (Padlet) that will be used to store documents, resources, and artifacts.

The PowerPoint presentation slides for PD day 1 are found below:

Differentiation in the Mathematics Classroom



PROFESSIONAL DEVELOPMENT
DAY 1


AGENDA

- Welcome
- Introduction
- Overview of 3-Day PD session

Learning Goals & Objectives

- Learn**
 - Participants will learn about the components of differentiated instruction
- Participate**
 - Participants will actively engage in PD activities that encourage instructional discourse about various differentiated instructional strategies.
- Create**
 - Participants will create a portfolio to hold artifacts, resources, and activities collected throughout the PD.
- Share**
 - Participants will share their learning experiences to cultivate an environment that supports teaching and learning.

Essential Questions



- What is differentiated instruction?
- Why do I need to differentiate instruction?
- What would differentiated instruction look like in a mathematics classroom?

Ice-Breaker Activity

<p>LEARNING STYLES INVENTORY</p> <ul style="list-style-type: none"> When teachers communicate, they are addressing auditory learners, visual learners, and kinesthetic/tactile learners. The teacher has a learning style that makes delivery most comfortable. The learners have a reception style that helps them retain information most comfortably. 	<p>FLEXIBLE GROUPS FOR 3-DAY PD</p> <ul style="list-style-type: none"> Learning Styles Groups <ul style="list-style-type: none"> Homogenous - Same learning style Heterogenous - Mixed group (auditory, visual, tactile) Content Groups <ul style="list-style-type: none"> Homogenous - Same grade level content Heterogenous - Mixed group (6th, 7th, 8th)
--	---

Brainstorming Activity



Think-Pair-Share

- What do you observe?
- Why did the photographer take this picture?
- What questions would you ask?

Think Tank

- Define "differentiation" in your own words.

What is DI? What does it look like?

What is Differentiation?

- Differentiation means tailoring instruction to meet individual needs. Whether teachers differentiate content, process, products, or the learning environment, the use of ongoing assessment and flexible grouping makes this a successful approach to instruction.

[Carol Ann Tomlinson](#)


What does DI look like in a Mathematics Classroom?

1-Hour CLASS

- ❑ 10-minute opening and mini-lesson (Whole class)
- ❑ 40 minutes work period with small group instruction, partner pairs, and/or independent (e.g. 4 10-minute small groups)
- ❑ 10-minute closing

Sorting Activity

- ❑ Participants will be given a set of statements to sort.
- ❑ Participants will work collaboratively to sort the statements into two columns with the following headings:
 - ❑ Differentiation IS ... and IS NOT...



BRAIN BREAK – 10 Minutes

Differentiation of Instruction

Is a teacher's response to learner's need for

- Flexible Grouping
- Engaging Tasks
- Continuous Assessments

Teachers can differentiate through

- Content
- Process
- Product
- Environment

According to a students'


- Interests
- Readiness
- Learning Profile

Through a variety of instructional strategies such as

- Tic-Tac Toe, Learning Contracts, Menus, Tiered Assignments, Learning Centers, Small Group Instruction, etc.

Source: Carol Ann Tomlinson

Differentiate Content



Strategy	Readiness	Interest	Learning Profile
Tiered Content	+		
Providing a Variety of Materials	+	+	+
Presentation Styles			+
Scaffolding	+		
Learning Contracts	+	+	+
Compacting	+		

Strategy	Readiness	Interest	Learning Profile
Tiered Activities	+		
Learning Centers	+	+	+
Interactive Journals	+	+	
Graphic Organizers	+		+
Jigsaw Activities	+	+	
Manipulatives	+		+

Differentiate Process



Differentiate Product



Strategy	Readiness	Interest	Learning Profile
Tiered Products	+		
Tiered Topic	+	+	+
Learning Centers	+	+	+
RAFT	+	+	+

Differentiate Environment



Differentiate According to a Students'...

Readiness

- Skills
- Concept Knowledge
- Concepts

Interests

- Self Selection
- Interest Surveys
- Student Choice

Learning Profile

- Areas of Strengths and Weaknesses
- Mode of Learning

Work Session Activity 1



OBSERVE A LESSON VIDEO
<https://youtu.be/SNqJmCvYs>








COMPLETE THE I SEE, I HEAR, I WONDER PROTOCOL






LUNCH BREAK - 1 Hour

Differentiated Instructional Strategies

-  Tiered Lesson
-  Flexible Grouping
-  Small Group Instruction
-  Student Choice Assignments
-  Stations

Tiered Lessons






-  Differentiation strategy based on a student's interests, readiness, or learning profiles.
-  Addresses a particular standard, key concept, and generalization
-  Allows several pathways for students to arrive at an understanding

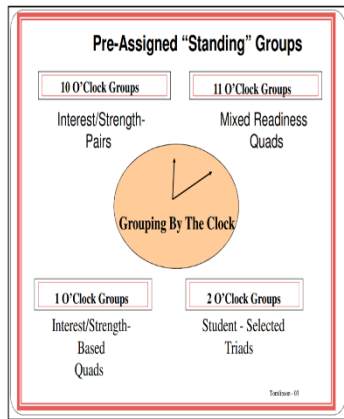
www.davidsongfted.org

Grade: Five
 Standard: Numbers and Operations
 Key Concept: Students understand and represent commonly used fractions such as $\frac{1}{4}$ and $\frac{1}{2}$.
 Generalization: Students will be able to illustrate how fractions represent part of a whole.
 Background: Fractions (halves/thirds) have been introduced and illustrated by the students with pictures.
 Materials: Paper circles, squares, rectangles, triangles.
 Tier I: Using paper circles (pizza) and squares (sandwich), students in pairs determine how to share the food equally and illustrate by folding the paper. Have two pairs determine how they can share equally with four people. They can cut the pizza and stack them to see if they match. Have the equal pair the process for sharing a Reese's Peanut Butter Cup equally with three people.
 Tier II: Using paper circles (pizza) and squares (sandwich), have students in triads determine how to share the food equally and illustrate by folding the paper. Have two triads determine how they can share equally with six people. Have the group of six repeat the process for sharing a birthday cake with 12 people. In each case, they can cut the pizza and stack to match. Have the group start with half a cake and divide equally for 3, 6, and 12 people.
 Tier III: Using paper rectangles (sandwiches) and triangle slices of pie, have students in pairs determine how to share the food in three different ways to get two equal parts. Have them illustrate by folding the paper. Are there other different ways to divide each shape equally? How many ways are there? Have the pair determine which shapes—circles, squares, rectangles, triangles—are easier to divide evenly and illustrate why with a particular food of their choice.
 Assessment: As the students work, the teacher will circulate among the groups and note the children's abilities to divide materials into equal parts and to recognize and check for equal parts. Can children explain orally how many equal parts there are and demonstrate how they know the parts are equal? Is it at the teacher's discretion to determine which children need more in-depth questioning to ascertain mastery of the concept.




Figure 1
 Tiered Lesson in Mathematics: Tiered in Content According to Readiness

Flexible Grouping

-  Differentiation strategy based on a student's interests, readiness, or learning profiles.
-  Temporary groups (groups change often based on the learning objective and students' needs or interests)
-  Groups can be heterogeneous (made up of varying skill levels)
-  Groups can be homogeneous (made up of the same skill level)
-  Teacher selected; student selected, randomly selected



Small Group Instruction

-  Differentiation strategy based on a student's interests, readiness, or learning profiles.
-  Teacher provides personalized instruction with targeted feedback
-  Students are grouped homogeneously to provide explicit instruction



WHEN FORMING YOUR GROUPS keep the following in mind...

GROUP 1	GROUP 2	GROUP 3	GROUP 4
*struggling students	*students on target or in need of enrichment	*students on target or in need of enrichment	*struggling students
*meets with teacher twice a week	*meets with teacher once a week	*meets with teacher once a week	*meets with teacher twice a week






Spatial	Linguistic	Kinesthetic
Linguistic	Free Space	Logical
Intrapersonal	Music	Interpersonal

Student Choice Boards

-  Differentiation strategy based on a student's interests, readiness, or learning profiles.
-  Incorporates interest-based differentiation
-  Allows students to move at their own pace and have choice over what they learn and how they review the content

Stations

-  Differentiation strategy based on a student's interests, readiness, or learning profiles.
-  Provides continuity in reviewing key skills throughout the school year
-  Teacher can provide differentiated activities at each station and these activities can change frequently as students progress in their ability to understand and apply each skill



Work Session Activity #2

Observe the modeled lesson

Collaboratively, with the people at your table, discuss what strategy is being utilized, how it works, and what you think the pros & cons of the strategy are.

Complete one of the sample activities with your group

BE SURE THAT EVERYONE IN YOUR GROUP HAS A COPY OF AN EXAMPLE AND CAN EXPLAIN THE STRATEGY.



BRAIN BREAK - 10 Minutes

Closing Activity

Participants will record a Flip Grid presentation answering the following questions:

What is differentiated instruction?

Why do I need to differentiate instruction?

How do I integrate differentiated instruction?

Which strategy/strategies seemed most applicable to your classroom?

What questions do you still have about these strategies?

TICKET OUT THE DOOR

What would differentiated instruction look like in a mathematics classroom?

Session Schedule - Day 2

Time	Activity	Method
8:30am – 9:00am	Sign-in, PD material pick-up, group assignment, and continental breakfast	Sign-in at table in the front of the designated room, and pick-up PD materials, table assignment for groups, and continental breakfast

9:00am – 9:15am	Review of Day 1, and overview of Day 2 Goals and Learning Outcomes	Led by PD facilitator using PowerPoint slide presentation
9:15am – 10:00am	Review, Reflect, & Revisit Opening Activity	Review Flip Grid Presentations with participants
10:00am – 11:00am	Differentiation in a Mathematics Classroom	Led by PD facilitator using PowerPoint slide presentation and handouts
10 MINUTE BREAK		
11:15am – 12:00pm	KUDs & AHA Protocol Activity	Led by PD facilitator using PowerPoint slide presentation and handouts
12:00pm – 1:00pm	Lunch	On your own
1:00pm – 2:45pm	Differentiated Lesson Planning Session	Led by PD facilitator using PowerPoint slide presentation and handouts
10 MINUTE BREAK		
3:00pm – 3:30pm	Closing Activity	Reflection: Exit Ticket

PD Facilitator Notes for Day 2

- Participants names will be organized alphabetically and grouped based on their identified grade level.
- Participants will receive another name tag and any necessary PD handouts for Day 2.
- Each table will have a resource box. This resource box will contain items that will be utilized throughout the workshop. Items will consist of grade-level curriculum guides, state-mandated mathematics standards, model lesson plans, and workshop supplies such as sharpies, index cards, whiteboard, dry erase markers/erasers, post-it notes, scissors, highlighters, pencils, and pens.

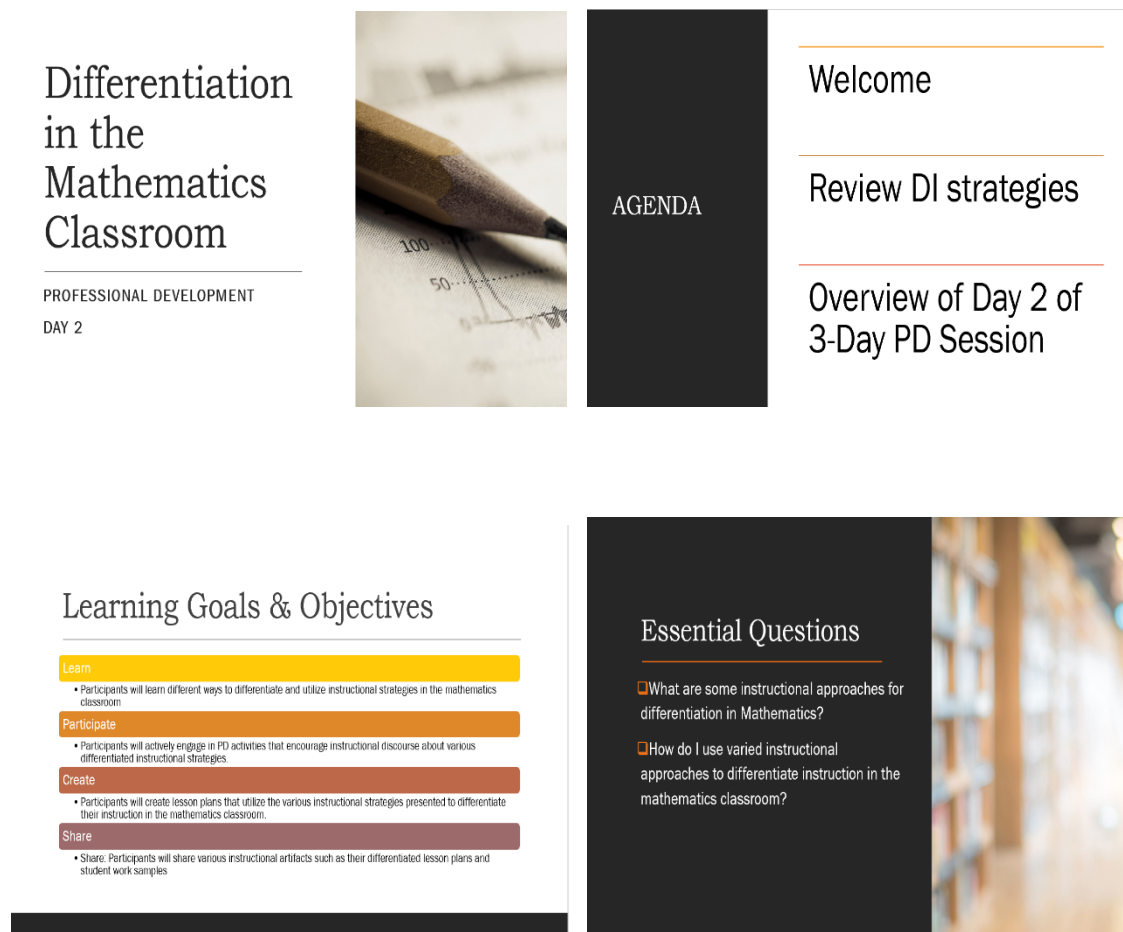
- The PD Facilitator will share all pertinent PD information with the participants using a PowerPoint presentation, providing them with a copy of the PowerPoint slides with note lines, and handouts.
- The participants will be provided with breaks during the sessions.
- Workshop Norms will be posted in the room to ensure they are easily visible throughout the session.
- The PD facilitator will address the following:
 - Welcome the participants to Day 2 of the PD
 - Provide brief recap of Day 1 session activities
 - Provide an overview of Day 2 scheduled activities
 - Review goals, learning outcomes, and essential questions
 - Confirm that teachers are in their assigned groups and at their designated tables.
 - Review the meeting norms group discussions and activities
- Begin session activities
 - Lead participants in a review, reflect, and revisit activity where they will review the Flip Grid presentations from Day 1. Participants will complete a video reflection sheet and engage in a turn and talk session where they share thoughts from their Day 1 experiences.
 - Provide an overview mathematics instructional approaches including, explicit instruction, Concrete-Representational-Abstract (CRA) method, multiple representations, and the Polya's Problem Solving Process. Have

participants engage in a work session activity where they review a mathematical learning task and discuss how they could differentiate the learning task based on the instructional approaches presented.

- Give participants a 10-minute break
- Provide an overview of the Know-Understand-Do (KUD) Method. Have participants engage in the AHA protocol to identify a clear understanding of the elements of KUD. Discuss how KUD can be used to differentiate mathematics lessons.
- Give participants a lunch break
- Provide an overview of key elements of lesson planning including a standards-based instructional framework, learning targets, success criteria, academic vocabulary, and formative assessments. Discuss how to use each of these elements to create a differentiated mathematics lesson plan. Have participants work collaboratively to create a differentiated mathematics lesson that they can use in their current classes. Participants will utilize lesson plan templates to plan differentiated lessons based on their current student population. Participants will be asked to record their lesson and submit it for a peer observation during Day 3 of the PD workshop.
- Finish day 2 with the Closing Session, which will involve teachers completing an exit ticket as a reflection activity. Remind participants of their recorded submissions and that they should bring student artifacts to

our next session. Review the expectations for selecting student work artifacts.

The PowerPoint presentation slides for PD day 2 are found below:



The image displays four slides from a PowerPoint presentation. The top-left slide is the title slide, featuring the text 'Differentiation in the Mathematics Classroom' and 'PROFESSIONAL DEVELOPMENT DAY 2' next to a photograph of a pencil on a graph. The top-right slide is the agenda slide, listing 'Welcome', 'Review DI strategies', and 'Overview of Day 2 of 3-Day PD Session'. The bottom-left slide is titled 'Learning Goals & Objectives' and lists four categories: Learn, Participate, Create, and Share, each with a bulleted description of participant activities. The bottom-right slide is titled 'Essential Questions' and lists two questions about instructional approaches for differentiation in mathematics.

Differentiation in the Mathematics Classroom
PROFESSIONAL DEVELOPMENT
DAY 2

AGENDA

- Welcome
- Review DI strategies
- Overview of Day 2 of 3-Day PD Session

Learning Goals & Objectives

- Learn**
 - Participants will learn different ways to differentiate and utilize instructional strategies in the mathematics classroom
- Participate**
 - Participants will actively engage in PD activities that encourage instructional discourse about various differentiated instructional strategies.
- Create**
 - Participants will create lesson plans that utilize the various instructional strategies presented to differentiate their instruction in the mathematics classroom.
- Share**
 - Share: Participants will share various instructional artifacts such as their differentiated lesson plans and student work samples

Essential Questions

- What are some instructional approaches for differentiation in Mathematics?
- How do I use varied instructional approaches to differentiate instruction in the mathematics classroom?

Review, Reflect, Revisit Activity



FLIP GRID PRESENTATIONS



COMPLETE THE VIDEO SUMMARY REFLECTION SHEET



TURN & TALK: DISCUSS THE DI STRATEGY THAT CONNECTS MOST WITH YOU. EXPLAIN WHY.

Differentiation in a Mathematics Classroom

In a differentiated mathematics classroom, the teachers proactively plan varied approaches to what students need to learn, how they will learn it, and/or how they will show what they have learned in order to increase the likelihood that each student will learn as much as he or she can, as efficiently as possible (Tomlinson, 2003).

Instructional Approaches

Explicit Instruction

Multiple Representations

CRA Method

Polya's Problem Solving

Explicit Instruction

- Explicit instruction involves teaching a specific concept or procedure in a structured and sequenced manner
 1. Modeled Instruction – Models concepts or procedures in a step-by-step manner
 2. Guided practice – Teacher and student work together to gradually solve problems.
 3. Independent practice – Students work independently or in small groups to solve problems.
- Video: <https://iris.peabody.vanderbilt.edu/module/math/cresource/q2/p04/>
- Observation Protocol: I see, I hear, I wonder

Multiple Representations

Multiple Representation is an instruction approach that is based on 5 tangible ways of representing knowledge

- Concrete – materials are used to model a concept
- Contextual – situations to engage student interest
- Visuals – diagrams represent a problem or record understanding
- Verbal – students talk and write about their learning
- Symbolic – students use symbols to record understanding

Seven Questions:		
Write this story using the numbers that... as a sale at the sporting goods store went, everything was _____% off. Calculate Cindy's expenses. How much money did she save? How much more money did she spend?	2a. Using pattern blocks, create a design in which 60% of the area is yellow. Record your design and explain how you know that 60% of the area is yellow.	3. How the students draw a design in which 60% of the area is yellow. Record your design and explain how you know that 60% of the area is yellow.
1.40 37.00 33.60	Concrete Pictorial Verbal Outcome: 7A12.7B-D	Pictorial Verbal Outcome: 7A12.8B
Write the following in the form of a story. Explain your answers. 1.20 20% 0.020	2b. Using pattern blocks and fraction blocks, create a design where 20% of the area is yellow. Record your design and explain how you know that 20% of the area is yellow.	4. Ask further questions such as: How many squares would you need to make a 10 cm by 10 cm square?
Concrete Pictorial Verbal Outcome: 7A12.7B	Symbolic Verbal Outcome: 7A12.7B	5. The highway department is responsible for 300 km of these roads and 300 km of four-lane roads. What percent of the roads are four-lane?
	Concrete Pictorial Verbal Outcome: 7A12.7B	Symbolic Verbal Outcome: 7B

C-R-A Method

CRA is an instructional approach for teaching math, and it is inclusive of the following 3 phases:

- Concrete: Teacher models mathematical concept with concrete objects (e.g., manipulatives). Student manipulates concrete objects to model the math concept/skill.
- Representational: Teacher transforms the concrete model into a representational level. Student draws pictures/models that represent the concrete objects previously used.
- Abstract: Teacher models the mathematics concept at a symbolic level. Student uses operation symbols (+, -) to indicate addition, multiplication, or division.

Polya's Problem Solving Process

In 1945 George Polya published the book, *How to Solve It* which identifies a four-step process for problem solving.

Step 1: Understand the problem.

Step 2: Devise a plan (translate).

Step 3: Carry out the plan (solve).

Step 4: Look back (check and interpret).

Strategy: UPS CHECK

Work Session Activity #1



BRAIN BREAK – 10 Minutes

K.U.D. Method

K: What Students Should KNOW

- Facts or categories of facts, dates, names of people or places, names and details of important events, definitions of terms or concepts, academic vocabulary, steps in a process, or rules.

U: What Students Should UNDERSTAND

- An enduring understanding, big idea, or "aha" moment in which students gain an understanding as a result of acquiring content and skills.

D: What Students Should DO

- Skills that students should master (i.e., thinking skills, organizational skills, habits of mind, procedural skills, or skills associated with the content)



KUDs & AHA Protocol Activity

Participants participate in a discussion on the selected reading using the "AHA" protocol.

1. Read article: Understanding the "Understands" in KUDs by Jennifer N. Kumpost
2. Each table group will discuss the reading using the "AHA" Protocol.
3. After the table group has discussed the article using the protocol, the group will come to a consensus as to which "AHA" moments they will post on the chart paper at the front of the room.
4. Once all table groups have completed the protocol, we will share our ideas in whole group discussion.



Lunch Break – 1 Hour

Lesson Planning



Standards-Based Classroom Instructional Framework

- STANDARDS FOR MATHEMATICAL PRACTICE - There are 8 Standards for Mathematical Practice that are incorporated in all mathematics lessons and activities
 - OPENING
 - TRANSITION TO WORK SESSION
 - WORK SESSION
 - CLOSING
- CARD SORT ACTIVITY: Identifying the appropriate descriptive activity for the opening, work session, and closing

Learning Targets

Learning targets are the WHAT! Learning targets helps students identify WHAT skills and/or concepts they will be learning

Learning targets describe what students will learn (not what they will do) during a lesson

- To create learning targets:
- Select the standard you will be teaching
 - Rephrase the standard using kid friendly language
 - I can...
 - Post the standard on lesson plan and on your instructional board and refer to it throughout the lesson

Success Criteria

- To create success criteria:
 - Determine the steps needed for students to successfully achieve the learning target
 - what students will say, do, make, or write to demonstrate mastery of the learning target
 - List the steps in order of how students need to complete them
 - Provide any coding, visuals, pictures, etc. necessary
 - Video: <https://learn.teachingchannel.com/video/criteria-for-success>
- Discussion Questions:
 - How do the criteria for success help students give targeted feedback to their peers?
 - How does Ms. Ivey make the criteria for success accessible to her young learners?
 - What has Ms. Ivey learned from using criteria for success with her students?

Academic Vocabulary

- Have students keep a math vocabulary notebook
- Display a math word wall
- Have students use thinking maps and graphic organizers
- Review math vocabulary throughout classroom instruction

Informal Vocabulary	Formal Mathematical Vocabulary
Split	Divide
Take away	Subtract
Slide	Translation
Turn	Rotation
Flip	Reflection
Change	Transformation
Same	Congruent/Equal
More	Greater
Less	Fewer
Holds	Capacity
Inside	Interior Area
Around	Perimeter
Cross	Intersection
Total	Sum

AISD Elementary Mathematics Department

Formative Assessment

Four Attributes of Formative Assessment

- **Clarify Intended Learning:** Helps students and teachers understand the expectations and goals for their work together
- **Elicit Evidence:** Evidence elicited by interacting with students, using appropriate questioning strategies, focusing on observations of students, and by looking at student work and analyzing it.
- **Interpret Evidence:** Interpretation of evidence is determined by looking at student work, observing and talking with students, and/or discovering the gap or misunderstanding in the student's prior knowledge.
- **Act on Evidence:** Adjustments to instruction are made to keep student on track; at times remediation and/or enrichment opportunities are offered to student

*Smarter Balanced Assessment Consortium

Work Session Activity #4

- Identify the learning targets for the lesson
- Determine the Success Criteria for the lesson
- Identify the academic vocabulary for the lesson
- Create a lesson plan outline for the selected standard
 - Opening
 - Work Period
 - Closing

Suggestions for Bringing Student Work Protocol

As you think about what student work you might bring to our meeting, consider work that

- you are wondering about
- work that you would like to revise
- work that raises a dilemma for you

The student work you bring to the table can be anything students produce: written pieces, drawings, math problems, science labs, 3-dimensional structures students have built, artwork, power point presentations, portfolios, videos of student presentations or performances, drafts and/or finished pieces, etc

Protocol Developed by Gene Thompson-Grow

Ticket Out the Door

- What did you learn today?
- How will you use what you have learned in your instructional practice?
- What questions do you have?

Time	Activity	Method
8:30am – 9:00am	Sign-in, PD material pick-up, group assignment, and continental breakfast	Sign-in at table in the front of the designated room, and pick-up PD materials, table assignment for groups, and continental breakfast
9:00am – 9:15am	Review of Day 2, and overview of Day 3 Goals and Learning Outcomes	Led by PD facilitator using PowerPoint slide presentation
9:15am – 12:00pm	Peer Observations: Observing DI in action	Led by PD facilitator
12:00pm – 1:00pm	Lunch	On your own
1:00pm – 2:00pm	Analyzing Student Work from a Differentiated Lesson	Led by PD facilitator using PowerPoint slide presentation and handouts
	10 MINUTE BREAK	
2:15pm – 3:15pm	Reflective Guide: Examining the Effectiveness of DI	Led by PD facilitator using PowerPoint slide presentation and handouts
3:15pm – 3:30pm	Closing Activity	Reflection: Exit Ticket

PD Facilitator Notes for Day 3

- Participants names will be organized alphabetically and grouped based on their identified grade level.
- Participants will receive another name tag and any necessary PD handouts for Day 3.
- Each table will have a resource box. This resource box will contain items that will be utilized throughout the workshop. Items will consist of workshop supplies such as sharpies, index cards, whiteboard, dry erase markers/erasers, post-it notes, scissors, highlighters, pencils, and pens.

- The PD Facilitator will share all pertinent PD information with the participants using a PowerPoint presentation, providing them with a copy of the PowerPoint slides with note lines, and handouts.
- The participants will be provided with breaks during the sessions.
- Workshop Norms will be posted in the room to ensure they are easily visible throughout the session.
- The PD facilitator will address the following:
 - Welcome the participants to Day 3 of the PD
 - Provide brief recap of Day 1 and 2 session activities
 - Provide an overview of Day 3 scheduled activities
 - Review goals, learning outcomes, and essential questions
 - Confirm that teachers are in their assigned groups and at their designated tables.
 - Review the meeting norms group discussions and activities
- Begin session activities
 - Lead participants in the Peer Coaching protocol. Facilitator will share a video clip about peer observations and discuss the expectations. Participants will work together to review their previously recorded DI lessons. Participants will use the protocol to review their recorded modeled lesson and share things they saw, heard, and thought about during the instructional delivery.
 - Give participants a lunch break

- Lead participants in the Standards in Practice: Standards and Looking at Student Work Protocol. Facilitator will share a video clip about student work analysis and discuss the expectations for examining these artifacts. Facilitator will share guidelines for analyzing student work. Participants will use the protocol to review student work artifacts and determine if the differentiated lesson should be modified and/or adjusted to support student growth.
- Give participants a 10-minute break
- Lead participants in the Reflective Guide Protocol to reflect upon their recorded lessons and their peer observation experience. Participants will use the protocol to identify any questions they have about their current practice and to determine possible next steps.
- Finish day 3 with the Closing Session, which will involve teachers completing an exit ticket as a reflection activity. Participants will have an opportunity to share their feedback by completing a PD evaluation form. Facilitator will remind participants that the online platform (Padlet) will remain available for them to review resources and strategies as needed, and to continue their collaboration.

The PowerPoint presentation slides for PD day 3 are found below:

Differentiation in the Mathematics Classroom

PROFESSIONAL DEVELOPMENT
DAY 3



AGENDA

Welcome

Review DI strategies and Instructional Approaches in Mathematics

Overview of Day 3 of 3-Day PD Session

Learning Goals & Objectives

Learn

- Participants will learn how peer observations, student work analysis, and teacher reflections can be utilized to determine the effectiveness of the differentiated instructional strategies employed.

Participate

- Participants will actively engage in PD activities that encourage instructional discourse about various differentiated instructional strategies.

Create

- Participants will create a reflective guide to help enhance their instructional practice.

Share

- Share: Participants will share teacher lessons and student artifacts to reflect upon teaching and learning.

Essential Questions

- How can I use varied instructional approaches to differentiate instruction in the mathematics classroom?

Peer Observations

- Peer observation involves teachers observing each others' practice and focuses on the following:
 - Supporting teachers' individual to provide opportunities to learn and give feedback to peers
 - Building collective efficacy to build a collaborative professional learning community
 - Improving teacher practice to promote student learning
- Peer observation cycle – pre-observation, observation, feedback, and reflection
 - Video: <https://youtu.be/MLBVJfQH0oQ>

Work Session Activity #1

- In your collaborative groups, review video observation of the differentiated mathematics lesson
- Participants will utilize the Peer Observer as a Coach Protocol (Developed in the field by educators affiliated with NSRF) to review their recorded videos and share things they saw, heard, and thought about during the instructional delivery



National
School
Reform
Faculty

Peer Coaching Observer as Coach

Developed in the field by educators affiliated with NSRF.

Receiving real feedback can be threatening to the receiver, therefore an important principle in this process is that at all times the person who is being observed is the one who is in control of the situation.

Guidelines

1. Each person should choose the person with whom they will work. They should agree to take turns being the observer and the observed.
2. The pair should establish ground rules for giving and receiving feedback. For example: "Our observation data will remain confidential", "We will meet to follow up on the observation within 24 hours of the observation."
3. The person asking for feedback specifies the areas in which they want feedback. For example: "Track the kinds of questions I ask, are they memory questions, or do they require evaluation?" "Do I give enough time for students to answer?" "Do I ask more questions than give?"
4. The observer, armed with a short list of what to look for from the person being observed, comes and watches the class or meeting for a short time (15-20 minutes at first, longer as the pair becomes more comfortable with both observation and feedback).
 5. The two people meet afterwards – undisturbed. During this meeting:
 - the partners should sit with the data between them.
 - the observed should discuss on the questions she asked. That is, reflect on the questions in light of the data brought back by the observer.
 - the observer should share the things she saw, heard, and tracked rather than what she thought about them. Allowing the observer to evaluate or judge the observed will poison the process quickly.
 - there should be some talk of what did and didn't happen and how the observed could make it happen next time.




Lunch Break- 1 Hour

Analyzing Student Work

- Student Work Analysis
 - Gives educators information about students' understanding of concepts and skills
 - Assists teachers with making instructional decisions for improving student learning.
 - Helps teachers identify the gaps between their expectation and students' actual performance
 - Provides teachers with information they can use to modify their practices and measure their effects on student learning
 - Helps teachers to develop a new and deeper understanding of their students

Standards in Practice: Standards and Looking at Student Work Protocol

- Participants will utilize the Standards in Practice Protocol to review student work artifacts.
- Video: <https://youtu.be/a2Ug@EDss>



Standards in Practice Standards and Looking at Student Work

Developed by Kath Mitchell, The Education Trust

Get prepared
Select a date, time, and place. Read and discuss the protocol. Make sure there is a batch of student work that the group will look at in using the protocol. Review the following ground rules:

1. Behavior is professional throughout -- no outbursts, no personal attacks
2. Everyone listens to everyone else and does not interrupt or talk over others
3. Praise where possible, but express critical opinions candidly
4. Accept criticism as if it were intended to help improve student achievement
5. Be brief, so that everyone gets lots of chances to talk

Do the assignment yourselves
Every member of the team does the assignment as given to the students.

Make a scoring guide
The group generates a rough scoring guide from the standards and the assignment.

Score the student work
The group scores the student papers, using the guide.

See what students know and can do
The recorder writes the group answers to the following questions:

1. What does this student work tell us about student learning?
2. What do students know, and what are they able to do?
3. Was the assignment well designed to help students acquire knowledge and exercise skills?


Do something about it
The recorder writes the group answers to the following question: What needs to happen on the classroom, school, and district so that all students can do this and similar tasks well?



BRAIN BREAK - 10 Minutes

Reflective Guide

- Participants will utilize the Reflective Guide to reflect upon this Peer Observation experience.



Reflective Guide

Developed Christine Estrada, adapted from the original by Cose Thompson-Crowe

In preparation for our meeting, please use this guide to:

- Identify a question about your practice.
- Select student work, or other work/life, that relates most directly to your question.

1. What questions do I have about my practice as an educator?
2. Which of these questions (from #1) most directly affects student learning? Why?
3. Of the questions generated in #2, which ONE question do I want to learn more about with the help of other colleagues? Why this question?
4. What data (student work, educator work, or other data) do I have -- or can I obtain -- that relates most directly to this question? How does this data relate to my question?

Ticket Out the Door

- Complete the 3-Day Professional Development Evaluation Form

3-Day PD Summative Evaluation Form**Name:** _____ **Date:** _____**Grade Level:** _____**(Please circle one response)**

1. How would you rate the overall quality of the PD?
Excellent Good Fair Poor
2. How well did the presenter state the learning goals and objectives?
Excellent Good Fair Poor
3. How well did the facilitator keep the session interesting and engaging?
Excellent Good Fair Poor
4. How effective were the PD handouts?
Excellent Good Fair Poor
5. What is your overall rating of the PD facilitator?
Excellent Good Fair Poor
6. How will you use what you have learned throughout this 3-Day PD?
7. What was the most beneficial part of this 3-Day PD? Why?
8. What was the least beneficial part of this 3-Day PD? Why?
9. What additional professional development do you need?

Appendix B: Interview Protocol

Thank you for agreeing to participate in this interview session for my doctoral studies. My name is Akecia Owens-Cunningham, and I will be conducting this interview. The purpose of this qualitative study is to explore teacher perceptions on implementing DI strategies in the classroom. You have been chosen because you met the following criteria: (a) certified to teach mathematics in middle school (b) 2 or more years of teaching experience. Your participation in the study is voluntary and will be kept confidential. The interview will be conducted within 45-60 minutes. The interview will be recorded using written notes and audio recording. Transcripts will be provided to ensure that there is accuracy in transcribing your responses. Do you have any questions or concerns before I begin to record?

IMPLEMENTING DIFFERENTIATED INSTRUCTION:

RQ1: What are middle school teacher perceptions implementing differentiated instructional strategies learned in a professional development workshop?

Interview Questions for RQ1

- How do you decide which DI strategies to use in your classroom? **Probe:** What are some DI strategies you use in the mathematics classroom?
- Can you tell me about a lesson where you successfully implemented DI in the mathematics classroom? **Probe:** How were the varying ability levels addressed when you implemented the DI strategy in your lesson? **Probe:** How does the class composition direct your use of DI strategies?

- In what circumstances, do you find DI most effective? **Probe:** How have you been able to measure the effectiveness? **Probe:** What results have you noticed in your classroom?

CHALLENGES OF DIFFERENTIATED INSTRUCTION

RQ2: What are middle school teacher perceptions about the challenges of implementing differentiated instructional strategies?

Interview Questions for RQ2

- In what circumstances do you find that DI is challenging to use? **Probe:** What supports (i.e. PD, administrative, planning time, resources) are in place to address these challenges? **Probe:** Tell me about supports that have positively or negatively affected your lesson delivery. Explain.
- Tell me about a time when you implemented DI and you experienced barriers with implementing DI in the mathematics classroom. **Probe:** What further help would you need to overcome those barriers?
- Can you share an experience where your students struggled with a differentiated lesson? **Probe:** How did your students respond to the DI strategies presented? **Probe:** How did you respond to your students who struggled?

IMPROVING PROFESSIONAL DEVELOPMENT

RQ3: What are middle school teacher ideas for improving professional development sessions about differentiated instructional strategies?

Interview Questions for RQ3

- Can you tell me about a PD session that you have participated in that was beneficial to implementing DI in your classroom? **Probe:** What were the advantages and disadvantages of the PD session? **Probe:** How has the way you implemented DI changed since participating in the PD session?
- How should PD sessions be structured to meet your needs as a teacher? **Probe:** In what ways do you as a teacher learn best? **Probe:** How do you currently participate in PD? (district, school, individual, etc.) **Probe:** How does the structure of the PD affect your ability to implement the DI strategies presented?
- Describe the ideal PD session related to DI. **Probe:** What makes the PD session ideal? **Probe:** How would this session differ from PDs you have previously attended? **Probe:** What could your school or district do to improve PD sessions related to the implementation of DI strategies in mathematics classrooms?

Are there any other questions I should have asked?

Closing: Thank you for sharing your time and experiences. I am appreciative for your participation in the study.