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How Do Curriculum Mandates Influence the Teaching Practices of High School Mathematics Teachers

Jacqueline Hennings

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HOW DO CURRICULUM MANDATES INFLUENCE THE TEACHING PRACTICES OF HIGH SCHOOL MATHEAMTICS TEACHERS?

by

JACQUELINE HENNINGS

Under the Direction of Dr. Christine Thomas

ABSTRACT

The purpose of this narrative inquiry study was to investigate the influence of curricular mandates on the teaching practices of high school mathematics teachers. Narrative inquiry, philosophically based on John Dewey's theory of experience (Dewey, 1938), provides the intimate study of an individual's experience over time and in context(s) (Clandinin & Connelly, 2000). This study focused on the experiences of three high school mathematics teachers' stories of educational change with data collected through interviews and personal documents. Socio-cultural narrative analysis was used to interpret the participants' stories of adaptation. The data, presented as an ethnodrama, is composed of scenes taken from the interviews and interweaves the participants' stories of evolution as they tackled the struggles of change on multiple levels: curriculum, student assessment, and teacher evaluation.

Results indicated teachers adopt both traditional and reform strategies when deciding on appropriate teaching practices. Collaboration and professional development were two important aspects used by the participants to enlarge their toolbox of teaching practices when forced to challenge their existing beliefs. This study contributes to the scarce research on the impact of curricular mandates on teaching practices. It also highlights the experiences of high school mathematics teachers as they embrace the paradigm shift associated with the mandates and implement changes to their practices to promote a more student-centered, collaborative environment.

INDEX WORDS: High school mathematics teachers, Dewey's theory of experience, Narrative inquiry, Curricular mandates, Ethnodrama, Teacher change

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DEDICATION

I dedicate this dissertation to my family. To my husband, Ryan, without his support this would not have been possible. Also to my baby girls, Raelyn and Amelia, never let anything get in the way of achieving your goals.

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ABBREVIATIONS

ABR	Arts Based Research
CCSS	Common Core State Standards
CCSSI	Common Core State Standards Initiative
CCSSM	Common Core State Standards for Mathematics
ESSA	Every Student Succeeds Act
FIP	Formative Instructional Practices
GCTM	Georgia Council of Teachers of Mathematics
GOFAR	Georgia Online Formative Assessment Resource
GPS	Georgia Performance Standards
GSE	Georgia Standards of Excellence
NAEP	National Assessment of Educational Progress
NCLB	No Child Left Behind
NCTM	National Council of Teachers of Mathematics
NSF	National Science Foundation
OAS	Online Assessment System
PARCC	Partnership for Assessment of Readiness for College and Careers
QCC	Quality Core Curriculum
RESA	Regional Educational Service Agency
SBAC	Smarter Balanced Assessment Consortium
SGP	Student Growth Percentile
SMP	Standards for Mathematical Practice
TAPP	Teacher Academy of Preparation and Pedagogy

TAPS	Teacher Assessment on Performance Standards
TEM	Teacher Effectiveness Measure
TKES	Teacher Keys Effectiveness System
TIMSS	Trends in International Mathematics and Science Study

1 INTRODUCTION

Imagine going to work excited about starting a new week. On Monday morning your boss calls a meeting with everyone to discuss implementing a new program—effective immediately. The rationale for the change is based upon research on improving the company's production. There will be limited assistance on implementing this new policy, and you are no longer allowed to use your old practices to perform your job. You have to use the program's new-and-improved ways. There is a thick handbook that must be followed and many resources to use, but you are ultimately responsible for the quality of your work. The frustration starts to set in as you frantically talk to your coworkers to see what they are doing and to get a better understanding of what you are supposed to do. You talk to your superiors but they offer little help because they are ill-informed of the daily details and connections needed to make the transition. You want to do the best job you can to help improve the company, but you feel helpless and alone while you tackle this latest change. The new program makes you second guess why you entered into this profession and if there are other occupations that would better fit your skills. You enjoy what you do but do not think you can do a good job implementing the new program and do not want your company to suffer.

The above fictional narrative[1] parallels stark changes in my own reality during the 2008-09 school year when the Georgia Department of Education chose to abandon its longstanding traditional high school curriculum for a standards-based curriculum. I was a ninth grade mathematics teacher at the time, and I was faced with the task of implementing a new reform-

[1] See Hennings, J. A. (2010). New curriculum: Frustration or realization? *Journal of Urban Mathematics Education, 3*(1), 19-26.

oriented curriculum for which I felt unprepared. I was not alone; this curriculum change caused many feelings of frustration and hopelessness among educators.

Background

I started my teaching career in the fall of 2003 under the Quality Core Curriculum utilizing the same traditional practices I encountered during my K-12 schooling. It was not until pursuing my master's degree and transitioning to the Georgia Performance Standards that I saw the incongruence between my teaching practices and student learning. With the rollout of the new curriculum and the teaching expectations focusing on connecting student learning through tasks, collaboration, and productive struggle, I began my transformation as an educator supporting a more student-centered classroom. I created my lessons around the state provided framework tasks, redesigned my classroom based upon collaboration to promote problem solving, and developed ways to support productive student struggle with practices students were not accustom to throughout their educational careers.

The first year was riddled with complaints from both students and parents because of my transformation out of the traditional classroom setup, but I stuck to my emerging beliefs and saw tremendous growth from the ninth-grade students during that initial year. I decided to move up a grade level each year through the four years of the curriculum to get a better understanding of how it all fit together. Each year the group of students I started the journey with became more and more independent and willing to tackle mathematical problems without needing my constant support. I was able to enjoy my students and get to know them on a more personal level because I was not constantly focused on being the sole provider of information.

My professional journey in bridging the gap between my strategies and student learning led me to the current research study. This research focuses on teachers that were able to

overcome many barriers to change their teaching practices to reflect the National Council of Teachers of Mathematics (NCTM) vision as well as the new curriculum expectations by the state of Georgia, which differ drastically from what they experienced as students. The purpose of this chapter is to outline curriculum changes both nationally and within the state of Georgia as well as provide the reader the background for the curriculum recommendations from the National Council of Teachers of Mathematics and the Common Core State Standards (CCSS) that influenced the teaching practices of the participants in this study.

Changing Mathematics Curriculum – National Focus

As Reys, Reys, and Rubenstein (2010) state: "For more than a century, mathematics curriculum has been changing, and these changes have generated much discussion. In fact, the past thirty years have witnessed an unprecedented focus on mathematics in the United States" (pp. xii–xiii). In this section, I briefly describe the characteristics of four national movements in mathematics: the unified mathematics movement, the modern mathematics movement, the Back to Basics movement, and the *Standards* movement (see Appendix A for a timeline of historical events). These movements, all occurring during the 20th century, in many ways, provide the background for the curriculum changes being implemented in Georgia during the 2015-16 academic year. In each movement, I focus on the goals of high school mathematics instruction and curriculum revision. I begin with a historical overview, because as Stanic (1986) argued:

> Historical inquiry does not provide answers to contemporary curriculum problems in any direct way, but it does open up the range of questions that can be raised with respect to such problems. Without curriculum history, we have tunnel vision about current problems; we see them in a restricted framework. (p. 190)

Unified (Applied) Mathematics Movement (1890s–1910s)

The unified mathematics movement, considered the first effort at mathematics reform, occurred because of a growth in school enrollments putting pressure on schools to provide "education for all students," not just the wealthy (NCTM, 1970). During this time period, new psychological research, mathematics education entering the professional arena, and changing theories of learning, each, influenced by the Progressive Education Movement (1890s–1910s) were born because of the social problems brought on by corporate capitalism (Urban & Wagoner, 2009). Mathematics as a purely mental discipline at the time was beginning to be questioned.

The goals of high school mathematics instruction during the unified mathematics movement were twofold: (a) prepare students for the more "rigorous" college admission requirements, and (b) create more useful mathematics for non-college and vocational students. With the growing high school population, "a number of educators and sociologists called for schools to be more efficient and school subjects more useful, reflecting the apparently different needs, interests, abilities, and future destinations of the many students who were staying longer [and graduating]" (Stanic & Kilpatrick, 1992, p. 410). More technical and commercial courses were called for in the high schools "to equip students, both boys and girls, to deal with the realities of modern life" (Urban & Wagoner, 2009, p. 235). Along with changes in curriculum, a "shift to newer methods using concrete, developmental, and intuitive approaches" (NCTM, 1970, p. 36) challenged the mental discipline[2] approach to teaching mathematics in the high schools. The needs of college and non-college bound students brought about changes to the high school

[2] Mental discipline was based on the psychology of Cotton Mather and Calvinism, where "the best materials and methods were those that trained the faculties of the mind to the upmost capacity" (NCTM, 1970, p. 156).

mathematics curriculum and created curriculum interest groups[3] differing on their views of the importance of mathematics beyond arithmetic (Stanic, 1986).

Because of the rising college expectations, arithmetic was moved to elementary school and replaced with algebra and geometry in the high schools. Professor E. H. Moore, influenced by John Perry in England and John Dewey's ideas about pedagogy, urged schools to abolish the separate mathematics courses in the high schools and pushed for a more integrated approach to content both within mathematics and with other subjects (NCTM, 1970; Romberg, 2010; Stanic & Kilpatrick, 1992). Mathematics as a requirement for all high school students was challenged as the four curriculum interest groups struggled to make their mark on the subject. As student enrollments grew, "claims were made that the curriculum had to be changed in order to accommodate, control, and educate the school population" (Stanic, 1986, p. 194) leading some states to not require mathematics in the high schools. This crisis, according to humanist mathematics educators, motivated, in many ways, the formation of the National Council of Teachers of Mathematics in 1920. Ironically, during this time period mathematics education was being established as a professional field of study in higher education as "the role of mathematics in the secondary school curriculum was seriously threatened, with steady decreases in both requirements and enrollments in algebra and geometry" (NCTM, 1970, p. 410).

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[3] Stanic (1986) describes the four curriculum interest groups: (a) the humanists "emphasized the importance of the traditional disciplines of knowledge as embodiments of the Western cultural heritage"; (b) the developmentalists "argued that the curriculum should be based on the natural order of development in the child"; (c) the social efficiency educators "advocated a 'scientific' approach to developing a curriculum that would contribute to a smoothly functioning, efficient society, a curriculum through which each person would be prepared for his or her predetermined place in that society"; and (d) the social meliorists "saw the school as an important instrument for improving society in general, and the plight of suffering individuals in particular" (p. 191). The developmentalists, social efficiency educators, and social meliorists represented the voice of reformers against the traditional humanists.

As the role and effectiveness of mathematics in secondary schools was being questioned, rising failure rates added to the problems. Several factors contributed to the failure of enacting the sweeping integrated reform in mathematics teaching sought by the unified mathematics movement: resistance to change by teachers and administrators, lack of innovative leadership, financial and political consequences of the Great Depression, demands on teachers' workloads resulting from increased enrollments, and the outbreak of World War II (NCTM, 1970). These factors (among others) maintained the compartmentalized nature of teaching subject matter in secondary schools, with the main focus on preparing students for college. Nevertheless, the ideas put forth by the reformers were not lost, as illustrated in the Modern Mathematics Movement.

Modern (New) Mathematics Movement (1950s and 1960s)

The modern mathematics movement, the second effort at reform, was shaped by three wars: World War II (WWII), the Cold War, and the War on Poverty. Due to the mathematical weaknesses of servicemen from WWII, mathematics as a discipline of study was revitalized and returned to a level of prestige that had not been experienced for several years (NCTM, 1970). The impact of the Cold War on U.S. education, in general, and mathematics and science education, in particular, is reflected in the federal government's response to the launching of the first satellite *Sputnik* by the Soviet Union in 1957, which "seemed to confirm the sorry state of American schooling to its critics" (Altenbaugh, 2003, p. 357). In response, the federal government passed the National Defense Education Act, which "legitimized broad-based federal aid to education for the first time" (Urban & Wagoner, 2009, p. 338). This broad-based aid supported the development, and somewhat the implementation, of a "modern" (or more popularly known as "New Math") curricula in mathematics and science supported by the

National Science Foundation (Schoenfeld, 2004). The effects on mathematics education reform brought on by WWII and the Cold War were coupled with the War on Poverty as the disadvantaged student became a new focus of curriculum development work in the 1960s (Stanic & Kilpatrick, 1992). The impact of these wars was reflected in the reform efforts of the 1950s and 1960s in both mathematics instruction and mathematics curriculum.

Part of the impact of the three wars was societal pressures for high schools to teach advanced mathematics. During the 1950s and 60s, university mathematics curricula began to emphasize calculus and modern algebra; therefore, high schools began to include calculus, linear algebra, and statistics as well as Advanced Placement (AP) opportunities for students (Education Development Center, 1963). Technology, issues of non-achieving students, and the revolt against primitive pedagogy were concerns that schools needed to address (Romberg, 2010). However, the goals of the high schools changed little during the unified mathematics movement. The importance of mathematics was reinvigorated, but the high schools still needed to prepare students for college, military service, and everyday life.

Regrettably, the wars and societal pressure created dualisms with respect to curriculum revision. University mathematicians, who were better organized and more willing to get involved in precollege curriculum, wanted to emphasize pure mathematics (e.g., set theory and axiomatics), whereas mathematics educators wanted to see more applied practices (Stanic & Kilpatrick, 1992). Should the focus be on advanced mathematics or teaching practices based upon applications? The demise of the new math movement was highlighted by Schoenfeld (2004) cautioning

> One of the morals of the experience with the new math is that for a curriculum to succeed, it needs to be made accessible to various constituencies and stakeholders. If

> teachers feel uncomfortable with a curriculum they have not been prepared to implement, they will either shy away from it or bastardize it. If parents feel disenfranchised because they do not feel competent to help their children and they do not recognize what is in the curriculum as being of significant value…they will ultimately demand change. (p. 257)

Unfortunately, this movement was short lived and succumbed to the Back to Basics theme of the 1970s stressing skills, procedures, and testing.

Back to Basics Movement (1970s)

During this era, the movement towards basic skills impacted the goals of high schools, but the majority of concern focused on curriculum revision. There were many criticisms of the new math movement, popularized by Morris Kline's (1973) *Why Johnny Can't Add: The Failure of the New Math* as well as changes both nationally and internationally. The growth of computers raised the question of the type of statistics to be taught leading to discussions of how to use computers and basic calculators in classrooms (Romberg, 2010). New educational psychology work by Jean Piaget and Lev Vygotsky led to the evolution from behaviorism to cognitivism (Romberg, 2010). National achievement data showed too many students were not learning and dropping out of school, and emerging international concerns about curriculum change and stability were starting to develop (Romberg, 2010). Another curricular push during this time was mathematics for all students—not just the general mathematics used during the unified movement.

***Standards* Movement (1980s)**

The *Standards* revolution, spurred by an economic crisis and the United States' poor showing on the Second International Mathematics Study, called for change to promote problem solving instead of focusing solely on mastering skills and procedures (Schoenfeld, 2004). In

1980, NCTM published its first, of many, documents that outlined recommendations for the future direction of mathematics education, *An Agenda for Action: Recommendations for School Mathematics of the 1980s*. This initial document was based on research findings of studies funded by the National Science Foundation (NSF) and on standardized assessments from the National Assessment of Educational Progress (NAEP) (NCTM, 1980; Hill, 1980). This document was followed by two reports published by federal agencies in 1983. *A Nation at Risk: The Imperative for Educational Reform*, published by the National Commission on Excellence in Education and *Educating Americans for the 21st Century*, published by the National Science Board Commission on Precollege Education in Mathematics, Science, and Technology were "the actual catalysts that led to the development of curricular standards for mathematics" (Romberg, 2010, p. 13). *A Nation at Risk* highlighted the need to reform the U.S. education system in general, in order to "keep up" in the "information age":

> Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world…. We report to the American people that while we can take justifiable pride in what our schools and colleges have historically accomplished and contributed to the United States and the well-being of its people, the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people. What was unimaginable a generation ago has begun to occur—others are matching and surpassing our educational attainments. (National Commission on Excellence in Education, 1983, p. 9)

This quote highlights the "threat" to the American people in losing their elite status around the world. Reformers rallied and used the perceived threat as a platform to make changes to the mathematics curriculum and goals for schools.

Subsequent articles were written in response to *A Nation at Risk* calling for specific changes in the mathematics curriculum. For example, Usiskin (1985), a leader in mathematics education, wrote:

> the problem of lack of mathematical know-how is so massive, and the changes in the field of mathematics so pronounced, that current student needs in mathematics cannot be met without modifying the very goals and nature of secondary school mathematics. Recent reports confirm that the current curriculum needs overhauling rather than adjustment, *revolution rather than evolution* [emphasis added]. (p. 17)

Usiskin further argued the new content should be specified and detailed by grade level, materials must be available, and students held accountable for the content in order for the needed changes to be implemented. The revolution called for by Usiskin was set in motion by the NCTM *Standards* documents as they laid the framework for the actual curricular changes teachers are currently experiencing in their classrooms today.

NCTM's *Standards* documents. The NCTM *Standards*[4] documents include *Curriculum and Evaluation Standards for School Mathematics* (1989), the initial document in a trilogy focusing on providing a framework for educators to restructure mathematics curriculum and instruction; *Professional Standards for Teaching Mathematics* (1991), the companion document addressing the teacher's role in the reform process and how they should be evaluated;

[4] NCTM has since published other supporting documents for educators to assist them in transforming their teaching practices. For more information, visit http://www.nctm.org/.

Assessment Standards for School Mathematics (1995), the final document in the trilogy, addressing the need to reform assessment practices to reflect the educational changes in teaching and learning; and *Principles and Standards for School Mathematics* (2000), a revised and updated compilation of the first three documents to provide a quality mathematics education for all students. Collectively, the documents call for a shift in content, learning, teaching, evaluation, and expectations to encourage mathematical achievement for all students. The transition from an industrial to an informational society required mathematics professionals to create new goals for its schools in order for students to become productive, informed citizens (NCTM, 1989). "Mathematical power"[5] emerged as a new expectation. It developed as students improved their self-confidence while actively engaging in mathematics to solve non-routine problems.

The *Standards* movement and the impact of NCTM influenced and ultimately led to changes in Georgia's mathematics curriculum.

Changing Mathematics Curriculum – Georgia Focus

In this section, I provide the reader a historical background of mathematics curriculum reform in the state of Georgia. I also describe the professional development and resources provided to teachers during the reform journey.

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[5] NCTM uses the term *mathematical power*—

> to capture the shift in expectations for all students. The shift is toward understanding concepts and skills; drawing on mathematical concepts and skills when confronted with both routine and nonroutine problems; communicating effectively about the strategies, reasoning, and results of mathematical investigations; and becoming confident in using mathematics to make sense of real-life situations. It is away from mastering a large collection of concepts and skills in a particular order. (NCTM, 1995, Introduction section, para. 11)

The Quality Basic Education Act of 1985 required Georgia to maintain a quality curriculum throughout grades K-12 and led to the creation of the Quality Core Curriculum (QCC). However, an audit from Phi Delta Kappa in January 2002 concluded

> the Quality Core Curriculum (QCC) not only lacked depth and could not be covered in a reasonable amount of time; it did not even meet national standards.... Shallow standards forced our teachers to guess what they should teach and hope that what they were teaching is what would be tested. Inevitably, teachers used the curriculum not as a guide for quality instruction, but as a reference to mention in lesson plans and then place back on the shelf. (Georgia Department of Education, 2015a, para. 3)

The state of Georgia utilized this audit and the *Principles and Standards for School Mathematics* put forth by NCTM to pave the way for the creation and adoption of the integrated mathematics curriculum at the high school level called the Georgia Performance Standards (GPS) in 2008. According to the Georgia Department of Education (2015c):

> The Georgia Mathematics standards are designed to achieve a balance among concepts, skills, and problem solving. The standards stress rigorous concept development and real-world applications while maintaining a strong emphasis on computational and procedural skills. At all grades, the standards encourage students to reason mathematically, to evaluate mathematical arguments both formally and informally, to use the language of mathematics to communicate ideas and information precisely, and to make connections among mathematical topics and to other disciplines. (para. 1)

The term "integrated curriculum" can take on many forms, but in the state of Georgia the standards combined algebra, geometry, and data analysis to support a strong, cohesive, and coherent curriculum across grades K–12. The goal was for students to solve meaningful

problems while working on strengthening their skills across mathematical disciplines. Earlier, Simanu-Klutz (1997) stated that integrated curriculum will turn into just another educational fad if policymakers do not keep the importance of preparing faculty, making time for collaborative planning, changing evaluation techniques, and resource sharing in mind while teachers are required to implement the new standards.

In 2010, Georgia took its mathematics curriculum a step further and adopted the Common Core State Standards (CCSS) to provide a consistent framework to prepare students for success in college and/or the 21st century workplace. In the spring of 2014,[6] fueled by political pressure, the state sent out a survey for comments related to the standards. After compilation of the comments, the standards were clarified, some were moved grade levels, and the high schools were given the option to remain on the integrated track or move to the discrete classes of Algebra I, Geometry, and Algebra II. The reconfigured Common Core State Standards were then named the Georgia Standards of Excellence (GSE) starting in the fall of 2015. I will continue to reference Georgia's standards as the CCSS since this is the foundation document for the mathematics expectations around the state.

With the adoption of the GPS followed by the CCSS, the vision of the mathematics classroom transformed drastically from the previous QCC. Instead of a classroom dominated by teacher direction and student practice, the new standards integrated student-centered learning, collaboration, problem-solving, and conceptual understanding. Students incorporated mathematics into solving problems based on real-world experiences.

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[6] See https://www.georgiastandards.org/Georgia-Standards/Pages/default.aspx

The concentration was not solely on content standards; the writers also developed process standards that came to be known as the Standards for Mathematical Practice (SMP)[7] in the Common Core State Standards. These eight standards are a combination of NCTM's process standards (problem solving, reasoning and proof, communication, representation, and connections) and the strands of mathematical proficiency from the National Research Council's report *Adding It Up: Helping Children Learn Mathematics* (adaptive reasoning, strategic competence, conceptual understanding, procedural fluency, and productive disposition) (Common Core State Standards Initiative, 2016a). The SMP describe the activities students should display in a mathematics classroom and represent the habits of mind of a productive mathematical thinker while being engaged in the curriculum. Teachers construct lessons focused on the content standards as well as the SMP for greater student understanding of the material.

The shift from concentrating on procedural knowledge (algorithms) to conceptual understanding (concrete basis underlying the algorithms) was a strong push as the standards were revised. Unfortunately, many mathematics teachers (including me) had to endure the massive changes in such a short period of time leading to much anger and frustration. The lack of resources and instructional support only exasperated the educators on the front lines. Many teachers had to learn other mathematical content because they had taught the same thing for years following the same lesson plans each year and were not familiar with the integrated approach. Learning how to promote student discussion while helping students acquire new

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[7] The eight standards are 1) Make sense of problems and persevere in solving them, 2) Reason abstractly and quantitatively, 3) Construct viable arguments and critique the reasoning of others, 4) Model with mathematics, 5) Use appropriate tools strategically, 6) Attend to precision, 7) Look for and make use of structure, and 8) Look for and express regularity in repeated reasoning. They are posted along with the content standards for all grade levels in Georgia.

mathematical content proved to be a challenge. Teachers who faced the challenges and embraced the changes attended professional development workshops, collaborated with their fellow colleagues to adjust their instructional strategies, and persevered in a time laced with fear and frustration. It is the stories of these teachers I highlighted in this research.

With the rollout of the CCSS, professional development[8] in the state of Georgia took on many forms starting with webinars to provide support on the state framework units, wikis as a forum of discussion, and listservs to disseminate key information to teachers. The 16 Regional Educational Service Agencies (RESA) were charged with creating workshops for teachers in their areas and disseminating information and policies for the state department of education. The Georgia Council of Teachers of Mathematics (GCTM) provided annual conferences focusing on successful implementation of the new standards.

As implementation began, curriculum frameworks were revised by groups of teachers across the state during summer sessions based on the feedback from the wikis and concerns from teachers. Georgia was one of the recipients of the Race to the Top grant[9] from the federal government charged with strengthening state standards and assessments, improving data systems, enhancing teacher and school leader quality, and turning around low-performing schools (Rothman, 2011). The state used the money from the grant to fund three education initiatives. State benchmark items were created to be used by districts during the year to prepare for the state's increased rigorous tests aligned with the standards. An Online Assessment System

[8] To see examples of the support provided to teachers visit https://www.georgiastandards.org/Georgia-Standards/Pages/Math.aspx

[9] For more information about the grant visit http://www.gadoe.org/Race-to-the-Top/Pages/default.aspx

(OAS)[10], later named Georgia Online Formative Assessment Resource (GOFAR), provided assessment resources for teachers to prepare for the changing constructed-response items. The Formative Instructional Practices (FIP)[11] online learning modules for administrators and teachers assisted them in gathering evidence of student learning.

Over the past four and a half years, I have supported teachers in professional development through the a local RESA to help make the shift from teacher to student-centered classrooms as well as provided assistance on preparing for the changing assessment climate. Even with the support from the state, districts, and RESAs, the change process has been slow to develop throughout the state with respect to teaching practices.

Institutional Narratives of Mathematics Education

In this section, I give a brief history of NCTM and CCSS leading to the goals and features of both mandates. The story of NCTM describes the eight teaching practices analyzed during the data collection process.

Story of the National Council of Teachers of Mathematics

The National Council of Teachers of Mathematics was established by 127 mathematics teachers representing twenty states on February 24, 1920 (NCTM, 1970) during "a time when efforts were under way to make mathematics at the secondary level an elective and when numerous reports on reform in mathematics education were developed without substantial input from K–12 mathematics teachers" (NCTM, 2007, p. 12). With the unified mathematics movement underway (previously discussed in detail), a national council was needed to watch out

[10] For more information about GOFAR visit http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Online-Formative-Assessment-Resource.aspx

[11] For more information about FIP visit http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/GeorgiaFIP.aspx

for the interests of mathematics educators. Since its inception, NCTM has been widely involved in mathematics curriculum reform. Its *Standards* documents laid the foundation for the changes taking place in mathematics classrooms across the nation today.

Goals of the National Council of Teachers of Mathematics. The initial goals of NCTM were to adapt mathematics curriculum with changing times; give mathematics teachers a voice with respect to curriculum studies, reforms, and adjustments; as well as circulate information via its journal *Mathematics Teacher* to allow an avenue for teacher expression and solidarity (NCTM, 2007). The founders also sought to "help the progressive teacher to be more progressive. It will also arouse the conservative teacher from his satisfaction and cause him to take a few steps ahead" (NCTM, 2007, p. 14). Throughout its history, NCTM has stuck, so to speak, to its initial goals while maneuvering the changing educational terrain.

Principles and Standards for School Mathematics (2000) describes the current vision and goals for school mathematics. This vision is based upon six principles, equity, curriculum, teaching, learning, assessment, and technology, calling for shifts in teaching practices and assessment. Bridging the gap between theory and practice, NCTM published *Principles to Actions: Ensuring Mathematical Success for All* (2014) to provide teachers a resource on effective teaching practices that align with the Common Core[12] expectations, but call for a restructuring in teachers' beliefs about teaching and learning mathematics.

> *Principles to Actions* represents a significant step in articulating a unified vision of what is needed to realize the potential of educating all students…it describes the actions required to ensure that all students learn to become mathematical thinkers and are

[12] The goals and features of the Common Core will be further examined below.

prepared for any academic career or professional path that they choose. (Gojak, 2014, p. vii)

The eight teaching practices outlined in *Principles to Actions* require teachers to establish learning goals, promote reasoning and problem solving through tasks, connect mathematical representations, facilitate meaningful discourse, question purposefully, build fluency through conceptual understanding, support productive struggle, and adjust instruction to support student learning (see Figure 1).

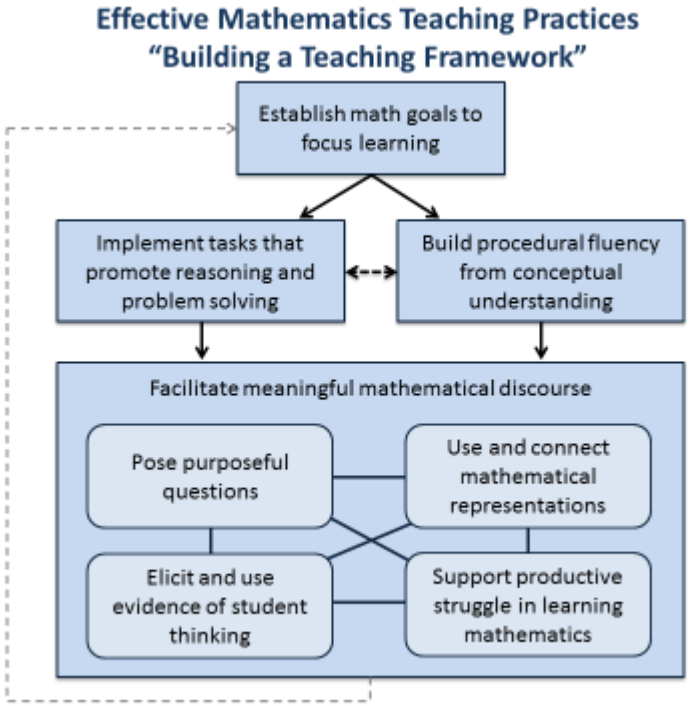

Figure 1. NCTM's eight teaching practices. To appear in *Taking Action: Implementing Effective Mathematics Teaching Practices in Grades 6–8*, by M. S. Smith, M. D. Steele, and M. L. Raith, 2017, Reston, VA: National Council of Teachers of Mathematics. Copyright 2017 by the National Council of Teachers of Mathematics. Reprinted with permission.

Because the Common Core State Standards do not mandate the instructional strategies teachers can use to implement the standards, it is up to education stakeholders from both the district and the state level to clarify the learning outcomes and provide instructional resources as well as informational assessments to promote successful implementation.

Features of the National Council of Teachers of Mathematics. The Teaching Principle envisioned by NCTM (2000) states: "Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well" (p. 11). To effectively create experiences for students to learn the content, teachers need to understand the standards, apply the appropriate pedagogical strategies, create a challenging and supportive learning environment, and continually engage in professional development and self-reflection (NCTM, 2000). Arbaugh (2010) highlights two teacher attributes important to student learning: the teacher's content and pedagogical knowledge and their beliefs about teaching and learning. Teachers choose instructional strategies based upon their comfort level of the topic, how they believe students learn, and the best way to assess the knowledge obtained during the lessons (Arbaugh, 2010). However, these strategies may not lead to increased student achievement if students are not given the opportunity to engage with the mathematics.

NCTM's *Curriculum and Evaluation Standards* (1989) set the stage for departing from traditional mathematics teaching practices. Subsequent publications *Professional Standards for Teaching Mathematics* (1991), *Principles and Standards for School Mathematics* (2000), and most recently *Principles to Actions* (2014) outline the teaching practices needed to make NCTM's vision a reality. The eight mathematics teaching practices, summarized below, infuse the content and practice standards from the CCSS and provide a framework for teachers to make the needed instructional transformations in their classrooms.

Establish mathematical goals to focus learning. Establishing appropriately challenging goals promotes student achievement through motivation as well as improved self-efficacy and confidence (Hattie, 2009), but requires teachers to think about many steps

> effective teachers set appropriately challenging goals and then structure situations so that students can reach these goals. If teachers can encourage students to share commitment to these challenging goals, and if they provide feedback on how to be successful in learning as one is working to achieve the goals, then goals are more likely to be attained. (p. 165)

Effective goals, also known as learning targets, guide teachers' decision making about instruction and assessment while shifting the focus from the activities of the curriculum to the learning taking place by engaging in the activity (Chappuis, 2009; NCTM, 2014; Stiggins, Arter, Chappuis, & Chappuis, 2006). Creating a clear, student-friendly vision of learning, providing examples on how to be successful, and teaching students to self-assess and set goals increases student motivation, results in higher-quality work, and allows students to become more involved in the curriculum (Chappuis, 2009).

Stiggins and colleagues (2006) argue that the use of appropriate learning targets benefits teachers, students, and parents. Teachers can work collaboratively to clarify the learning targets and plan appropriate instructional activities. Learning targets help teachers know what to assess and what the assessment reflects. Students are allowed to monitor their own progress and keep themselves on track by setting goals. Parents can use learning targets to focus their assistance in productive ways by talking to their child about their strengths and working on their areas for improvement. This teaching practice allows students, teachers, and parents to work together to improve student achievement.

Implement tasks that promote reasoning and problem solving. Teachers are responsible for selecting challenging tasks to promote both conceptual and procedural understanding that require mathematical thinking, capture students' curiosity, promote classroom discourse, and can

be solved multiple ways (NCTM, 1991). In 2011, the Trends in International Mathematics and Science Study (TIMSS) questionnaire[13] asked teachers to identify their confidence level (very confident, somewhat confident, and not confident) in five areas: answering students' questions about mathematics, showing students a variety of problem solving strategies, providing challenging tasks for capable students, adapting teaching to engage students' interest, and helping students appreciate the value of learning mathematics. The results for very confident showed 8th grade teachers in the United States were less confident in providing challenging tasks for capable students (76%), adapting teaching to engage student interests (65%), and helping students appreciate the value of learning mathematics (67%) compared to confidence levels at 97% on answering student questions about mathematics and 91% showing students a variety of problem solving strategies (Mullis, Martin, Foy, & Arora, 2012). Discrepancies in confidence levels suggest teachers need to develop a plan to incorporate challenging tasks to engage student interest and promote the appreciation of mathematics.

The mathematical content, students' experiences, and modes of student learning should be considered when selecting appropriate tasks for classroom instruction (NCTM, 1991). T increase rigor and scope while focusing on the instructional changes needed to implement the standards, Lassiter (2012) believes in weaving "worthwhile" problems into daily instruction to increase problem solving, stimulate higher-level thinking, and promote conceptual understanding, communication, student interest, and curiosity. One way to do this is to utilize real data and current events to help engage students in the mathematics making the content more relevant.

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[13] The TIMSS questionnaire is given to students, schools, and teachers that participate in the testing to gain valuable contextual factors affecting student achievement.

According to Rollins (2014) motivation for students to engage in tasks depends on the value assigned and confidence level in successful completion. Student motivation, and therefore, student engagement with tasks hinges on creating ones that are relevant and interesting, provide an appropriate level of difficulty, as well as incorporate choice and social interaction.

It is important to match mathematical tasks with the goals for student learning (Stein, Smith, Henningsen, & Silver, 2009). Stein and Smith (1998) provide a task analysis guide based upon four levels of cognitive demand: memorization tasks, procedures without connections tasks, procedures with connections tasks, and doing mathematics tasks. The two lower-level cognitive demand, memorization and procedures without connections, focus on reproduction or use of an algorithm without making connections to the mathematical meaning. Too many students are engaged in these types of tasks instead of more thought-provoking ones (Smith & Stein, 2011). As teachers move to incorporate more cognitively demanding tasks such as procedures with connections and doing mathematics, students engage in the content and explore the nature of mathematical relationships. NCTM and CCSS promote the use of instructional tasks with higher levels of cognitive demand. To accomplish this teaching practice, it is essential for educators to become comfortable incorporating tasks into the curriculum so students have the chance to make the mathematical connections required by the new standards.

Use and connect mathematical representations. Students need opportunities to see mathematics through a variety of lenses in order to connect different mathematical representations. These representations can be in the form of tables, graphs, and/or equations. Students deepen their understanding as they move flexibly among the various forms while discussing similarities and differences (NCTM, 2014). Using multiple representations allows students to utilize the best one to solve problems (Lassiter, 2012) and helps them see

mathematics "as a unified, coherent discipline" (NCTM, 2014, p. 29). Without incorporating the above instructional practice, students may not be able to connect mathematical representations and come to a better understanding of the relationship between the various areas of the subject.

Facilitate meaningful mathematical discourse. Selection of appropriate tasks that emphasize thinking and reasoning engages students in mathematical discourse allowing them "to develop the ability to formulate problems, to explore, conjecture, and reason logically to evaluate whether something makes sense" (NCTM, 1991, p. 34). The flow of ideas shifts from being dominated by the teacher to involving students in the construction of their own mathematical knowledge. Rather than the sole authority, the teacher monitors and organizes student participation (NCTM, 1991, 2014).

Smith and Stein (2011) developed five practices for orchestrating classroom discussions: anticipating, monitoring, selecting, sequencing, and connecting. The first practice occurs during the planning stages of a lesson. The teacher is responsible for anticipating students' responses to the mathematical task based upon possible strategies and interpretations. The next three practices—monitoring, selecting, and sequencing—are done as students are engaged in the task. The teacher monitors student responses and connects them to the anticipated solutions developed before the lesson. Selecting appropriate students to present their ideas and sequencing the discussion to develop conceptual, representational, and abstract thinking enable students to follow the classroom discourse. The final step in creating productive discourse is connecting students' solutions and having them explore the similarities and differences between approaches. "Rather than having mathematical discussions consist of separate presentations of different ways to solve a particular problem, the goal is to have student presentations build on one another to develop powerful mathematical ideas" (Smith & Stein, 2011, p. 11), recognized as an important

aspect of mathematical learning in the Standards for Mathematical Practice in the Common Core State Standards.

Pose purposeful questions. Once appropriate learning goals are established and instructional tasks are selected, teachers are responsible for providing students the opportunities to think and reason mathematically (Smith & Stein, 2011). The types of questions teachers utilize as well as the discussion techniques required to further thinking and communication are important for "deeper explorations of mathematical concepts and ideas" (p. 61). Students need to be encouraged to explain and reflect on their thinking. Two critical issues are important: the types of questions and the pattern of questioning (NCTM, 2014).

Boaler and Brodie (as cited in Smith & Stein, 2011) identified nine different types of questions mathematics teachers utilize with their students:

1. Gathering information, leading students through a problem
2. Inserting technology
3. Exploring mathematical meanings and/or relationships
4. Probing, getting students to explain their thinking
5. Generating discussion
6. Linking and applying
7. Extending thinking
8. Orienting and focusing
9. Establishing context

Their findings showed that the majority of teachers utilized questions of type 1, but more diverse questioning techniques led to higher student achievement. Smith and Stein (2011) highlighted the importance of three types of questioning techniques (types 3, 4, and 5) as these questions

allow teachers to scaffold the process without taking over the thinking for the students. Teachers can create more thought-provoking questions before a lesson to avoid focusing on one type of question that allows students the ability to thoroughly scour a topic for understanding.

Lassiter (2012) gives teachers suggestions on how to ask quality questions to promote student discourse. For example, teachers can pose an unanswered question to challenge students, leave a question unanswered at the end of class, give students the answer to a problem and ask them to come up with the question, and teach students to acknowledge and pursue the struggle and process of learning. Posing questions is hard to monitor if not considered ahead of time; however, it is essential in allowing students to think critically about mathematics.

Build procedural fluency from conceptual understanding. **F**or students to be able to transfer their knowledge to new situations they need to develop both conceptual and procedural fluency (NCTM, 2014), yet many teachers at the high school level focus on utilizing standard algorithms void of any conceptual representations. Fluency is built using student-generated strategies as they solve problems. It means "students are able to choose flexibly among methods and strategies to solve contextual and mathematical problems, they understand and are able to explain their approaches, and they are able to produce accurate answers efficiently" (p. 42). Students need visual models and practice to solidify their knowledge of standard algorithms. Manipulatives are a powerful tool for teachers to use to build student conceptual understanding leading to procedural fluency. High school teachers can move students along the CRA model (concrete, representational, abstract) using manipulatives; however, many are not familiar with how to utilize them effectively.

Support productive struggle in learning mathematics. The TIMSS 1999 international video study compared teaching methods of 8th grade classrooms in both mathematics and science. Analyzing the data, Hiebert and Stigler (2004) "studied a number of dimensions of teaching, including the ways classrooms are organized in different countries, the kinds of mathematics problems presented to the students, and the ways problems are worked on during classroom lessons" (p. 11). They found teachers in the United States almost always intervened and did the work for students when working on more difficult conceptual problems. Teachers were not allowing students to tackle more thought-provoking questions without their assistance. Because of the changing curriculum and expectations "teachers must learn how to avoid stepping in and giving the answers, and instead provide students with opportunities to think more deeply about mathematical concepts and then discuss these concepts or relationships with the students" (p. 13). Lassiter (2012) points out:

> Teachers all too often give the answers to students during the struggle. When they tell students how to solve a problem, teachers remove the challenge and take over the thinking and reasoning. It is important for students to be encouraged to use any approach they can think of, draw on any knowledge they have, and justify their ideas when solving problems. (p. 81)

NCTM along with the CCSS encourage teachers to provide students opportunities to delve more deeply into mathematics and to make connections among varying ideas instead of just finding the correct solution. Because teachers in the United States rescue students by breaking down harder tasks and guiding them through the difficulty, they undermine the efforts of the student, lower the cognitive demand of the task, and deprive student engagement (NCTM, 2014). Students and teachers need to change their ways of thinking when it comes to supporting learning. It is

essential for students to embrace confusion and errors while teachers accept struggle as an important part of the learning process and provide students time to work through their uncertainties (NCTM, 2014).

Elicit and use evidence of student thinking. Teachers have to make sense of the mathematics in students' comments and actions, consider the knowledge the students have with respect to the learning goal, determine how to respond and support current student thinking, as well as gather evidence after instruction to reflect and identify next steps for future lessons and interventions (NCTM, 2014). This is no simple task. Utilizing Assessment *for* Learning[14] techniques, teachers can get a better understanding of student thinking during instruction and maximize student learning. Black and William (1998) found teachers' evaluation practices concentrate on rote learning and recall of isolated details. There is little collaboration and reflection on the assessment questions. Grading is over-emphasized while learning is under-emphasized creating a tendency for competition between students instead of focusing on personal improvement. Frequent ungraded formative assessments allow students to focus on learning rather than the assessment itself. Providing encouraging, timely, explicit feedback based upon the specific learning goals and involving students in the process allows them to be successful in mathematics (Rollins, 2014).

Given the previously mentioned eight teaching practices, educators have a detailed roadmap of how to change their instructional strategies, but face daunting obstacles. Dominant cultural beliefs, entrenched traditional lesson paradigms, and pressure from parents and other

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[14] Stiggins et al. (2006) define Assessment *for* Learning as—

> the assessments that we conduct throughout teaching and learning to diagnose student needs, plan our next steps in instruction, provide students with feedback they can use to improve the quality of their work, and help students see and feel in control of their journey to success. (p. 31)

education stakeholders make embracing the changes needed to implement the current curricular expectations difficult for teachers (NCTM, 2014).

Story of the Common Core State Standards

The evolution of a common core set of standards for mathematics has spanned many decades and can be characterized by multiple political battles. The Common Core State Standards (CCSS) were constructed during a time of preparation for the 21st century learner. Just as in the early 1980s, the concern over the United States' shrinking economic supremacy led to a review of current state standards showing they were not rigorous enough in many cases to prepare students for post-secondary college and careers (Lassiter, 2011). The standards were to be clear, rigorous, internationally benchmarked, and common across all states (Rothman, 2011).

The *Standards* movement was a top-down effort by national groups and the federal government to influence state standards. This influence was not realized due to vague standards, the lack of alignment between standards and assessments, and lack of focus on curriculum and professional development (Rothman, 2011). Learning from previous mistakes, the committee responsible for drafting and revising the CCSS recommended a state-led effort focusing on creating assessments aligned with the expectations as well as providing guidance and support for educators.

Goals of the Common Core State Standards for Mathematics. The Common Core State Standards for Mathematics (CCSSM)[15] are built to be "fewer, clearer, and higher" (Rothman, 2011). In the beginning, the argument of state standards being "a mile wide and an inch deep" called for fewer standards to allow teachers to go into more depth. Fewer, coherent

[15] From here on I will refer to the Common Core State Standards more specifically as the Common Core State Standards for Mathematics to distinguish them from the English standards.

standards were the goal but for grades six through twelve this was not a reality. The CCSSM actually include more topics grouped in fewer categories (Rothman, 2011). Clearer standards were developed in an attempt to use understandable language rather than vague generalities to inform teachers, administrators, and parents. Finally, the committee used the highest state standards as guidelines to build the expectations for all students. The end goal was to prepare students to be successful in entry-level, credit bearing, academic college courses without remediation or in workforce training programs. Because of this end-in-view approach, the committee first developed college and career readiness standards which became the anchor standards for the entire K–12 program.

The goal of the CCSSM was to provide focus on the important topics in a coherent, logical sequence. States that adopted the standards were charged with revising their assessments and curriculum, providing professional development for teachers, and building awareness of the changes to the larger community and parents during a time of budget constraints.

Features of the Common Core State Standards for Mathematics. The Standards for Mathematical Content and Standards for Mathematical Practice detail the expectations for student learning. The content standards span the mathematical concepts of numbers and operations, algebra, functions, statistics/probability, and geometry, while the eight practice standards, mentioned earlier, represent the activities displayed in a mathematics classroom.

Each grade band also has certain features. The K–5 standards focus on arithmetic and developing fluency in basic operations as the foundation of algebraic thinking in order for students to "demonstrate that they understand key concepts, not just that they can perform operations" (Rothman, 2011, p. 95). The 6–8 standards build on, instead of repeat, elementary school content with the introduction of statistics and algebra topics. The expectation is that

students learned the prior standards and are able to apply their understanding. The high school content is broken into six conceptual categories: number and quantity, algebra, functions, modeling, geometry, and statistics and probability. According to Rothman (2011): "Modeling is a standard of mathematical practice, rather than content… Modeling is, essentially, using mathematical thinking to analyze real-world situations and make appropriate decisions" (p. 97). Therefore, instead of standing alone, it is woven into other content standards. The standards for K–8 are laid out for all states that adopted the CCSSM. At the high school level, states could choose a traditional or integrated approach as well as accelerated curriculum. The traditional approach breaks up content into discrete compartments of algebra, geometry, and trigonometry, while the integrated approach utilizes elements from multiple contents each year.

Testing is another significant feature of the CCSSM. Upon adoption, state officials recognized the need for assessments to match the new standards because of the strong influence assessments have on instruction (Rothman, 2011). Therefore, there was a need to change assessments to encourage teachers to address the content and practices of the standards. The United States Department of Education awarded $330 million to two consortia, Partnership for Assessment of Readiness for College and Careers (PARCC) and Smarter Balanced Assessment Consortium (SBAC), to develop assessments to measure student progress towards the CCSSM. Both consortia also created tools for teachers to help in test preparation. The new assessments incorporated more rigorous selected-response (multiple-choice) items as well as introduced constructed-response (open-response) problems to allow students to show their problem-solving and thinking skills with respect to the mathematics content.

The last and probably most important feature of the CCSSM is the curriculum expectations for teachers. The standards provide the objectives teachers need to get their

students to meet by the end of the year. They do not provide a guide to teachers on how to integrate the content and practice standards, nor what the classroom changes should look like on a daily basis. In many aspects, there is a "call for quite different instructional expectations than teachers are accustomed to, so enabling teachers to understand what students will be expected to learn and how they can structure classrooms to bring about that learning will be critical to the success of the Standards" (Rothman, 2011, p. 124).

The states are responsible for providing the curriculum, assessments, professional development, and building awareness needed to assist districts and teachers in the process of changing instructional strategies to meet the rigor of the new standards. Rothman (2011) points out:

> The adoption of the Common Core State Standards, while hugely significant, pales in scope to what must be done to implement them. Only when teachers make the Standards part of their everyday classroom instruction, when they are prepared to teach them effectively, when the Standards are aligned with assessments that measure them faithfully, and when higher education institutions integrate the Standards into placement decisions and teacher education programs (and parents understand them), will they have a chance of improving student learning. (p. 119)

The expectations differ greatly from the traditional practices that dominate today's classrooms. The traditional practices of emphasizing basic understanding, memorizing facts, forgoing thinking to practice skills using drill, focusing on getting the right answer, and teaching small bits and pieces are replaced with a focus on developing critical thinking and communication, making connections from previous year's learning, student debate and

discussion, as well as lessons designed to improve speaking and listening (Lassiter, 2011). Bell (2011) argues—

> Although the CCSS establish consistent expected achievements, they do not prescribe how teachers should teach and modify their instruction in order for all learners to be successful. In fact, the Common Core may unintentionally create barriers to learning for some students if teachers attempt to use traditional delivery models for these new rigorous standards. (p. 111)

Teachers are faced with many challenges on how to effectively implement the expectations of the CCSSM. The integration of content and practice standards is a big challenge for teachers. It is a requirement that teachers are strong in content knowledge and have a great understanding of the conceptual and procedural learning of students when most of them were taught procedurally without necessarily understanding the concepts. Applying concepts learned through problem-solving strategies instead of explicitly taught may cause discomfort to teachers. The shift from a teacher-centered classroom focused on explanations to a student-engaging one that utilizes discourse, explanation, verification, collaboration, and metacognition to develop understanding is a major transition for many teachers: "The bottom line is that teachers will have to examine how they think students effectively learn mathematics, what information that belief is based upon, and what training and support they need to make the necessary changes in their instructional practice" (Christinson, 2012, p. 73).

The Problem of a Changing Mathematics Curriculum

According to Stanic and Kilpatrick (1992):

> the story of mathematics curriculum reform is not the story of a continual progression toward a curriculum that is best for students, teachers, and society nor even the story of

> different ideologies cyclically replacing each other's influence on school mathematics; instead, it is the story of a developing community preoccupied with a limited and ill-defined agenda. (p. 408)

This "limited and ill-defined agenda" can be seen in the history of national curriculum reform. The reforms were reactions to crises (growing student enrollments, war, loss of supremacy)—reformers did not take time to think about the ethical and moral implications the proposed changes placed upon teachers. The CCSS is once again a reaction to a crisis of preparing students for 21st century college and career expectations. However, unlike other reform efforts, the CCSS, as well as Georgia, attempted to utilize teacher expertise[16] in creating and revising standards. Is this enough though?

Educational reform has many limitations due to the severe constraints placed upon schools. The schools are required to adhere to the state department of education's expectations, are constantly bombarded with testing and accountability, and are confined to what textbooks and test publication industries produce as resources (Stanic & Kilpatrick, 1992). Our current educational climate calls for teachers to adapt and modify their instructional strategies to transform their practices based on the recommendations of new curricular expectations. Georgia has gone through, and continues to go through, shifts in content, learning, teaching, evaluation, and expectations to encourage mathematical achievement for all students. For these shifts to occur, a commitment to discussing the goals of mathematical instruction as well as approaches to mathematics teaching and learning is needed. The problem addressed by this research is how the

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[16] Teachers played a critical role in developing the CCSS. They served on the work groups and feedback groups, national organizations brought teachers together to provide constructed feedback as the standards were developed, teachers were part of teams providing regular feedback during the drafting process, and they provided input during the public comment period (CCSSI, 2016b). Georgia also used teachers to strengthen their state frameworks every year and as an active part of the state assessment process.

goals of mathematical instruction proposed by the NCTM and CCSS impact the teaching practices of high school teachers.

Research Question

Currently, the state of Georgia, along with many others across the nation, is experiencing changes in curriculum and assessment coupled with higher teacher accountability. To meet the current adjustments, it is important for teachers to adapt their instructional strategies. This study depicts the stories of high school mathematics teachers making the changes recommended by the National Council of Teachers of Mathematics and the Common Core State Standards. Through narrative inquiry using a pragmatic philosophical orientation based on John Dewey's theory of experience, the stories of three high school mathematics teachers able to embrace the curriculum mandates of the NCTM and CCSS will be conveyed. One main research question guided this study:

> In what ways did the mandates to implement new curriculum influence the teaching practices of high school mathematics teachers?

The use of narrative inquiry allowed the participants (and me) to construct and reconstruct their (our) personal stories related to curriculum changes through the use of interviews and personal documents. For too long "practitioners have experienced themselves as without voice in the research process…. They have been made to feel less than equal" (Connelly & Clandinin, 1990, p. 4). The application of Dewey's theory of experience is useful because narrative inquirers "study experience … inspired by a view of human experience in which humans, individually and socially, lead storied lives" (Clandinin, 2006, p. 45). For this study, I define teachers as anyone who has transitioned from the old Quality Core Curriculum to the Common Core State Standards.

Significance and Rationale

According to Lloyd (2008),

> It is important now for researchers to identify and explore specific obstacles and challenges encountered by teachers when they attempt to teach mathematics in unfamiliar ways…. Additional studies are needed that examine the challenges and successes faced by teachers over time as teachers evaluate and make decisions about curricular innovations with respect to their own classroom experiences. (p. 164)

Ever since the early 1980s, the concepts instilled in the current curriculum have been talked about with little push towards implementation. Every year, teachers complain that their students do not have problem solving or thinking skills and struggle with the same content. The vision of the NCTM *Standards* documents, as well as the CCSS, pushes teachers to change their instructional strategies, but many educators continue to utilize traditional teaching practices. It has taken us over 30 years to start the vision laid out by NCTM, and many teachers are reluctant to make the needed changes.

The significance of this research study is that it is situated during a time of national curriculum reform with a strong emphasis on NCTM's vision of a mathematics classroom. This research will highlight how some high school teachers have found a "middle ground" in their attempts to transform their teaching strategies and bridge the gap between their traditional backgrounds and the new opportunities of the current curriculum. The experiences that lead them to their adaptations will be extremely important to the stories.

Summary

Today's mathematics teachers have undergone an overhaul with respect to curriculum standards and expectations as well as testing requirements. These changes have occurred over the course of many years at both the national and state levels. The National Council of Teachers of Mathematics has been a driving force in the interests of mathematics educators as well as curriculum reform since the early 20th century. NCTM created eight teaching practices to assist teachers in making the move to a classroom that would encompass the expectations of the Common Core State Standards. This is the transformative story of three high school mathematics teachers as they embraced the changes influenced by curriculum mandates.

2 REVIEW OF THE LITERATURE

The purpose of this study is to investigate how curricular mandates influence high school mathematics teachers' practices. As this review will show, there is limited research that investigates the impact of reform on teaching practices, with no studies found dealing with high school teachers. In this chapter, I first provide empirical studies on the influences of reform on teaching practices done in the United States addressing how mandates impact teaching practices. I then detail the hardships of teacher change and how teachers respond to curriculum reform. I conclude this chapter with a summary situating my study within the current literature on the influences reform and change have on teaching practices.

Influences of Reform on Teaching Practices

When searching for the impact curriculum reform has had on instructional strategies, the majority of the literature focuses on professional development activities used to change instruction (Jenkins & Agamba, 2013; McGee, Wang, & Polly, 2013) or how teachers' practices relate to improved student achievement (Firmender, Gavin, & McCoach, 2014; McCaffrey, Hamilton, Stecher, Klein, Bugliari, & Robyn, 2001; Schoen, Cebulla, Finn, & Fi, 2003; Thompson, 2009). However, few studies highlight the impact from national or state mandates on changing teaching practices in the United States.

The focus of this section is to highlight the scarce research done connecting teachers' practices to national, state, and local mathematics curriculum mandates. In this section I highlight three studies. The first two attempt to connect NCTM's vision to instructional practices of elementary and middle school teachers. The third, most recent, study depicts teachers' and principals' perspectives on Common Core implementation. I conclude this section by summarizing the characteristics of the three studies.

In the first study, Spillane and Zeuli (1999) examined elementary and middle school teachers' "patterns of practice" as they aligned with NCTM's definition of mathematical knowledge and doing mathematics "in the context of recent national, state, and local efforts to reform mathematics education" (p. 1). The framework used connected the implementation of mathematical tasks and discourse patterns based upon procedural[17] or principled knowledge. They selected 25 teachers who reported utilizing teaching practices aligned with reform proposals based upon the TIMSS questionnaire and were familiar with national and/or state reform efforts. Of the 25 teachers selected, only four "taught mathematics in ways that resonated with reformers' proposals" (p. 20) employing conceptually grounded tasks and conceptually centered discourse. The researchers found most of the teachers had a hybrid of traditional and reform-oriented practices. Spillane and Zeuli (1999) argue because of this selective revising of teaching standards "careful analysis of teaching practice as an essential, though frequently neglected, component of policy implementation research" (p. 3) is needed.

The second study conducted by McKinney, Chappell, Berry, and Hickman (2009) investigated the instructional practices of elementary mathematics teachers in high-poverty, urban environments in relation to NCTM's (2000) six principles (equity, curriculum, teaching, learning, assessment, and technology). They argued, "despite the clear and focused goals, recommendations, and standards that the NCTM (2000) set, a majority of classrooms continue to fall short in implementation and direction, especially in urban high-poverty schools" (p. 278). They developed a Mathematics Instructional Practices Assessment Instrument based on the literature to examine how teachers' practices aligned with NCTM's principles. For their study,

[17] Spillane and Zeuli (1999) define procedural knowledge as concentrating on computational procedures "following predetermined steps to compute correct answers" (p. 4) and principled knowledge involving "key ideas and concepts that can be used to construct procedures for solving mathematical problems" (p. 4).

they choose teachers who had attended a conference sponsored by NCTM. However, they found "teachers continue to implement traditional mathematics methodology more frequently than student-centered approaches" (p. 282) and argued for the need for more professional development and guidance for teachers to change their practices.

The third study conducted by the Center for Education Policy Research at Harvard University (Kane, Owens, Marinell, Thal, & Staiger, 2016) sought to gain educators' perspectives on Common Core implementation. The researchers surveyed elementary and middle school teachers and principals in five states inquiring into—

> the extent to which teachers and principals have embraced the CCSS, the supports they have received from their districts and states, and the specific strategies they are using to help students master the new standards. More specifically, our surveys focused on changes in instructional materials and lesson plans, the types and amounts of professional development, the frequency and type of collaboration within schools, classroom observations and feedback, and the content of teachers' performance evaluations. (p. 8)

During the first stage of data analysis, Kane and colleagues sought to address the support for the Common Core State Standards as well as strategies used for implementation. They found teachers and principals embraced the standards, felt effective with implementation, and were knowledgeable about the standards in both mathematics and English language arts.

Focusing on the mathematics results, teachers reported changing their instructional materials and strategies. The instructional materials were developed mainly by themselves or colleagues at their school. Teachers also reported using materials from their district or state as well as multiple online sources (e.g., Engage NY, LearnZillion, and Achievethecore.org). With respect to teaching strategies, "The vast majority (81%) of mathematics teacher reported having

increased their emphasis on students' conceptual understanding of mathematics; 78% have increased the time students spend on real-world application of mathematical skills and knowledge" (p. 11).

Professional development and collaboration were also topics addressed in the quantitative survey. The topics of professional development focused mainly on developing materials, content knowledge, and assessments aligned with the curriculum instead of tailoring instruction to meet the needs of diverse student populations and were primarily provided by colleagues in house. Collaboration over the Common Core State Standards for Mathematics (CCSSM) topics every week was reported by 45% of the teachers surveyed. The types of collaboration included sharing effective instructional strategies, developing aligned materials and assessments, understanding instructional shifts, analyzing student work to improve mastery, and observing other teachers' lesson that model CCSSM expectations.

The second stage of data analysis focused on which aspects of implementation associated with stronger performance on national assessments. In mathematics, they found "more training and more classroom observations with explicit feedback on the required changes in instruction [were] associated with greater student achievement on the PARCC and SBAC math assessments" (p. 26) as well as teacher evaluation systems including a component of student achievement on the more rigorous assessments measuring higher standards.

As shown above, there is limited research connecting the influence of curriculum reform mandates to teaching practices. The few studies discussed address elementary and middle school teachers. The frameworks these studies utilized only deal with a limited number of teaching practices promoted by NCTM and CCSS. Also, the methodology used was either purely quantitative (surveys) or mixed methods (questionnaire, observation, interviews).

Teacher Change

One thing any teacher can count on is that change is inevitable. It is not a matter of if; it's a matter of when. My experience as an educator since 2003 has taught me this. I have experienced changes at the national, state, and local levels. At the national level I have dealt with No Child Left Behind (NCLB) initiatives and transitioned to Every Student Succeeds Act (ESSA).[18] At the state level, changes in curriculum, assessment, and evaluation, spurred by the national initiatives stated above, affected what I did with my pedagogy in the classroom as well as the approach and support I provided teachers at the local level. The change has been multifaceted to say the least, but as Harris (2011) points out with respect to large-scale educational changes worldwide "millions of dollars have been spent on initiatives, strategies, and interventions that have made little, if any difference to the performance of school systems or to the life chances of young people" (pp. 159–160). Past reform attempts have not put children first; they have been highly political focusing on "changing structures or systems, tinkering with resources, altering curriculum content, or providing 'teacher proof' programs" (p. 161).

Learning from the past, the current research on educational change highlights the importance of a Fourth Way (Hargreaves, 2012; Hargreaves & Shirley, 2008a, 2008b, 2009; Hargreaves & Wallace, 2015; Harris, 2011) calling for a collective responsibility between teachers, parents, and the community taking the burden of change solely off the shoulders of the teachers. The Fourth Way developed because of the failures in the first three educational reform attempts. The First Way originated after World War II and extended into the mid-1970s. It was characterized by innovation and inconsistency. Equal rights campaigns fueled the development

[18] For more information on The No Child Left Behind Act of 2001 and Every Student Succeeds Act of 2015 visit http://www.ed.gov/

of federal and state programs to solve social issues but were stunted by the lack of cohesion in leadership, accountability, and disparity in achievement standards ultimately leading to a shift in focus (Hargreaves, 2012; Hargreaves & Shirley, 2009; Harris, 2011). The Second Way, lasting from the mid-1970s to the mid-1990s, promoted accountability through standardization and drove innovation by marketplace reform models. The emergence of government control and increased regulation on the teaching profession expanded the workload and collapsed motivation in educators (Hargreaves, 2012; Hargreaves & Shirley, 2008b). Looking to find a middle ground between the first two ways of change, the Third Way focused on performance and partnership, but ultimately paved the way for high-stakes testing and accountability systems (Hargreaves, 2012; Hargreaves & Shirley, 2008b, Harris, 2011) that stifled educational innovation. The need to find a better approach led the educational community to the current push. Hargreaves and Shirley (2009) posit:

> *The Fourth Way* is a way of inspiration and innovation, of responsibility and sustainability. The Fourth Way does not drive reform relentlessly through teachers, use them as final delivery points for government policies, or vacuum up their motivations into a vortex of change defined by short-term political agendas and special interests with which they are aligned. Rather, it brings together government policy, professional involvement, and public engagement around an inspiring social and educational vision of prosperity, opportunity, and creativity in a world of greater inclusiveness, security, and humanity.
>
> The Fourth Way pushes beyond standardization, data-driven decision making, and target-obsessed distractions to forge an equal and interactive partnership among the people, the profession, and their government. It enables educational leaders to "let go" of

> the details of change, steering broadly whenever they can and intervening directly only when they must—to restore safety, avoid harm, and remove incompetence and corruption from the system. (p. 71)

This quote describes the need for a collaborative effort between all members of society to promote educational change that benefits everyone. To be more suited to building prosperous societies, removing injustices, restoring professionalism, and establishing inclusion (Hargreaves & Shirley, 2009), the Fourth Way consists of six pillars of purpose and partnership that support change, three principles of professionalism that drive the change, and four catalysts of coherence that sustain and unify change.

The six pillars of purpose and partnership—an inspiring and inclusive vision, achievement through investment, corporate educational responsibility, students as partners in change, and mindful learning and teaching—rest on clear, realistic, and achievable purposes used to empower educators through collaborative relationships (Hargreaves, 2012; Hargreaves & Shirley, 2008b; Hargreaves & Shirley, 2009). The three principles of professionalism—high-quality teachers, positive and powerful professional associations, and lively learning communities—provides teachers, "the ultimate arbiters of educational change" (Hargreaves & Shirley, 2009, p. 87), support instead of commanding compliance. The four catalysts of coherence—sustainable leadership, integrating networks, responsibility before accountability, and differentiation and diversity—bring diverse people together under the common cause to impact learning, achievement, and results (Hargreaves, 2012; Hargreaves & Shirley, 2008b; Hargreaves & Shirley, 2009).

Evidence of the movement towards the Fourth Way is already being modeled worldwide. Finland has created a nationwide vision consisting of a decentralized educational system valuing

a strong teaching profession built on a shared responsibility for children (Hargreaves & Shirley, 2008a, 2008b). In Ontario, Canada the focus has shifted to "intelligent accountability, increased investment, heightened trust, and strengthened professional networking" (Hargreaves & Shirley, 2008a, p. 139) to support reaching the provincial targets. In England, the "peer factor" used to raise achievement through building networks, discretionary budgeting, and collaboration between schools as well as the community is being used to bolster student performance and cultivate student leaders (Hargreaves & Shirley, 2008a, 2008b). In the United States a grassroots development is taking place in urban education, and the driving force behind this change is community-based and youth organizations being supported by powerful funders (Hargreaves & Shirley, 2008a). Still in its infancy, this type of educational activism spreading through urban communities is an example of what can be done without governmental support and correlates "with higher levels of teacher-parent trust, sense of school community and safety, achievement-oriented culture, and parent involvement in the school" (Hargreaves & Shirley, 2008b, p. 59). Singapore has developed a national vision aimed to inspire educators and promote innovation in teaching and learning, values the teaching profession and professional development, and uses communication to make educational decisions (Hargreaves, 2012). Lastly, there is evidence of the Fourth Way occurring in Wales where the reform process reflects high quality teachers, positive and powerful professional associations, and lively professional learning communities aimed at using data to *inform* not *drive* teaching practice (Harris, 2011).

The exemplar, case studies above are evidence that the Fourth Way of educational change has already begun. The stage is set because of the failures of the previous reform attempts. The reasons for the repeated failures lie in the top-down imposition of the change, adapting and adopting reform from other successful programs without regard to differences between countries,

and the politically motivated charge to change quickly usually without sufficient time to assess the outcomes (Harris, 2011). Hopefully, the move will focus more attention on teaching practices and student learning.

Teachers' Response to Curriculum Reform

In this section, I describe the barriers to curriculum reform as well as the challenges teachers face when trying to change their instructional practices.

Story of Barriers to Curriculum Reform

NCTM's *Standards* documents created a vision encompassing "mathematical power for all in a technological society" (NCTM, 1989, p. 255) utilizing the power of mathematics to solve problems, communicate, and reason through an active, constructive curriculum including "a broad range of content, a variety of contexts, and deliberate connections" (p. 255) based on real problems allowing evaluation to improve instruction, learning, and programs. In *Curriculum and Evaluation Standards for School Mathematics* (1989), three barriers to implementation as well as next steps needed to overcome the barriers are highlighted. The most important barrier to curriculum reform is the beliefs, expectations, and attitudes of educational stakeholders (NCTM, 1989) based upon their past experiences in the process of learning mathematics. The reluctance to change is very powerful, so—

> the best way to bring about reform is to challenge directly the perceptions held by many about the content of mathematics, what is important for students to learn, the job of teaching, what constitutes the work of students, and the professional roles and responsibilities of teachers and administrators. (p. 255)

Maintaining long-held beliefs and practices inconsistent with intended reform practices will hinder curriculum implementation and cause no changes in mathematics classrooms.

The second barrier relates to the politics involved in making decisions about schooling (NCTM, 1989). Elected officials from the local to the federal level create educational policy to be implemented, but the changes required by the new CCSSM should encompass directives about resources, assessment, and include mathematics professionals in the decision-making process in order for changes to take place.

The third barrier is the cost of reform (NCTM, 1989). In a time of educational cuts, resources are required to make the needed changes to sustain efforts. Teachers need time and professional development to strengthen their instructional strategies and network with their colleagues. The use of technology, textbooks, online tools, and productive working environments are critical tools to help in the reform effort. If teachers are not given the needed resources to perform at the expected higher lever, they will fall back on their old, traditional ways of teaching which are counter-productive to the reform effort.

To help overcome these barriers the *Standards* documents create the vision and goals for professional educators to become empowered to find the necessary steps in implementing the reform, however, this task that has taken over 30 years to blossom. The *Curriculum and Evaluation Standards* promote a Professional Development Change Strategy that puts the process and decisions in the hands of educators instead of utilizing a top-down approach. There are many steps to be taken along the way to overcome the curriculum reform barriers: curriculum development, resources, assessments, instruction, teacher in-service programs, teacher education, technology, students' needs and interests, equity, working conditions, and research.

The first step in the Professional Development Change Strategy is curriculum development. Mathematics educators are charged with the task of creating lessons based upon

the appropriate standards. This has been accomplished through the development of the Common Core State Standards for Mathematics. Now that the curriculum has been developed and adopted, the next steps are crucial in overcoming barriers for implementation according to the *Curriculum and Evaluation Standards.*

Resources need to be developed to assist implementation including innovative textbooks, manipulatives, and online resources. In order for teachers to change their instructional strategies to meet the challenges of the CCSSM, assessments should be developed to assess problem-solving and reasoning skills: "Without changes in how mathematics is assessed, the vision of the mathematics curriculum described in the standards will not be implemented in classrooms, regardless of how texts or local curricula change" (NCTM, 1989, p. 252). In the state of Georgia, online resources have been designed for teachers and a new test, the Georgia Milestones Assessment System, has been created to assess student achievement with respect to the standards. The new mathematics assessment contains open-ended, constructed response items and norm-referenced items used for a national comparison.

Instruction, another step in the Professional Development Change Strategy, should be consistent with the expectations of the standards utilizing multiple strategies and evaluation techniques to gauge student learning. If instructional strategies do not change, the vision of the standards will not be achieved. Both prospective and veteran teachers will need programs and professional development to "ensure support for the proposed changes" (p. 253). This support could be achieved through in-service programs and workshops focusing on impacting instructional strategies.

Utilizing technology while providing opportunities for all students to thrive and learn mathematics is an important part of the *Standards* documents. Creating courses to allow

students to succeed is a challenge educators have to face to prepare all students for college and careers.

The working conditions in schools should also be set up for teacher success. NCTM (1989) points out:

> In too many schools, teachers will find it difficult to teach the mathematical topics or create the instructional environments envisioned in these standards because of local constraints, such as directives about which chapters or pages to cover, inadequate time for instruction, and the administration of tests…. Teachers also lack the necessary resources, the time to reflect, and the opportunities to share ideas with other teachers. Under such conditions, it is difficult to create a sense of exploration, curiosity, or excitement in the classroom. (p. 254)

Research, the last step in the Professional Development Change Strategy, is needed to see how classroom teachers are changing instruction to meet the expectations of reform: "Instead of dealing solely with the study of what is happening in the teaching and assessment of mathematics instruction, research should deal more with what ought to be" (p. 254). My study focuses on teachers who were able to take the initial steps in transforming their teaching practices to meet the vision and objectives of NCTM and CCSSM. They have had to overcome some of the barriers to change mentioned above. This research highlights eight teaching strategies to help teachers reform their practices to incorporate a task-based, collaborative classroom environment.

Story of Coping with Change

Not much research has been done about high school mathematics teachers with respect to coping with changes in pedagogical techniques. The main reason in lack of research is even with

content changes the mode of instruction has mainly been traditional—check homework, teacher-directed lecture, followed by individual student practice. High school mathematics teachers have had to endure changes in content over the years, but they have not been challenged to change the way they think about teaching mathematics.

The literature describes some of the challenges faced when implementing a new curriculum or changing from a "traditional" approach to a more "standards-based" approach, but usually concentrates on elementary and middle schools. A standards-based curriculum is "designed to support an instructional approach and classroom environment that emphasize students' engagement in making sense of mathematical ideas largely through problem solving" (Schoen, Cebulla, Finn, & Fi, 2003, p. 229).

One of the challenges faced when changing the curriculum is teacher preparation. Many teachers feel overwhelmed and uncertain about their ability to teach the standards correctly (Christou, Eliophotou-Menon, & Phillippou, 2004; Frykholm, 2004; Handal & Bobis, 2004; Lloyd, 2008). If they do not feel confident about the material, they may fall on more traditional ways of teaching because that is the way they learned mathematics and have taught it in the past. It is important to make sure teachers are prepared to adjust their pedagogical style to meet the needs of a changing curriculum. Ongoing professional development will help teachers cope with the challenges they will face while implementing new curriculum.

Another challenge is student accountability (Christou, Eliophotou-Menon & Phillippou, 2004; Frykholm, 2004; Handal & Bobis, 2004; Harris & Alexander, 1998; Lloyd, 2008). The standards are, at times, written vaguely and left to interpretation. Teachers need to be able to set up a classroom environment where group discussions will lead to better mathematical understanding. Ultimately, teachers are expected to prepare students for their state and national

standardized tests, which may or may not be written with task-based questions in mind. It is hard for teachers to prepare their students with so much ambiguity and uncertainty. Teachers ought to find a way to foster high expectations with growing diversity and varying student motivation.

A third challenge imposed on teachers implementing a new curriculum is pedagogical constraints (Christou, Eliophotou-Menon & Phillippou, 2004; Frykholm, 2004; Handal & Bobis, 2004; Lloyd, 2008; Orrill & Anthony, 2003). It takes much more time to prepare for each day's lesson. It is essential for teachers to put the task of gaining knowledge on the student, which may be harder for some to let go of the teacher-centered way of disseminating information. A shift in the roles of the teacher and students in the classroom is needed. The struggle to let students become creators of their own knowledge during the learning process (Steffe & Kieren, 2004) is a hard one for teachers to overcome.

In some school systems, teachers have the ability to choose how they implement the standards. Teachers are responsible for helping students understand the material mandated by the government to prepare them for their standardized tests that are supposed to measure the students' learning over the course of a year. Teachers decide to change with the times or adhere to their old way of instruction. Ultimately, they choose what goes on in the classroom every day and they can choose not to implement the standards (Spillane, Reiser, & Reimer, 2002) or change the way in which implementation is achieved. In other words, they can decide to use standards-based strategies in the classroom or use traditional lecturing techniques.

Another challenge is not having adequate support from outside the classroom (e.g. administrators, parents, community) or materials to help teachers implement the standards. According to Orrill and Anthony (2003), teachers struggle not only with finding adequate

support and materials, but also with assessment and classroom organization for maximum student achievement. In their study with middle and high school teachers, they encountered challenges such as teachers' perceptions of students' skills, external expectations from parents and standardized tests, lack of teacher experience with the material, lack of professional development, and not understanding the "big picture" as deterrents of change.

Even with the challenges, if teachers learn to address the issues that come up, better outcomes are possible for all involved in the change process. Frykholm (2004) highlights the spirit of curriculum reform as:

> It examines the essence of constructivist-based teaching, those critical moments in the classroom when children and teachers may meet—when the teacher's willingness to let go overlaps with the child's native curiosity, when teachers pose open-ended questions that foster creative ideas and strategies, when the teacher's willingness to be vulnerable meets the child's desire to trust, when the teacher's decision to remain silent allows children to develop their own voices, when the teacher's appreciation for the elegance of mathematics leads the child to life-long learning and appreciation of mathematics. (p. 149)

A natural outcome of learning about teachers' struggles with curriculum change is how they can address these issues. Some of the ways teachers can address the issues and move to a more student-centered approach are outlined by Bay, Reys, and Reys (1999) including administrative support, opportunities to study, sampling the curricula, daily planning, interaction with experts, collaboration with colleagues, incorporating new assessments, communicating with parents, helping students adjust, and planning for transition.

Even with state and national mandates, teachers can adapt their practices to meet the needs of every student. NCTM's eight teaching practices can help high school mathematics teachers embrace the curricular expectations of these mandates and transform their classrooms into engaging environments where students become the center of learning.

Summary

What the literature tells us is that elementary and middle school teachers are capable of adapting their instructional practices to meet reform initiatives but to varying degrees. With respect to the CCSSM, teachers have reformed their strategies learning through professional development and collaboration as well as tailored their materials to meet students' needs. What the literature lacks is how high school mathematics teachers adapt their teaching practices based upon curriculum mandates. My study situates high school mathematics teachers within the literature, as well as, looks at NCTM's eight teaching practices influenced by the CCSS.

We are now faced with the Fourth Way of teacher change where everyone has a place at the table to make a difference in all children's education. We must provide each other the support needed to overcome the barriers and challenges associated with change to the betterment of society.

3 THEORY

As stated in the previous two chapters, mathematics education is currently undergoing a tremendous overhaul with respect to teaching and learning. The once traditional process of teacher-directed, individual student learning is slowly transforming into a more student-centered, collaborative, problem-solving process. Historically, high school teachers have been reluctant to change their teaching practices (Cuban, 1993; Newman, 1998). I have witnessed this reluctance during my time in the classroom, while visiting surrounding high schools, and during professional learning workshops around the state. The hesitation and frustration felt by the more specialized high school mathematics teacher stems from their lack of resources and tools to successfully transition into a more facilitator-based approach to teaching. They simply do not know how to transform their longstanding practices or they wish not to embrace the purpose of the change.

Using the eight NCTM teaching practices (discussed in chapter 1) and Dewey's pragmatism, this research can help bridge the gap between the theory behind the new curriculum expectations and the practice of teaching in actual classrooms. The philosophy of pragmatism incorporates the connection between theory and practice and calls for a more collaborative educational environment based upon students' experiences.

The purpose of this research is to determine how the curriculum mandates influence the teaching practices of high school mathematics teachers. Dewey's pragmatism forms the basis of critique in education and ways to find the middle ground between the dualism of traditional and progressive education as well as theory and practice. With this purpose in mind this chapter describes the theoretical framework of pragmatism for this study.

Why Pragmatism? – My Personal Philosophy

I started my personal educational journey in the traditionalist camp because I, like many teachers, used what I knew and what worked for me and took it into the classroom. It did not take long to see that mathematics was not easy for all students, and I would have to find other avenues to get the material across to everyone. My instructional practices remained pretty traditional until Georgia rolled out the high school Georgia Performance Standards in 2008.[19] For really the first time, I challenged my philosophy of mathematics and started to change my instructional practices to focus on student learning and engagement.

My changing philosophy of mathematics education was one that I was not prepared to utilize. I struggled with the lack of connections to authentic experiences during my first nine years of teaching. If philosophy means the love of wisdom, I believe the current educational system diminishes this in both students and teachers. I believe people are naturally curious problem-solvers. The current system focuses on covering standards instead of bolstering curiosity and the ability to think. Instead of students being intrigued by mathematics, I have heard countless students complain about the material wondering when they will ever use it. My philosophy would use the students' lives and backgrounds to help them discover the mathematical content all around them. This is a daunting task given that there are usually more than 25 students in a classroom each bringing their own values, beliefs, and knowledge, but I believe it would help students connect their experiences to the subject.

My ideal philosophy of education is one where the students and teachers journey through mathematics together as a collaborative team, learning from each other through mistakes and

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[19] As stated in chapter 1, Georgia adopted the Georgia Performance Standards in 2005 after an audit revealed the lack of rigor in the Quality Core Curriculum.

triumphs while connecting the discipline to the world. Various resources are used (e.g. technology, textbooks, culture) to further our innate curiosity, and hopefully, gain an appreciation for the field. Does mathematics deserve the pedestal that it stands upon in the eyes of many? NO! People get along fine in this world without mastering many of the concepts that students are pushed into learning during their schooling years.

In my work with teachers, I am troubled by the mundane exercise of lecturing and skill practice utilized far too often. Many teachers do not take a step outside their comfort zone because they, like myself, were not prepared. However, the teaching "profession" is also degraded by the bureaucratic regulations that take all creativity out of the hands of the teachers, the ones closest to the students. In my ideal situation, I would base learning on problem-solving contexts. I would develop the mathematics through the students' natural curiosity with problems that apply to them. Why are complex numbers and trigonometric functions valuable to students without a context and reason for the topics? I believe the goal should be to create life-long learners and productive citizens that can solve problems and not just find the one "right" answer. I believe we have created robots that are incapable of thinking outside the box and solving any real problems without depending on someone else.

Pragmatism allows me to understand the transaction between teachers and their practices as they have gone through a reform-oriented curriculum. My interest in determining how national and state curriculum mandates have affected teaching practices led me to narrative inquiry methodology to tell the stories of teachers that have reflected and changed their instructional strategies because of the conversion to standards-based, student-centered practices. Pragmatism is the perspective that will help me analyze the dichotomies that exist in the classroom in order to see if teaching practices are changing because of the mandates.

Pragmatism

Epistemology is concerned with what constitutes knowledge. Fallibilism is the epistemological foundation of pragmatism where truths can be changed or withdrawn when new information becomes available, which challenges the privilege of science and mathematics. Fallibilism insists "that every knowledge claim—and, more generally, every validity claim—is open to challenge, revision, correction, and even rejection" (Bernstein, 2010, p. 36). Fallibilism dates back to the 17th and 18th century with René Descartes[20] and David Hume.[21]

There have been many fallible beliefs made throughout history. In the field of science, Earth was thought to be flat but proven to be spherical, and at one time we believed the planets and sun revolved around the Earth. In the discipline of mathematics, Euclidean geometry was the only subject taught until people questioned its basic parallel postulate, which opened the door to revision and the creation of non-Euclidean geometry. With the invention of new technology and the growth of communication, the amount of information that passes through communities is tremendous. We are always updating and changing our beliefs with the creation of new information. I believe it is a necessity to modify or throw out "truths" when new evidence is available. John Dewey believed in "truths" existing for a certain period of time but they were not "ultimate" truth or "absolute" knowledge because of the possibility of change in the future (Dewey & Bentley, 1949).

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[20] René Descartes', a 17th century French philosopher, idea of an evil genius/demon demonstrated his source of Fallibilism. He argued any belief could be false no matter the evidence used as proof because it could have been instilled and/or controlled by an evil genius (Hetherington, 2005, Section 7).

[21] According to Hetherington (2005), David Hume, an 18th century Scottish philosopher, argued "observations can never provide conclusive assurance—a proof—that the world is not about to change from what it has thus far been observed to be like" (Section 6). Just because the sun rose today and has for hundreds of years, does not mean that the same will happen tomorrow. His beliefs have come to be known as inductive skepticism.

Pragmatism was popularized by Charles Sanders Pierce and named by William James (Short, 2001). It developed because of the practical problems occurring over the birth and growth of the United States (White, 1973). All three founding fathers of pragmatism, Pierce, James, and Dewey, were influenced by European philosophy and "argued in one way or another that philosophy should take the methods and insights of modern science into account" (Biesta & Burbules, 2003, p. 5). Campbell (2007) describes pragmatism as "a uniquely powerful way for Americans to understand and to try to improve the human situation" (p. 3). It concerns itself with the relationship between humans and nature, experience, and community in order to meliorate our existence. The two central themes in a pragmatic vision are pluralism and humanism. Pluralism describes the world as dynamic and shifting bringing about many realities, whereas, humanism implies humans bring about truths based upon their interests and purposes (Koopman, 2006). Dewey's pragmatism stems from his naturalistic approach to inquiry.

Dewey's Pragmatism

Dewey's philosophy was developed through his own experiences growing up and evolved into published works on a variety of topics. Three central concepts provide the foundation of his pragmatism: transaction, inquiry, and experience.

Dewey's Theory of Transaction

Charles Darwin's *The Origin of Species* published in 1859 gave Dewey a central tenant for his pragmatism—species are constantly undergoing change between phases of imbalance and equilibrium (Hickman, 2009). He was influenced by Charles Darwin's theory of evolution and based his philosophy on the experiences between humans and their environment (Newman, 1998). Dewey's reflex arc concept described the transaction between organisms and their environment as "an active, adaptive, and adjustive process in which the organism seeks to

maintain a dynamic balance with its ever-changing environment" (Biesta & Burbules, 2003, p. 10). As the organism actively explores its environment, stimuli guides inquiry towards an "end-in-view" in search of equilibrium reflecting a process of learning and growth (Alexander & Field, 2003; Garrison, 2009).

Humans interact constantly with the environment in order to maintain a balance and develop habits used to respond to changes in the surrounding setting. He believed humans were always doing something that affects the environment creating consequences of action making them adjust and continue the cycle. Using communication, individuals create an intersubjective world of shared experiences (Biesta & Burbules, 2003). Humans should constantly be looking for ways to solve social problems and never settle for the "truth" because it is always changing with respect to time.

Dewey's Theory of Inquiry

Early on, Dewey was influenced by Hegel's idea of a universal consciousness which provided links between the individual and its environment. Hegel concentrated on the individual and Dewey concentrated on the environment and human interaction. Dewey's theory of inquiry was shaped by Hegel's dialectic[22] (Garrison, 2006). Hegel believed "that Concepts (the *Begriff)* grow when confronted by obstacles that are initially inadequate to overcome" (p. 3). Dewey's

[22] For Hegel, the dialectical method—

> is not only a way of thinking but also the process by which reality revolves. The harmonious integration of the parts of reality into the whole is achieved in three stages: the thesis provokes an antithesis, out of the latter emerges a synthesis, representing a higher and more comprehensive level than the first two stages. Having developed by preserving some aspect of an existing circumstance and reacting against others, this higher synthesis becomes a new thesis which produces another antithesis, and the process begins anew. (Johnston, 1989, p. 135)

theory of inquiry began when humans interact with their environment creating disequilibrium which must be settled. Dewey's position according to Garrison (2006) follows

> When we cannot satisfy need and desire, when we are in doubt, we inquire to creatively overcome the disrupted situation. Successfully reconstructing novel situations and restoring unity through creative action requires creating novel concepts, hypothesis, and ends-in-view, which is how Dewey readjusted Hegel's *Begriff*. (pp. 3–4)

Thayer (1952) laid out the six stages of Dewey's inquiry. The first stage, the indeterminate situation, precedes inquiry and reflection and occurs when there is an "imbalance in organic-environmental interactions" (p. 51). The second stage occurs when the organism establishes a problem setting the stage for inquiry and begins the transformation into finding a determinate solution. The forming of a hypothesis or plan of action while anticipating consequences of choices made based on prior experiences and observations realizing there are many possible solutions is the third stage of Dewey's theory of inquiry. The fourth stage occurs when reasoning examines the hypothesis and looks for operational meaning to possibly resolve the problematic situation. Following this reasoning, the plan of action or experiment either reaches a determinate solution or continues inquiry to achieve equilibrium. The last stage of inquiry concludes by producing a warranted assertion or "true" statement. This process of inquiry continues ad infinitum creating the pragmatic paradox.[23]

Dewey's Theory of Experience

In *Experience and Education* (1938), Dewey lays out the need for a theory of experience and discusses the three criteria that make up this theory: continuity, situation, and interaction.

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[23] "Ultimate reality exists at the end of infinite inquiry." (Boyles, 2001, p. 94)

For Dewey, "Everything depends upon the *quality* of the experience which is had" (Dewey, 1938, p. 27), where quality is defined by its immediate effect as well as its influence on future experiences. His philosophy of education is based upon a philosophy of experience grounded in democracy with constant battles between the *Either–Or* philosophies that make up the many dualisms[24] present in society.

The first principle in forming his theory of experience is continuity or the experiential continuum. This criterion attempts to "discriminate between experiences that are worth while educationally and those that are not" (Dewey, 1938, p. 33). There are three types of experiences a student can have—mis-educative, non-educative, and educative. In mis-educative experiences, student intellectual growth is stunted. Non-educative experiences occur when the student is not engaged and no learning exists. An educative experience, for Dewey, should always be occurring, and is where inquiry continues to flourish and problems are solved (Boyles, 2001; Dewey, 1938).

Continuity rests on the characteristic of a habit where "every experience enacted and undergone modifies the one who acts and undergoes, while this modification affects, whether we wish it or not, the quality of subsequent experiences" (Dewey, 1938, p. 35). With our experiences we create two types of habits (Boyles, 2001; Dewey, 1938). $Habit_1$ are those that are routine. There is not much thought that goes into these types of activities. Dewey believed

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[24] Many of Dewey's writings address the multitude of dualisms occurring in society: traditional/progressive education, child/curriculum, individual nature/social culture, theory/practice, logical/psychological, school/society, manual training/occupations. He was introduced to the work of Hegel during his graduate studies at Johns Hopkins University as a way to break free of the divisions and separations that encompassed his life (Boyles, 2001). "Hegelian metaphysics stressed organicness and interrelatedness" (Phillips, 1998, p. 406) which provided a natural avenue for Dewey to connect the many disjointed aspects of his life through the use of dualisms (Boyles, 2001) that drew a parallel to Hegel's dialectical method (Phillips, 1998).

the schools created habit$_1$ experiences for students. Habit$_2$ are educative. These are the experiences that are active, social, and require the process of inquiry. It is the job of the educator to set up experiences in the classroom to promote the growth of habit$_2$ experiences.

The second and third principle, interaction and situation, "are inseparable from each other. An experience is always what it is because of the transaction taking place between an individual and what, at the time, constitutes his environment" (Dewey, 1938, p. 43). For Dewey, interaction depends on two factors—objective[25] (external) and internal conditions—of an experience. Interaction focuses inquiry in multiple directions: inward (internal conditions such as feelings, hopes, aesthetic reactions, and moral dispositions); outward (existential conditions the environment); backward and forward (temporality: past, present, and future).

> To "*experience an experience*"—
>
> that is, to do research into an experience—is to experience it simultaneously in these four ways and to ask questions pointing each way. Thus, when one is positioned on this two-dimensional space in any particular inquiry, one asks questions, collects field notes, derives interpretations, and writes a research text that addresses both personal and social issues by looking inward and outward, and addresses temporal issues by looking not only to the event but to its past and to its future. (Clandinin & Connelly, 2000, p. 50)

As people experience their world, they live in a series of situations connecting them to their surroundings, both objects and other people. There is also a union between continuity and

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[25] Objective conditions cover a wide range of external states including—

> what is done by the educator and the way in which it is done, not only words spoken but the tone of the voice in which they are spoken. It includes equipment, books, apparatus, toys, games played. It includes the materials with which an individual interacts, and, most important of all, the total *social* set-up of the situations in which a person is engaged. (Dewey, 1938, p. 45)

interaction. Taken together they "provide the measure of the educative significance and value of an experience" (Dewey, 1938, pp. 44-45).

The three criteria of experience put a large responsibility on educators. Teachers are charged to select the objective conditions conducive to the current needs and capacities of students to generate an educative experience of growth for preparation for later experiences.

Pragmatism's Connection to NCTM and CCSS

The Common Core State Standards for Mathematics (CCSSM) as written are not Deweyan. Instead, the CCSSM focus on the end-in-view, which is standardized tests and not the process of learning. However, in connection to NCTM's vision, they have challenged teachers to look at classroom activity to find the middle ground between practicing skills and solving problems, between the curriculum and the "real-world" experiences of the students, between using and understanding mathematical formulas, and between the relationships of student to teacher by incorporating a balance between mathematical content and the standards for mathematical practice.

Educators can transform their practices using NCTM's eight teaching strategies to help find a common ground and overcome the educational dualisms surrounding their profession. One of the most important of the eight practices teachers can use is to support productive struggle while students learn mathematics. This practice allows students to work individually or in small groups using their experiences and knowledge to work through mathematical ideas in a supportive environment (NCTM, 2014). Teachers can also implement real-world tasks promoting reasoning and problem solving and connecting the mathematics to a context for students to gain better understanding. Instead of going straight to the abstract algorithm, teachers can build mathematics from conceptual understanding so students are able to use mathematics

flexibly in many contexts. Teachers can use student thinking to assess their knowledge and provide support or adjust instruction to support and extend students' learning (NCTM, 2014).

Teachers can use the principles of establishing mathematical goals and posing purposeful questioning to broaden students' experiences with the material. It takes a strong educator to use students' prior experiences, whether below, at, or above expectations, to create a learning environment to allow for student growth. Along with the two practices previously mentioned, teachers can also use and connect mathematical representations to prior student experience as well as to the concepts learned in the classroom. Allowing students to see the bigger picture of how everything fits together (e.g. algebraically, graphically, and tabular) as a part of the development of mathematics makes the material connect to students' experiences and gives them references points to their learning.

Finally, creating an active classroom and being able to facilitate discourse among everyone allows the tenants of democracy to shine through. Everyone becomes a part of a community striving for a common goal while using their experiences and backgrounds as an integral part of the journey.

These eight practices help teachers make connections between the content and process standards of the CCSS allowing them to work within both teaching paradigms (traditional/progressive), helping to make connections between the child's experiences and the curriculum, as well as allowing for individual growth in a social climate.

Summary

Pragmatism, with its foundation in fallibilism, is the theoretical perspective that drives this study. Dewey's theories of transaction, inquiry, and experience make up his pragmatic vision. His theory of experience is the cornerstone to the methodology used in this study:

narrative inquiry; it allows me to study the experiences of three high school mathematics teachers as they journey through changing curriculum and grow as educators.

4 METHODOLOGY

The purpose of this study is to understand the influences that the curricular mandates of the National Council of Teachers of Mathematics and the Common Core State Standards have on the teaching practices of high school mathematics teachers during a time of educational change in instructional expectations. The research question that guides this study is: In what ways do the mandates to implement new curriculum influence the teaching practices of high school mathematics teachers? In this chapter, I present a comprehensive description of my study covering six topics: (a) design of the study, (b) participant selection, (c) data collection, (d) data analysis, (e) trustworthiness, and (f) role of the researcher.

Design of the Study

There are many functions of narratives. They can help people remember and make sense of past experiences. Narrators can argue, persuade, convince, engage, entertain, or mobilize an audience (Riessman, 2008). The participants in this study utilized many of these functions when telling their stories of educational change. I chose to do a narrative inquiry study because I was interested in identifying changing instructional practices through the development of teachers' stories.

Qualitative Research

According to Merriam (2009) "Qualitative researchers are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (p. 5). Qualitative research is philosophically positioned in constructivism or interpretive research where "reality is socially constructed, that is, there is no single, observable reality. Rather, there are multiple realities, or interpretations, of a single

event" (p. 8). This decision fit nicely with my theoretical framework selection of pragmatism with its roots in fallibilism where multiple truths are embraced.

There are many characteristics that made qualitative research a good fit for this study. The focus of qualitative research is on meaning and understanding (Merriam, 2009), which is an important quality in trying to understand how curricular mandates impact teaching practices. Qualitative research uses the researcher as the primary instrument for data collection and analysis (Merriam, 2009), which is an essential aspect to narrative inquiry. Furthermore, qualitative research is inductive, emergent, flexible, and purposeful (Merriam, 2009). It allows the researcher to interpret data using multiple methods emerging from the study while viewing it holistically. All of these characteristics are important to my study because they allowed the stories of changing teaching practices to develop during the data collection process.

Narrative Inquiry

As a narrative researcher my study looked at the ways teachers' described their changing teaching practices (Pinnegar & Daynes, 2007). According to Caine, Estefan, and Clandinin (2013), narrative inquiry emerged as a social science research methodology in the late 1980s. Narrative inquirers seek to understand; they have a "curiosity about how people are living and the constituents of their experience" (p. 575). For narrative inquirers, experience is personal and social as well as embedded within larger narratives[26] consisting of time and place. Because narrative inquiry strives to understand experience it creates a relational commitment incorporating a transaction between researcher and participants:

[26] The larger narratives represented in this study are the curricular mandates of NCTM and CCSS. Their goals and features were outlined in chapter 1.

> A collaboration between researcher and participants, over time, in a place or series of places, and in social interaction with milieus. An inquirer enters this matrix in the midst and progresses in this same spirit, concluding the inquiry still in the midst of living and telling, reliving and retelling, the stories of the experiences that make up people's lives, both individual and social. (Clandinin & Connelly, 2000, p. 20)

It allows both the researcher and participants to intertwine their experiences as they journey through the process confronting their lived stories revealing their vulnerabilities and uncertainties. Because of the centrality of relationships between researcher and participants, "it is important that narrative inquirers carefully consider who they are, and who they are becoming, in the research puzzle. The researcher's presence and investment is an important feature of narrative inquiry research" (Caine, Estefan, & Clandinin, 2013, p. 577). As a researcher, it is also important to understand stories lie in what people do not say "and stay mindful that our words might call forth or shift attention in new and unsettling ways" (p. 578).

Narrative inquiry is both a research methodology and a view of phenomena (Caine, Estefan, & Clandinin, 2013; Clandinin, 2006; Clandinin & Connelly, 2000; Connelly & Clandinin, 1990). As a research methodology, it gathers information through the researcher's and participants' stories, but as a view of phenomena it situates the experiences "as lived in the midst, as always unfolding over time, in diverse social contexts and in place, and as co-composed in relation" (Caine, Estefan, & Clandinin, 2013, p. 575).

Narrative inquiry allowed me to study the phenomenon of the impact curricular mandates had on the teaching practices of high school mathematics teachers. Situating the experiences of the participants and myself with respect to the literature and Clandinin and Connelly's (2000) three-dimensional narrative inquiry space allowed me to study the tensions between our

experiences and the grand narratives of NCTM and CCSS. As outlined in chapter 3, Dewey's theory of experience is the backdrop for narrative inquiry. Clandinin and Connelly (2000) use Dewey's three criteria for experience—situation, continuity, and interaction—to form their three-dimensional narrative inquiry space. In the three-dimensional narrative inquiry space, situation represents the place, continuity signifies components of the past, present, and future, and interaction embodies the personal and social aspects of experience. This space is categorized with instability and change.

For Clandinin and Connelly (2000), boundaries exist between narrative inquiry thinking and the grand narrative creating tensions. These tensions can be categorized by temporality, people, action, certainty, and context. Temporality is locating things in time (past, present, and future). People are in the process of change working within temporality. Action is seen as a narrative sign, which relies on the narrative history. Certainty calls upon the fallibility in narrative thinking; it brings about the sense of uncertainty because many interpretations and possible explanations are possible. Context is necessary for making sense of anything; it is ever present, temporal, spatial, and within the context of other people. I used this three-dimensional narrative space as a lens while collecting and analyzing my data.

Strengths and Limitations

There are many strengths in using narrative inquiry as the methodology for this study. It allowed me to focus on the evolving experiences high school mathematics teachers had over the course of several years as they transformed their teaching practices. I was able to intertwine my story of transformation and use my experience in the process of data collection and analysis to link our experiences of change. Because I work closely helping teachers adapt their teaching practices through professional development, I was able to see what practices were utilized more

and less often as well as identify the multiple influences helping with the transformations. This research will assist me in determining future steps to take with respect to helping teachers implement practices acquired during professional learning workshops.

There are also limitations to using narrative inquiry. The focus can only be on a few participants because "the methods are slow and painstaking. They require attention to subtlety: nuances of speech, organization of a response, local contexts of production, social discourses that shape what is said, and what cannot be spoken" (Riessman, 1993, p. 69). So, making a generalization to the larger population of high school mathematics teachers is not possible. Another limitation is my experience as a high school mathematics teacher. This had positive and negative aspects. Being that I was a high school mathematics teacher that went through reform transformations, I understood the struggles the participants expressed in their interviews; however, I sometimes took this for granted and may have influenced their responses to the interview questions unknowingly. Given that the researcher is so connected to the data collection their opinions, prejudices, and biases could cause problems during the research process. To deal with these issues, I listened to the tape recorded interviews numerous times. I wrote in my research journal to reflect on my involvement in the research and the decisions I made along the way. I also sent the participants their transcribed interviews as well as the final story for their input.

Participant Selection

A purposeful sample was used for this study. According to Merriam (2009), "Purposeful sampling is based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (p. 77). Given that the purpose of this study was to understand how curricular mandates influenced high school

mathematics teachers' instructional practices during a time of changing expectations, three high school mathematics teachers from different school districts were selected to participate. At the time of the study, each participant was a high school mathematics teacher in the southeastern United States, although their years of experience at that level varied. The participants were chosen because they were at the high school level, they had been in the classroom long enough to experience the Quality Core Curriculum, the Georgia Performance Standards, and the Common Core State Standards, and they had self-reportedly changed their instructional practices. Being a School Improvement Specialist for many counties, I had the pleasure of working with each participant prior to the interviews on multiple occasions. This previous interaction gave me some background knowledge of their instructional habits because of conversations that evolved during our professional learning workshops.

The rationale for choosing these teachers was two-fold. I first wanted to see the impact the changing curriculum had on their teaching strategies. I also wanted to share their stories of transformation in order to help other teachers, especially those that find change difficult, make some shifts in their teaching practices. For I believe the shift is necessary for students to gain a more conceptual understanding and make connections among the multiple representations in mathematics as well as become better problem-solvers and thinkers.

Data Collection

Because each story is situated and understood within a larger cultural, social, familial, and instructional narrative where experiences are continuously interactive resulting in changes, data collection must—

> begin the ongoing negotiations that are part of engaging in a narrative inquiry. We negotiate relationships, research purposes, transitions, as well as how we are going to be

> useful in those relationships. These negotiations occur moment by moment, within each encounter, sometimes in ways that we are not awake to. The negotiations also occur in intentional, wide awake ways as we work with our participants throughout the inquiry. (Clandinin, 2006, p. 47)

Caine, Estefan, and Clandinin (2013) point out "Insofar as being able to describe, evoke, and represent experience, then, for narrative inquirers a transcript alone simply will not do" (p. 579). To gain a more accurate picture of teachers' changing instructional practices, I utilized two data collection tools for my study: interviews and personal documents. To solicit participation, I used my high school distribution lists created over the course of my 4 years working with teachers. I sent out numerous participant recruitment letters (see Appendix B for a copy of the recruitment letter), mostly without a response, and was able to find three teachers that fit the requirements for the study.

Interviews

According to Kvale and Brinkmann (2009), "The qualitative research interview attempts to understand the world from the subjects' points of view, to unfold the meaning of their experiences, to uncover their lived world prior to scientific explanations…. It is hard to do well" (p. 1). Utilizing their traveler conception of interviewing, I interwove the interviewing and analysis on an ongoing basis to provide useful pragmatic knowledge. I used a semi-structured interview protocol (Merriam, 2009) (see Appendix C for the interview protocol) sent to participants prior to our meetings and collected their stories via an audio recorder. I interviewed each participant three times over the course of 3 months (February–April 2016) at each of their respective public libraries. Teaching practices and their influences made up the topics of discussions over the course of the interviews.

Before the first interview, I sent the interview protocol and an overview of the purpose of the meeting. At our first meeting, I gave each participant a composition notebook and explained its purpose of collecting thoughts either from our discussions or things that came to mind while teaching their students. I had each participant sign the consent form (see Appendix D for the consent form) and create their own pseudonyms that were used on all collected data. The initial interview gathered background information and provided the participants a platform to tell their stories of how they entered into the profession. They also discussed their early career influences (added to the interview protocol just prior to the first participant's interview), their thoughts and feelings towards the changing mathematic curriculum, and described a typical class under the Quality Core Curriculum, the Georgia Performance Standards, and the Common Core State Standards. This first interview allowed me to create a map detailing their educational experiences during the transitions as well as highlight some of the instructional strategies they incorporated during the changes in curriculum. I sent a follow-up email with any pertinent information that needed to be addressed from our first meeting.

The second interview, scheduled a couple of weeks after the first to allow for transcription and development of follow-up questions if needed, focused on how the teachers changed their practices to match the curriculum expectations. Each participant received an e-mail prior to the meeting containing the questions and purpose of the interview. I started the interview off with a discussion on any memoing done in the notebook or documents brought so they could explain what extra data they provided. I followed this up with the first question on their definition of "teaching practices" because I found during the first interview when we discussed teaching practices each participant seemed to have their own definition; therefore, I added a question to the protocol for the second interview in order to get a better understanding of

their interpretation. The remainder of our time together allowed them to describe how their teaching strategies evolved during the curriculum changes and what they felt influenced those changes. I was looking for consistencies from their first interviews as well as evidence of any of NCTM's eight teaching practices. I ended our time together by providing them with a copy of NCTM's *Principles to Actions: Ensuring Mathematical Success for All* book. I decided to hold off until after the second interview to introduce them to the eight teaching practices I would be looking for in my study in order not to sway their responses. I wanted to see what teaching strategies they thought about initially before being introduced to the teaching and learning guiding principle of NCTM. I sent a follow-up email to each participant after this interview as well.

Before the final interview, I sent an email with the protocol as well as a reminder to bring any additional documentation. The final interview started with the participants talking about any entries they had in the composition notebook as well as any documents they brought. The sole purpose of the last interview was to see which of the eight practices they utilized during their changes in instructional practices. I also wanted to see which one they felt they changed the most, so I added a second question to my interview protocol. After all transcriptions were complete, the final draft was sent to the participants to check their accuracy. Only one participant gave feedback for clarification purposes, and those changes were implemented in the transcripts.

Personal Documents

A second source of data was used in this study. The participants provided personal documents of example items that either came up during the interviews or that highlighted some of the changes they made to their instructional practices. Personal documents can be "a reliable

source of data concerning a person's attitudes, beliefs, and view of the world" (Merriam, 2009, p. 143), but they are highly subjective and may not be very accurate. The term personal document is used broadly to encompass first-person narrative that may be solicited by the researcher (Bogdan & Biklen, 2007). I asked participants for documents that highlighted their changing practices because I chose not to do classroom observations. The participants provided a wide range of documents: lesson plans, assessments, warm-ups, assignments, tasks, and projects. These documents offered additional data showing their evolving teaching practices and expectations starting from the implementation of the Georgia Performance Standards.

Another personal document was the composition notebook provided at the initial interview for them to write down any ideas or resources that came to mind, but was used primarily for talking points in the last interview. The participants had a few epiphanies and jotted down some resources that came up during the interviews; however, there was not an abundance of data obtained from this data collection method. The majority of the notebook was used during the third interview discussions. While reading the eight teaching strategies, the participants jotted down their interpretations and used those as talking points during the last interview. Doing so allowed them to talk about the teaching strategy more fully given that they had time to read the book and reflect on their uses in their own classes prior to the interview. The notebook helped me understand what they felt was important in their reading and gave me an insight into their thoughts and perspectives on the eight teaching practices.

Questions Raised About Narrative Methods

While deciding which narrative methods to use to collect data, I kept in mind Pinnegar and Daynes' (2007) questions about power, authority, and community. With respect to power, they question the ownership of the story created, while authority problematizes competing

versions of those stories. In attempting to address these two questions, I tried to be as accurate in my interview transcripts and keep the stories intact as much as possible during my data collection and analysis. I also sent my final versions to participants for their feedback. The question about community or what stories actually do was also thought about during data collection. The purpose of collecting data through interviews and personal documents was to help readers in the wider teaching profession see the changes the participants made as obtainable and to encourage others to evolve in their practices. My goal was to understand their transitions not predict or control their world.

Data Analysis

I chose to use narrative analysis for my data because the participants told stories of their changing teaching practices during the interviews. The strength of using this form of data analysis is that it "gives insight into how individuals structure communication for effect and how they construct meaning from their life experiences" (Grbich, 2007, p. 125). The purpose of narrative analysis

> is to see how respondents in interviews impose order on the flow of experience to make sense of events and actions in their lives. The methodological approach examines the informant's story and analyzes how it is put together, the linguistic and cultural resources it draws on, and how it persuades a listener of authenticity. Analysis in narrative studies opens up forms of telling about experience, not simply the content to which the language refers. We ask, why was the story told *that* way? (Riessman, 1993, p. 2, emphasis in original)

According to Caine, Estefan, and Clandinin (2013), "Often our understanding as narrative inquirers does not come instantaneously, or quickly, or by engaging in clever analysis. Instead

our understanding deepens as we retell and relive our lived stories over time, place, and social contexts" (p. 581). Because data collection and analysis is recursive and dynamic (Merriam, 2009), analysis began with my first interview. Utilizing narrative analysis allowed the story of the participants to shine through and their experiences to be highlighted. The narratives composed through the interviews and personal documents focused on the time, place, and social contexts, therefore, I used vignettes throughout the data representation to help the reader make these connections.

Because I was interested in the "what" of the interviews and the documents, I adopted Riessman's (2008) thematic analysis. Participants' stories were kept intact and allowed me to theorize starting with the first interviews. I was able to look for similarities and differences both in each individuals' accounts as well as across interviews. The data was cleaned up to construct an unambiguous plot line for the reader (Riessman, 2008).

Because stories are representations of experience (Riessman, 1993), I had to make decisions on how to interpret the data. Keeping in mind—

> narratives are composed for particular audiences at moments in history, and they draw on taken-for-granted discourses and values circulating in a particular culture. Consequently, narratives don't speak from themselves, offering a window into an 'essential self.' When used for research purpose, they require close interpretation. (Riessman, 2008, p. 3)

I had to choose between two versions of narrative analysis: socio-linguistic and socio-cultural. I chose to utilize the socio-cultural approach. It "looks at the broader interpretive frameworks that people use to make sense of particular incidents in individuals' lives" (p. 124). Moreover, it allowed me to show the interactions between the researcher and participants as well as show the

links between their stories instead of focusing solely on the structure of the narrative which is the emphasis of socio-linguistic narrative analysis.

The Process

Below I used Riessman's (1993) five levels of representing experience and Grbich's (2007) narrative data analysis process to describe the steps taken with my own data.

Attending experience. For Riessman (1993), attending to experiences is the first step of representation where the investigator makes "certain phenomena meaningful" (p. 9). This meaning making was accomplished as I developed the purpose of the study. I wanted to find high school mathematics teachers that were successful in changing their pedagogical strategies during a time of curricular modifications in order to tell their stories of transformation. I used NCTM's eight teaching practices as a tool for data analysis. The practices allowed me to describe the importance given to each practice by the participants as they depicted their transformations in the classroom.

Telling experience. This step was considered when creating my interview protocol. For Riessman (1993)

> To encourage those we study to attend to and tell about important moments in their lives, it is necessary to provide a facilitating context in the research interview, which implicates the interview schedules we develop. Certain kinds of open-ended questions are more likely than others to encourage narrativization. (p. 54)

To achieve this detail of narration, I created a semi-structured interview protocol that allowed the participants to describe their changing teaching practices as well as the influences involved in their transformation. I used probing questions for clarification purposes. This type of

questioning resulted in long accounts given by the participants of their teaching stories. These stories became the scenes in my ethnodrama[27].

Transcribing experience. Transcribing, Riessman's (1993) third level of representing experience following attending and telling, was the method used to get a representation of the participants' experiences with the changing curriculum. Keeping in mind that transcribing is "incomplete, partial, and selective" (Riessman, 1993, p. 11), I listened to each interview, transcribed by myself, multiple times. During the initial transcription I focused on getting down the majority of the interview knowing I would listen again for accuracy. While listening to the interviews, I used the techniques of memoing in my research journal or in the margins of my transcripts beginning with my first interview, as my data analysis began. Memoing is a way to track thoughts and hunches while analyzing data (Merriam, 2009). After I listened to each interview twice, I sent all three transcripts to the participants for them to check for accuracy. Only one participant made corrections to her interviews for clarification purposes. I saved each of these interviews and marked them as my originals.

While listening to my data over and over, it began to take the form of a drama in my mind; because of this I listened to the data a third and fourth time. During the third attempt, I included pauses (p), laughs (lol), put quotation marks to denote past dialog, and parsed lines when participants took breaths or paused to create a more natural dialog. I inserted more thoughts in the margins and filled in minor missing words. The fourth time through, I checked for accuracy as well as numbered the lines to help keep data straight during analysis. I then saved this version as my transcription for data analysis.

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[27] Ethnodrama will be described in detail in chapter 5.

Analyzing experience and identifying the boundaries of the narratives. In-depth analysis, Riessman's (1993) fourth level of representing experience, really started as I looked through the data for narrative segments in the transcripts, (Grbich, 2007) and it continued throughout the process outlined below. While transcribing the data, I noticed the narratives did not follow a simple chronological sequence. Participants' train of thought moved from topic to topic disregarding the impact of time; they talked about what came to mind and many times would backtrack in their conversations. Like Riessman (1993), I struggled to adopt the traditional qualitative method of coding the data because many times the participants gave long accounts, and I did not want to fragment them into specific categories. According to Pinnegar and Daynes (2007),

> The turn from numbers to words as data is not a general rejection of numbers but a recognition that in translating experience to numeric codes researchers lose the nuances of experience and relationship in a particular setting that are of interest to those examining human experience. (p. 15)

Also, there were times that a certain story permeated through all three interviews. Instead of coding the data, I printed each participant's transcribed interviews ready for more in-depth data analysis on colored paper. Each participant had their own color. I proceeded to cut the transcripts, pulling out long participant accounts with data pertinent to my research question. I denoted which interview the data was from on the bottom right after cutting took place. The cut chunks of data helped me form the acts and scenes of what would later be formed into my ethnodrama.

Exploring the stories. The next three steps of Grbich's (2007) narrative data analysis process took place as my drama unfolded. The first step, exploring the content and context of

the story, was achieved by sequencing the events chronologically and adding vignettes to elaborate the emotions and feelings expressed in the interviews. I created different acts as breaking points in the story for the reader signifying the changing curricular expectations. The second and third steps, comparing and linking stories, developed through my use of scenes created within the different acts. Each scene was named from participants' words that described its purpose. Within each scene, I also denoted the interview where each block of text resided. The scenes allowed me to compare the participants' stories, whether similar or contrasting views were displayed, as well as see what teaching practices were utilized more often than others. The vignettes linked the participants' stories to the larger political structures and current locations.

Story interpretation. The last step in Grbich's (2007) process was constantly on my mind during data collection, analysis, and representation. This step involves the researcher being aware of their positionality with respect to participants' stories and how this shapes the final text. I had to make decisions on positioning my dialogue from the transcripts within the ethnodrama. Being a narrative inquiry study, my story was part of the research, but I did not want to overshadow the participants' stories. Keeping this in mind, I put my story of entering the profession last in act 1. I also decided to use my participants' conversations as the majority of my drama, using my portions to move the story along or to provide minimum commentary.

Reading experience. The last level of representing experience (Riessman, 1993) transpires as readers encounter the written report. This level of experience takes into account that meaning and truths are interpreted based on people's subjectivities representing a reality. Riessman (1993) points out "Meaning is fluid and contextual, not fixed and universal. All we have is talk and texts that represent reality partially, selectively, and imperfectly" (p. 15). This first occurred as I sent my initial drafts to my writing group and dissertation committee members

for their input. I also sent my final drama to my research participants for their comments before my final draft. This level of representing experience will continue indefinitely as my research is published and others encounter the report making their own interpretations.

Trustworthiness

For narrative inquiry,

> Prevailing concepts of verification and procedures for establishing validity (from the experimental model) rely on realist assumptions and consequently are largely irrelevant to narrative studies. A personal narrative is not meant to be read as an exact record of what happened nor is it a mirror of a world "out there." Our readings of data are themselves located in discourses (e.g., scientific, feminist, and therapeutic). (Riessman, 1993, p. 64)

For narrative researchers, "The acceptance of the relational and interactive nature of human science research, the use of the story, and a focus on a careful accounting of the particular are hallmarks of knowing" (Pinnegar & Dayner, 2007, p. 25). Because individuals construct stories in different ways for varying purposes, the traditional notions of reliability and validity "must be radically reconceptualized" (p. 65). Riessman (1993) approaches the question of validity through trustworthiness instead of truth. For her truth "assumes an objective reality" (p. 65); whereas, trustworthiness "moves the process into the social world" (p. 65). There are two levels to address with respect to narrative projects, "the story told by a research participant and the validity of the analysis, or the story told by the researcher" (Riessman, 2008, p. 184). The following four ways address the issue of validation within narrative work: persuasiveness, correspondence, coherence, and pragmatic use.

Persuasiveness

To check for persuasiveness, the researcher must ask, "Is the interpretation reasonable and convincing?" (Riessman, 1993, p. 65). To achieve persuasiveness, it is important to link the theoretical claims to evidence in the narrative accounts as well as account for alternate interpretations (Riessman, 1993, 2008). "Persuasiveness is strengthened when the investigator's theoretical claims are supported with evidence from informants' accounts, negative cases are included, and alternative interpretations are considered" (Riessman, 2008, p. 191). This practice rests on how the data are written as well as how the reader responds to the written report. However, because texts have unstable meanings, interpretations at one moment in time by change at another (Riessman, 1993).

To attend to persuasiveness, I kept a research journal or memoed in the margins of my transcriptions to reflect on my thoughts as they occurred. I make theoretical claims connected to the literature in my concluding epilogue section after my data representation. I highlighted the teaching practices that were brought up on multiple occasions as well as those that were only discussed in the last interview in order to question the fundamental use of that strategy even though the participants described what they used. Also, some teaching practices were interpreted differently by each participant, which were analyzed and discussed as well.

Correspondence

The second way to address trustworthiness in narrative analysis is through correspondence where "an investigator can take results back to those studied" (Riessman, 1993, p. 66). This "talking back," so to speak, is important to check the accuracy of the material as well as obtain participants' thoughts of the researcher's conclusions. Riessman (1993) cautions researchers on this practice because—

> human stories are not static, meanings of experiences shift as consciousness changes. Nor can our theorizing across a number of narratives be evaluated by individual narrators. They may not even agree with our interpretations…. In the final analysis, the work is ours. We have to take responsibility of its truths. (pp. 66–67)

To accomplish correspondence with my data analysis, I provided the participants with the original three transcripts for their input on clarification. I also provided them with the final ethnodrama after the chapter was written for their feedback. In the methods section, I outlined the two data collection methods used, and in the data analysis section, I detailed the process I went though. In the epilogue or data analysis section of chapter 5, I outline how I used thematic analysis to form my themes.

Coherence

Global, local, and themal coherence must be shown "as thick as possible" (Riessman, 1993) to justify interpretation. Global coherence highlights the interviewee's beliefs and goals in telling their story. For this study, the participants told their transformational story of changing teaching practices and what influenced those changes on the local, state, and federal levels. Local coherence attends to the structure used by interviewees to tell their stories. Many of the participants used topic centered narratives linking past events to current discussions as well as persuading a skeptical audience on the importance of changing instructional strategies to meet the needs of today's students (Grbich, 2007; Riessman, 2008). Finally, themal coherence attends to the themes that unify the text. The themes helped create the scenes of my drama and focused around NCTM's eight teaching practices. Coherence can also be strengthened "if the analytic story the investigator constructs links pieces of data and renders them meaningful and coherent theoretically" (Riessman, 2008, p. 191). This strengthening was accomplished by filtering the

data through Dewey's theory of experience outlined in chapter 3 as well as Clandinin and Connelly's three-dimensional narrative inquiry space discussed above.

Pragmatic Use

The final check for trustworthiness lies with pragmatic use or "the extent to which a particular study becomes the basis for others' work" (Riessman, 1993, p. 68). As I do not have control of who will access my research or what will be done with it in the future, I can show how my interpretations were produced, make my methodology visible to others, specify how I represented experience, and make my primary data available to others (for the time specified in my IRB) (Riessman, 1993, 2008). My interpretations are outlined in my epilogue at the end of chapter 5. Hopefully, readers will understand the methodology used and the process I went through for data analysis after reading this chapter. My primary data will be available until December 2016, per my IRB. However, "Ultimately, it is up to future communities of human scientists to evaluate the work as trustworthy—worthwhile to pursue as a line of inquiry and/or a springboard for future work. Such is the socially constructed nature of social science" (Riessman, 2008, p. 196).

Role of the Researcher

> In the move toward narrative inquiry, the turn is characterized as a movement away from a position of objectivity defined from the positivistic, realist perspective toward a research perspective focused on interpretation and the understanding of meaning. In turning, narrative inquirers recognize that the researcher and the researched in a particular study are in relationship with each other and that both parties will learn and change in the encounter. (Pinnegar & Daynes, 2007, p. 9)

Researcher Bias

The interaction between researcher and participants is extremely close as each other's stories are told and retold. Because of this Clandinin (2006) cautions researchers to tend to the tensions that emerge because of the close relational work between researcher and participants,

> As we continue to negotiate our relationships with participants, at some points, we do leave the field to begin to compose research texts. This leaving of the field and a return to the field may occur and reoccur as there is a fluidity and recursiveness as inquirers compose research texts, negotiate them with participants, compose further field texts and recompose research texts. These transitions from field and field texts to authoring research texts are tension-filled. Some tensions are created by the concerns about audiences; others are created by concerns about our participants; still others by issues of form. (p. 48)

It is important for researchers to be aware of their impact on the collected data. My position as a School Improvement Specialist provided access to the participants. Each participant has attended some of my professional learning workshops where teaching practices were discussed. Our interaction may have influenced some of their responses as they know my positionalities with respect to changing teaching practices. I also shared some of my thoughts and past experiences throughout the interviews as our teaching stories of change developed together.

Researcher Assumptions

For qualitative research, investigators must "acknowledge that no matter how much you try, you cannot divorce your research and writing from your past experiences, who you are, what you believe, and what you value" (Bogdan & Biklen, 2007, p. 38). With this in mind, I outline the perceived assumptions I brought to this study.

The first assumption is that high school mathematics teachers can adapt their teaching practices. While in the classroom, I taught both the Quality Core Curriculum and the Georgia Performance Standards. Like the participants in my study, through collaboration and furthering my education, I was able to adapt my teaching strategies to meet the changing pedagogical expectations. While working in my current position as a School Improvement Specialist, I work with many teachers that have shared their stories of pedagogical evolution continuing through the Common Core State Standards, but I also work with many who just want to keep doing what they are doing even though they complain their students are not performing. I started off just like these teachers. When my students did not understand a concept, I did not change my instructional strategies; I talked louder and slower while giving them more practice. It was not until moving to the Georgia Performance Standards that I saw the flaws in my instructional practices. Because of my evolution as an educator, I believe other high school mathematics teachers are capable of such transformation; hence, I searched for those teachers to participate in my study. I did not concentrate on the teachers reluctant to change because I wanted to show the positive outcomes of change for both educators and students.

The second assumption is my belief that the current curriculum reflects the important standards and strategies needed to produce students that are able to problem solve and think about mathematics as more than a rote set of rules to be memorized. The focus on student-centered learning instead of teacher-directed instruction is paramount in this transition. I struggled in making this transition during the 2008–2009 school year with the incoming freshmen who were never asked to solve problems in collaborative groups (Hennings, 2010). With great effort on everyone's part, I soon saw them blossom into independent thinkers. I take

this positionality into my work with educators, and I try to help them enlarge their teaching strategy toolbox instead of relying solely on lecture and skills practice.

The third assumption is my faith that the eight teaching practices from NCTM will help educators make the needed transitions in the classroom. During my final year working on this research project, I attended both state and regional conferences that focused on these practices. At the annual Georgia Council of Teachers of Mathematics conference at Rock Eagle, they used the eight teaching practices as the focus of the workshops. I presented as well as went to sessions at the conference in order to dialog about what the practices meant to my work. I also attended a regional summer institute hosted by NCTM, where the focus again was on the eight teaching practices. I was able to discuss my work with a few presenters and came to a better understanding of how my research fit within the larger mathematics educational community. With this in mind, I assumed going into the study that the participants would detail accounts of their transformations with respect to these teaching practices found that some were present more than others.

The last assumption deals with how experience shapes people. Before even coming into contact with the works of Dewey, I saw the dualisms present in the educational profession. I heard veteran educators talk about "old" and "new" educational practices. I saw how students disconnected school from their lives, and how an outdated school bureaucracy thwarted student communication, thinking, and potential. Dewey gave me the language to challenge traditional concepts of education and promote dialog leading to educational change. I have adopted many of Dewey's arguments and use his work in my interactions with educators. For I believe—

> experiences in order to be educative must lead out into an expanding world of subject-matter, a subject-matter of facts or information and of ideas. This condition is satisfied

> only as the educator views teaching and learning as a continuous process of reconstruction of experience. This condition in turn can be satisfied only as the educator has a long look ahead, and views every present experience as a moving force in influencing what future experiences will be. (Dewey, 1938, p. 87)

In summary, the assumptions I had going into this study not only shaped its development but also the selection of the theoretical perspective, methodology, data representation, and data analysis. My experiences both inside and outside the classroom allowed me to see the participants' stories from two perspectives: classroom teacher and instructional support specialist.

Ethics and Confidentiality

Clandinin (2006) believes narrative inquirers must think and act in responsive and responsible ways:

> For those of us wanting to learn to engage in narrative inquiry, we need to imagine ethics as being about negotiation, respect, mutuality and openness to multiple voices. We need to learn how to make these stories of what it means to engage in narrative inquiry dependable and stead. (p. 52)

Ethical concerns arise because "the first responsibility of narrative inquirers is always to participants. The negotiations of entry and exit, as well as the representation of experience, are central ethical concerns" (Caine, Estefan, & Clandinin, 2013, p. 579). Attending to ethics, I obtained informed consent from each participant. The document outlined the purpose, procedures, risks, benefits, compensation, voluntary participation and withdrawal, and contact information for the study. I adhered to the stipulations outlined in the consent form while collecting and analyzing data. To ensure confidentiality, participants picked pseudonyms for

themselves as well as their schools and districts. These were used on all data collection documents. Participants also reviewed the transcribed interviews and final story for input and clarification.

Summary

Narrative inquiry research allows the researcher to understand experiences of the participants in a study on a more personal level. Through interviews and personal documents gathered by a purposeful sample, I was able to come to a better understanding on the changing teaching practices experienced by my participants. Using narrative analysis, I was able to attend, tell, transcribe, analyze, and read the experiences of the three high school mathematics teachers in my study. To address validity, I use Riessman's (1993) trustworthiness detailing the four characteristics: persuasiveness, correspondence, coherence, and pragmatic use. Being that I used narrative inquiry, and became part of the story, I had to be aware of my bias and assumptions when entering into the study, and I kept ethical concerns and confidentiality a priority at all times.

5 TEACHERS' STORIES

The purpose of this study is to understand the influences that the curricular mandates of the National Council of Teachers of Mathematics and the Common Core State Standards have on the teaching practices of high school mathematics teachers during a time of educational change in instructional expectations. The research question that guides this study is: In what ways do the mandates to implement new curriculum influence the teaching practices of high school mathematics teachers?

The data are presented as an ethnodrama (Saldaña, 2003) using the actual conversations from the transcripts. I begin this chapter by describing arts based research and ethnodrama. Following this description, the ethnodrama begins. I open the drama with a prologue—a compilation of my own words in multiple interviews outlining how I came to my dissertation topic and explaining the goal of my research. I follow this up with three acts. In the first act, comprised of soliloquies, each participant describes how they became a teacher. The scenes are chronologically presented based upon years of teaching experience. The second act takes place in a teacher's lounge signifying the isolation of teachers during the Quality Core Curriculum. For many teachers, the lounge was the only place where collaboration occurred during this time. In this act, the participants define the term teaching practices and what influences were detrimental at the early stages of their careers. The third act makes up the bulk of the ethnodrama. The scenes in this act take place in teachers' classrooms portraying the move to collaboration instead of isolation. This act concentrates on the teachers' feelings towards the changing curricular expectations, NCTM's eight teaching practices, and the influences that affected their careers during these transformations. Some data analysis is interwoven

throughout the scenes using italics to set it apart from the ethnodrama. I conclude this chapter with an epilogue in which I provide a summary of the drama and more in-depth data analysis.

Arts Based Research

Arts Based Research (ABR) was introduced to the education field through the works of Tom Barone and Elliot Eisner (Eisner & Barone, 1997; Barone & Eisner, 2011). In ABR both the inquiry and presentation of research contain aesthetic qualities drawn from the arts and humanities (Quinn & Calkin, 2008; Barone & Eisner, 2011) aimed at inviting an audience to re-experience a phenomenon causing questioning and additional perspectives (Barone & Eisner, 2011). It requires researchers to be open to understanding and representing the world in a variety of forms to "raise significant questions and engender conversations rather than to offer final meanings" (p. 166). It is through the artistic structures used by the researcher that experiences of the participants are detailed, and according to Dewey (1934/1959) art "does something different from leading to an experience. It constitutes one" (p. 84). It was the connection of learning about experience that let me to narrative inquiry and adopting an arts based research approach to data collection and analysis.

Eisner and Barone (1997) outline seven design elements related to literary forms of art: (a) the creation of a virtual reality, (b) the presence of ambiguity, (c) the use of expressive language, (d) the use of contextualized and vernacular language, (e) the promotion of empathy, (f) personal signature of the researcher/writer, and (g) the presence of aesthetic form.

For my study, the virtual world of the ethnodrama relays the realities of the teachers' experiences evolving with curricular expectations but also provides the reader with descriptions so they can draw similarities from their own experiences (Quinn & Calkin, 2008). With respect to ambiguity, my purpose is to engage the reader in the dialog that took place between the

participants and me as we all reflected in how we have grown as educators. I wanted to share personal experiences open to interpretations to show how a few high school educators worked through the difficulties of curriculum change. I chose to use the participants' words broken up by natural breaths as well as incorporate their pauses and laughs in order to maintain their expressive, contextualized, and vernacular language. "Precisely because they are essential meaning-making structures, narratives must be preserved, not fractured, by investigators, who must respect respondents' ways of constructing meaning and analyze how it is accomplished" (Riessman, 1993, p. 4). Another purpose of using arts based educational research was to promote empathy towards the teachers using a purposeful aesthetic form. Through my ethnodrama the reader—

> is enabled to participate vicariously with the subject of the text. He or she is able to feel the emotions of the students, motivations of the characters, or the thoughts of the teacher. This empathetic understanding is made possible with highly descriptive language that allows the reader to feel as if he or she is in the shoes of those portrayed in the text. (Quinn & Calkin, 2008, p. 13)

Finally, my personal signature is inseparable from the text. My imprint is seen throughout the drama as both a researcher making data and analysis decisions as well as a participant in the overall storyline because "for narrative inquirers both the stories and the humans are continuously visible in the study" (Pinnegar & Daynes, 2007, p. 7).

Ethnodrama

While collecting data and transcribing the interviews, the participants' long narratives related stories that took on a play-like form in my mind. The story of the evolving teaching practices started to unfold and the plot developed into dramatic structures of acts, scenes, and

vignettes taking on a chronological timeline as I printed out the transcripts and started sorting them for analysis. This experience led me to look for a creative way to represent my data and ultimately led me to ethnodrama.

Ethnotheatre, a fairly recent movement in qualitative research, "employs traditional craft and artistic techniques of formal theatre production to mount a live performance event of research participants' experiences and/or researchers' interpretations of data for an audience" (Saldaña, 2003, p. 218). The ethnodrama written below is the script created from analyzing and dramatizing interview transcripts and personal documents; the characters are the research participants, including me (Saldaña, 2003). As I began writing, I was reminded of how Saldaña (2003) judges ethnodrama criteria:

> This may be difficult for some to accept, but theatre's primary goal is neither to "educate" nor to "enlighten." Theatre's primary goal is to entertain—to entertain ideas and to entertain for pleasure. With ethnographic performance, then, comes the responsibility to create an entertainingly informative experience for an audience, one that is aesthetically sound, intellectually rich, and emotionally evocative. (p. 220)

Ethnodrama data is reduced to the "juicy stuff" for "dramatic impact" resulting in meaningful vignettes, significant insights, and epiphanies generating the plot and story line (Saldaña, 2003). The characters are "composed of the minimum number of participants necessary to serve the story line's progression" (p. 221), and each character serves multiple purposes. The data below has been reduced to tell the stories of the three participants and researcher.

List of Participants

Elizabeth:	*Mathematics Teacher at State High School in Porter County*
Dee:	*Mathematics Teacher at Almond High School in Scott County*
Theresa:	*Mathematics Teacher at Green High School in McMinn County*
Jacqueline (Researcher):	*School Improvement Specialist at a Regional Educational Service Agency*

I used Wolcott's (2002) The Brad Trilogy as a guide to set up my ethnodrama. I followed his structure using a prologue as a contextual framing, the projector to change the NCTM teaching practices in the third act, and an epilogue for the reflection at the end.

Prologue

Jacqueline addresses the audience walking back and forth on stage. The purpose of the prologue is to give background details and establish the setting of the play.

JACQUELINE (*pulling hair out*)

How many times have I said "these kids can't factor these kids can't solve equations" and what do I do I talk louder I talk slower and I give them more problems
I never changed anything until I obtained my position at RESA and I saw
"wow I can use algebra tiles I can try this I can try that I can
create a discussion where they discover all of these things
I can just sit back and let them work on tasks
and talk and discuss"

Yeah that's kinda what led me to this study to see
how these curricula have impacted teachers and how they have kinda formed and kinda changed some of their strategies
working with teachers that are open to change, you know
just to show other teachers out there that it can happen
it's a struggle and it's a long process but you can change some of your practices (Interview 1 with Elizabeth)

(*flipping through NCTM's Principles to Actions book*)

The National Council of Teachers of Mathematics was a big drive behind the Georgia Performance Standards and the Common Core their standards documents
and so a lot of teachers were having trouble transitioning their teaching practices and the reason I'm focusing on high school math teachers is
historically they have even a harder time because they are so specialized in math in changing some of their teaching practices
and so what I focus on, um, in my dissertation are the eight principles in NCTM's *Principles to Actions*

that will help teachers kinda transition their teaching practices and put them into action (Interview 2 with Elizabeth)

(*turns towards audience with a big smile on her face*)

so my goal is to say "hey
here are these teachers that have the same kinda thing they're high school math teachers that have been able to change they don't just stand up and lecture
with all of the expectations and all of the things changing it can happen
so what, what in their stories could help you
make some of the changes with your teachers
and students" (Interview 1 with Dee)

Act 1 – Soliloquies on Becoming a Teacher

The stage is clear except for a single podium down center. In Act 1, the teachers present their stories of how they entered into the profession allowing for some background information and developing each character. Each scene is titled using the participants' own words summarizing how they started teaching.

Scene 1 – "oh my gosh I think I have found what I really was kinda meant to do"

Elizabeth enters stage right to address the audience. She is standing behind the podium with the stage lights highlighting her as she tells her story of how she entered the teaching profession. It is the fall of 1988 and another school year is ready to begin. Elizabeth excitedly prepares for her first year teaching six graders at an elementary school. She just graduated with a bachelor's degree in teaching from a top university in the southeastern United States and is ready to enter the classroom.

ELIZABETH (*speaks to the audience in an upbeat smiling voice*)

I began at Porter University
and had not declare a major did not know what I wanted to do
um, and had that for my first year at Porter
I do not have one of those I've always wanted to be a teacher stories where the, you know, little girls grading papers and stuff that was not me at all I really didn't know what I wanted to do
um, I was kinda an average student in high school
um, I thought about being a veterinarian just I liked animals just things like that
my second year at Porter I joined a sorority
I found a best friend very quickly and she said (*Elizabeth laughs*)
um, "it's time to register for classes" and she said "what's your major let's take some classes together" and I said "I don't have a major" and she said "well mine is education put down education" so I did that's (*Elizabeth laughs*) not a very great way to pick a major
but I think my boyfriend at the time
his parents were both educators

and I think we had been dating quite a while like from high school into college so I think I was around them enough and I think looking back they had sorta talked about that
but I never really said "wow that's something I want to do"
and once I started taking education classes I was like "I love this", I mean
I was average my first couple of years at Porter but I made A's in every education class I took I loved it and I was like "I'm good at this, I really like this"
and so it's not your typical "oh I've always wanted to be a teacher" but once I started those classes
and I know one of my professors maybe in one of my
um, I guess they call them like a practicum it wasn't student teaching but where you would be with the teacher and just do some of the lessons I remember he said "you really you're a natural teacher"
and I never had anyone tell me anything like that before and I think it just gave me that "oh my gosh I think I have found what I really
was kinda meant to do" so
I love telling my students, you know, how I became a teacher I said "not the best way to pick a major"
you know, I said "but I think there were things looming around me that maybe were sorta leading me there that I had in the back of my mind that I hadn't thought about", you know
but, um, yeah it's kinda for me I always feel like, you know, I picked it because my friend picked it but we both, you know, we ended up both being teachers so it worked out (Interview 1)

Elizabeth exits stage left as the lights dim.

Scene 2 – "you know this could be what I really want to do"

Dee walks on stage right and presents her story behind the podium illuminated by the stage lights. She is eager to use what she learned in the private sector and the time spent in the pre-school program at her church to teach fourth graders at an elementary school.

DEE (*speaks methodically to the audience*)

Well that was not my goal in high school or when I left high school thinking I'm going to be a teacher that was probably the last thing I ever thought I would be
um, and then after a while working in the
professional, um, you know, world I did inventory control
then I was a flight attendant for five years and during that time I got married and then had children and
was fortunate enough not to have to go back to work and be able to stay home with my children
um, I had the first one
and then when he became three, um, I got, um, involved in the pre-school program at our church and so
you had to volunteer so many times during the school year as the aid for that day that was called the co-op program and
so I really got to the point where I really enjoyed it and then when I had my second child being able to do it with her

and a position came open at the pre-school and they asked if I would be willing to take
it
so I did and in the meantime began to think "you know this could be what I really want to do" so
I was able to go back to school at night and teach at the pre-school during the day and get my
teaching degree
and so I graduated and immediately got a job but I was at the elementary level (Interview 1)

Dee exits stage left and the lights dim.

Scene 3 – "ok go teach it now"

Theresa walks on stage right as the lights slowly come on highlighting the podium where she also tells her story of how she became a teacher. It is late August or early September; Theresa is looking through the newspaper for a job. She just finished her degree and moved down to the South. She is waiting to go to medical school in order to become an optometrist. School has already begun.

THERESA (*speaks to the audience in her southern accent*)

Ok I originally went to
undergraduate school to be an optometrist so I did pre-med
the science, the math, and some of the computer science classes and then as soon as I (*Theresa laughs*) graduated
I got married and we moved down south just to
be somewhere different and
I didn't automatically go to optometry school so I was looking for a job and
it was September
or late August and
I was just looking through the newspaper and it said they still needed a math teacher at
Green High School and, um
so I was like "school's already started" (*Theresa laughs*)
so I called the phone number and the principal was like "can you come right now" and I said
"I'm in street clothes" and he said "it's ok come right now"
and I came and I was sitting down on the couch and he walked by me a couple of times and
finally the secretary was like
"she's here for the job" and he's like "oh my gosh I (*Theresa laughs*) thought she was a student"
and so, um (*Theresa pauses*)
he said "can you start tomorrow" and I didn't have the education part I just had a math degree
through my pre-med
my school that I went to didn't actually have a pre-med it just
you took your math and your science classes and I had enough to have a math degree so
I said "ok"

and he said they would put me in the TAPP[28] program
so that next like Monday I think I started the TAPP program and two weeks later I started teaching there so I was just kinda thrown in it, um
there was no like
here, you know, teach, you know, student teaching or anything it was just
"ok go teach it now" (Interview 1)

Theresa exits the stage left as the lights dim.

Scene 4 – "ok let me be an educator"

It is the fall of 2003, and Jacqueline excitedly sets up her classroom. She has just graduated with a degree in mathematics teaching and anxiously awaits the bell to release students to her first period class. Jacqueline walks quickly to the podium stage right to address the audience in order to tell her story of how she became a teacher.

JACQUELINE (*voice trembles with nervous excitement*)

I'm the one that played school
I'd do the practice worksheets and my teachers would give me things but going into college my um, major was computer science
I'm like "I don't know why I don't even know why I picked computer science" and then the first semester I took a computer science class I'm like "Oh No"
I was good at math so I was like "ok let me be an educator" so
just like Elizabeth I was like "Oh Wow I really like this" and I was born to teach looking back on all of the things (*Jacqueline laughs*) (Interview 1 with Elizabeth)

The lights go out as Jacqueline stays behind the podium.

Act 2 – Early Teaching Practices and Influences

The stage resembles the typical teacher's lounge. There are a few round tables surrounded by chairs for teachers to sit while having their lunch if they decide to leave their classrooms. There is a copier available to make copies and a set of teacher bathrooms. A refrigerator and microwave are also available for those that need to store and warm up their food from home. For many high school teachers during the Quality Core Curriculum this was the only place where teachers came together to have discussions both involving their work and home lives. In Act 2, the teachers outline their early teaching practices and what influenced those practices to show their changing pedagogy as the Georgia Performance Standards were adopted.

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[28] The Georgia Teacher Academy for Preparation and Pedagogy (TAPP) is a non-traditional route "designed for individuals who wish to transition into teaching from another career path, did not complete a teacher education program, and have never held a clear and renewable (professional) teaching certificate" (Georgia Professional Standards Commission, 2016, para. 1).

Scene 1 – "how you run your classroom"

All four participants are sitting around a table center stage in the teacher's lounge talking about what teaching practices mean to them.

JACQUELINE (*gets up from the table to warm her lunch*)

Ladies, when I say teaching strategies
what things kinda pop into your mind
um, with respect to that term?

ELIZABETH (*enjoying her lunch*)

I guess it makes me think of
ways in which you teach something
you know, that there are different ways like you can teach by
modeling or you can teach by
discovery or you can teach through a task
or you can teach through
um (*Elizabeth pauses to think*)
maybe I don't know working in a small group or working with a partner I guess strategies to me are just sorta that bank ideas that you have that you use
when you are teaching
to me they can be
academic related but they can also be like just classroom environment or
um, effectiveness related to me a teaching strategy can even be how can you deal with a student who's off task, you know, I guess

JACQUELINE (*responding thoughtfully to Elizabeth's response*)

Yeah never thought of it that way (Interview 2)

THERESA (*agreeing and expounding on Elizabeth's definition*)

Teaching strategies to me really goes back how you (*Theresa pauses*)
run your classroom I mean are you more of a (*Theresa pauses*)
manipulatives or technology or
just all the strategies you have in a (*Theresa laughs*) box somewhere to get the kid to learn something I mean
how you, um
you know, some people lecture and some people have the kids do more investigations and
it's just different strategies you're trying to get them to
learn the concept, you know, what's your unique
way or thoughts, um (*Theresa pauses*)
how you collect
information back from them how you do your little formative assessments

and things like that (Interview 2)

DEE (*getting up to throw some trash away and goes to make some copies before the bell rings*)

Well I always think of, um (*Dee pauses*)
what am I going to utilize in order to make the concepts that I want the students to understand clear to them
I think that's teaching strategies as far as my part is just making sure that I've delivered the curriculum
in a way that they are grasping the concepts and then can take those concepts and
move on (Interview 2)

Everyone nods in agreement as the lights go out.

Scene 2 – "I just sorta did it cause they did it"

Both Dee and Elizabeth started their educational careers at the elementary school level. The focus of discussion is on their typical high school class implementing the Quality Core Curriculum.

The four participants are still seated at the round table during their lunch time in the teachers' lounge. They are reflecting back on their early teaching practices and what influenced those practices as the lights come on.

Theresa starts the conversation about what her typical classroom was like during the Quality Core Curriculum given that her story is probably descriptive of the majority of the high school mathematics classrooms during that time.

THERESA (*starting the new topic of early teaching practices at the lunch table*)

It would be
they would come in, um
we would go over the examples in the book
we might have two or three more that we would do together and then they would spend the rest of the class period doing the
problems in the book

JACQUELINE (*remembering Theresa didn't start as a traditional educator*)

And you said because you didn't have any training before is that
just pretty much all you knew from your K–12 experience?

THERESA

Right
that's all we did and

for the most part, you know
the kids would try but, um (*Theresa pauses*)
and they would work for the most part I mean
they would work in groups or they would work
individual and the next day they would come in and we would go over it and then we would move on or
maybe if they needed another day we would do
some more of the odd (*Theresa laughs)* problems or even problems
and then, um, same thing, you know, go over it the next day

JACQUELINE

Yeah pretty traditional that's how I did you go over the homework you give some examples you give them time to do homework then (*Jacqueline pauses*)
Repeat (*Jacqueline laughs*)

THERESA

Right and at the end of the unit we would take a unit test
and it would be just over that unit
it wouldn't be so much comprehensive or anything like that (Interview 1)

ELIZABETH (*pulling out some examples of previous warm-ups she used while describing one of her early teaching practices*)

Everybody did warm-up quizzes
and that's what I did, I just, I guess I just sorta did it cause they did it, you know
and I thought well too that's a good thing to have them do when they come in, you know, cause everybody that I spoke with was "you gotta have something for them to do as soon as they walk in the door" I was like "ok"
um, and I sorta did that in middle school but not always I mean sometimes
they walked in and sat down and we just started talking, you know, we worked on something else
but um, I would do the warm-up every day I did a warm-up quiz every Friday and they could use the warm-ups they had done for the week and when I look back at that I think
I wouldn't call it a waste of time but it wasn't the best use of time, you know, because sometimes the warm-up could take up half the class
which it should really (*Elizabeth laughs*) be a very small amount of time
and it was, it was just very skills-based is all it was, you know, here's the skill, you know
um, and I would get frustrated as would the other teachers that I worked with in that same group you know, that "why are they not doing well on these", you know, "all they gotta do is watch what we do up front write it down and then take the quiz and they can make a 100 on it" but that, you know
looking back on it I think that was not, I knew better than that, you know, I was thinking "I've done this long enough I shouldn't just be following what other people do", you know, but it was just sorta

that's what we all did, you know, I don't do that anymore (Interview 2)

DEE (*remembering back to a typical geometry class under the Quality Core Curriculum to share an example with the group*)

We would usually kick off the day
with of course we always had a, um, what we called bell work or bell activity
which was just to get them started it was usually I related it to a
homework very similar to something that they had done for homework or depending upon what time of year
you know, just bringing back something that they might have forgotten from previous
um, we would usually discuss what they had to complete for homework assignments answer any questions
then I would model the new lesson
then you were, you know, we gotta get to work at this and make sure (*Dee pauses*)
um, that the kids were, you know, practicing the skills and trying to go around and make sure that before they left
they did not have any questions
so that was the goal to have them work at least one problem before they left that classroom
so if they didn't understand what they were doing they could ask before they left (Interview 1)

ELIZABETH (*remembering another teaching practice she used early in her career*)

We would have like projects we would come up with it's almost like we thought well other subjects do projects we need to do projects (*Elizabeth laughs*), you know, so we would have like a math project I know one year we did
you know, exploring mathematicians and then one year we did, um
a roller-coaster project with slope and things like that
so we would have culminating projects instead of tasks embedded along the way (Interview 1)

JACQUELINE (*addresses all three educators on their outdated teaching practices*)

What influenced those teaching practices early in your career?

Elizabeth started teaching 6th grade where she had a reading class with mostly boys, full of nonreaders at the end of the day. She attributes getting through that first year to her mentor and mother. Elizabeth followed her mentor teacher to middle school. Because of her positive experience with her mentor, she became a mentor teacher for several years. She expressed many times that she doesn't know how teachers get through without a strong mentor for guidance.

ELIZABETH

Honestly, my mentor I had a really great mentor who I'm still good friends with today and she was very influential
for me I remember I came up over the summer and like decorated my room but that to me was my

that's all I really knew
that's all I (*Elizabeth pauses*)
how do I say it I felt like college prepared me in some ways but it doesn't really prepare you for
ok here's 30 something kids walking in here, you know
and she was great and she was assigned to me, um
like a TSS a teacher support specialist they used to have
and she was great and I would meet with her I would cry with her I would go in there and she helped me plan my lessons and
I got to the point where I felt comfortable enough that
that sometimes I wouldn't wanna even teach it until I'd shown it to her first, you know
like "look at this does it look" and she was great about saying "ok you got this setup" she would tell me "that may not work and here's why or you got them set up to do this but I can tell you from experience" so that was helpful but then
she was so good she would kinda ween me off and let me
softly fall (*Elizabeth laughs*) a little bit, you know, and learn from my own mistakes so she was very supportive
I, I don't know how I made it without her that year I mean there were days that I was like "I am in the wrong profession this is horrible I can't stand this" (Interview 1)

For Dee her mentor teacher during student-teaching, the veteran teachers with high expectations of their students that she worked with during her first years in the elementary school, team teaching with her grade level, and a supportive principal were the factors that influenced her teaching practices early in her career. Her love of mathematics came as she team taught in the elementary school when she was able to only focus on one subject. This love carried on with her to the middle and high school level.

DEE (*agreeing with Elizabeth*)

Oh I think it was more (*Dee pauses*)
a collaboration or watching, you know, veteran teachers do things and
and new practices coming into play
um, and just sometimes having the
ability to switch or try something new
especially when you had an administrator that was very supportive said "yeah that sounds like a good idea do that"
and it was it was also about, you know, we were working, working with people that allow you to try new things
and, you know, we all know we're different individuals and they'll say "well that works for you it may not work for me" but so (Interview 1)

Theresa did not have as good of an experience as the other two participants when it came to a supportive mentor. She had to fall back on the textbook, her own K–12 experience, and the teaching practices of those around her when it came to teaching the material since she had no formal training before entering into the classroom. When she transitioned to a larger school system she was able to pick up on more diverse teaching practices and learn from others. She

still expressed the looming high stakes testing as a drive for what could be accomplished in her classes.

THERESA (*chuckling as she reflects back on her not so good mentor experience while throwing her trash away before the bell rings to dismiss from lunch*)

they gave me a mentor and he was
not personable like it was not somebody that I really felt like I could go to and he was
busy doing other things he was teaching these AP level classes and, you know, this was my first year so they immediately put me in like
pre-algebra the lowest, you know, that they were offering which was fine REP math
um, and they just basically gave me a book and
I, I went from the book, you know, I didn't know anything else I just knew, you know, "here's the book you're teaching pre-algebra"
it's a small school where I started so there would be like one teacher per subject so one teacher taught pre-algebra and that was me one teacher taught algebra so whatever I did was pre-algebra
so there was nobody really
guiding me like "this is what we've done in the past" so it was just there was a book you're a pre-algebra teacher you have all the pre-algebra kids (Interview 2)

ELIZABETH (*agreeing with Theresa and remembering back to her middle school experiences before the transitioning*)

I remember we had a textbook and I remember we never met we never talked about who's doing what
it was very isolated I remember I was also in a trailer (*Elizabeth laughs*) those two years and I just felt like it was just me and this book, you know, and that
we just never met and talked about anything
and I was kinda making everything, you know, on my own whereas
when we got rid of the book we had to depend on each other which was good, you know, cause I think when you don't have something like that you're forced to look at each and go "oh my gosh what do we do now" and that was a good thing, you know (Interview 2)

The bell rings to dismiss from lunch, the ladies exit stage left as the lights dim.

Act 3 - The Tides of Educational Change 2006–2016

Elizabeth has moved between elementary and middle school and even changed counties. She followed her mentor teacher from her elementary school to a middle school then transferred again to a brand new middle school. Wanting to work closer to home she took a job in her county. She was a middle school teacher when the tides started to change and the curriculum took on different expectations. She moved up to the high school because "that just seemed like the logical thing to go onto," and she enjoyed teaching mathematics. During the 2015–2016 school year, Elizabeth taught 9th grade Coordinate Algebra.

Dee also has had educational experience at the elementary and middle school level. She stayed at the same elementary school for ten years teaching both the 4th and 2nd grades. Her middle school experience was spent teaching the high school level Algebra I course. The last year of her middle school experience took place during the beginning of the rollover curriculum. She taught for one year at the high school level before the Georgia Performance Standards rolled into that arena and has been there ever since. She transitioned from each level and followed her principal. Currently, Dee's high school teaches the integrated curriculum (Coordinate Algebra, Analytic Geometry, and Advanced Algebra), however, they call it by the discrete names of Algebra I, Geometry, Algebra II. The rationale was political—parents and colleges didn't understand what the integrated subjects meant according to Dee. During the 2015–2016 school year, Dee taught Accelerated Pre-calculus, AP Statistics, and AP Calculus.

Theresa has mainly had only high school teaching experience, but she did a year of substitute teaching where she worked with middle school students. Therefore, she was in the high school classroom when the changes started taking place. During the 2015-2016 school year, Theresa taught Foundations of Algebra and Analytic Geometry

Jacqueline only taught at the high school level in two schools in the same county. The only elementary and middle school experience she had was during substitute teaching prior to her student teaching experience while obtaining her degree. Currently, she is a School Improvement Specialist for mathematics at a Regional Educational Service Agency.

The stage resembles a classroom. There are desks put in small groups to allow for more student collaboration instead of the isolated rows typical of a traditional mathematics classroom. All four teachers are meeting in Dee's classroom. This set-up signifies the collaboration that emerged with the changing curriculum expectations. They no longer had to meet in the teacher's lounge because they adopted a more collaborative learning environment. The teachers moved the desks so they were in a group of four. Dee is standing by her teacher's desk while the other three are seated at the group of desks positioned center stage.

Act 3 highlights the instructional changes starting with the Georgia Performance Standards rollout. The first scene allows the participants to talk about their thoughts and feelings with respect to the changing curriculum. The second scene describes how each educator changed their procedures with respect to NCTM's eight teaching practices. The last scene talks about the influences that have supported the teachers later in their careers.

Scene 1 – "Oh I have been through them all"

DEE (*walking from her teacher's desk to join the others, she sighs through a smile and starts the discussion on her thoughts and feelings of the curriculum changes*)

Oh I have been through them all (*Dee pauses*)
I mean I didn't get through the changes at the elementary before moving to middle school
but I was there for the implementation
I have seen good things and bad things, um (*Dee pauses*)
the idea of units is great because you can develop a kinda layout and a unit plan

that allows you to kinda keep yourself on track and to try to get as much instruction
for the high school kids as possible, um (*Dee pauses*)
I have seen some bad parts too
I've found holes with my kids especially
you know, the ones that missed that change over year
there were holes there were years that the level before me
was unable to accomplish everything
so not only did I have to go back and pick up material that they should've known I had to then also
teach my own level of material so those became very difficult years
I've seen (*Dee pauses*)
kids that have the ability to grasp things easily
move much deeper into understanding
but I've also seen the kids that don't grasp the ideas just simply fall further and further and further behind
as far as developing the curriculum (*Dee pauses*)
if you've got a strong team with you it makes it a lot easier (*Dee pauses*)
if you are (*Dee pauses*)
an experienced and veteran teacher with the love for the subject and know things that you have learned along the way
it helps
but for a brand new teacher coming in that has no bag of tricks (*Dee laughs*) to pull on
it becomes difficult and I think that's
where we begin to see the struggles too is
if you asked a new teacher to come in and say "ok this is just the standards you've got to teach these" and they don't know how to
implement those standards it's difficult (Interview 1)

THERESA (*reflects on how the changes created more collaboration and how testing made her more structured*)

a lot more collaboration started happening as
as it's changed over in my opinion before
I don't remember it being a big deal (Interview 2)

I think it's very
test driven (*Theresa laughs*) now, um, which
I don't like that because there's so much more that I want to do
with the math classes and it's just not possible now
I mean that's a definite
downside to it all, um
it does make me, you know, I'm more structured
than what I used to be, you know, you, you can't fly by the seat (*Theresa laughs*) of your pants any longer you, you have to
know what you are doing when you come in there, um
I just remember when it did change

for me, um (*Theresa pauses*)
scheduling became a
nightmare I remember because we weren't letting kids move on (Interview 1)

ELIZABETH (*describes her thoughts about the changes*)

And I guess for me (*Elizabeth pauses*)
when it changes I've just picked it up and run with it because
and I know some people can be very resistant to it and want this to go back and I think I've just found (*Elizabeth pauses*)
for me whatever the change is I better just roll with it, you know, and make it work, you know
um, you know, a lot of it tends to stay the same content wise for the most part
but we keep giving it different names Coordinate Algebra people still call it Math I, I mean I still have people who'll make things and it's got Math I and I'm like "we don't call it that anymore"
you know what I mean it's like math just seems to keep getting different names
it's like we're selling the same product we're just putting a different label on it and for me I guess
I don't really see huge changes in what the standards say per se for me
but we just tend to call it different things
it's almost like every time it happens we're givin' this promise they're going to be easier to understand more specific (*Elizabeth laughs*) but I never see that
I mean there are still standards we sit there and go "what does that mean"
you know, "interpret this" I mean it's like they're still somewhat vague
you know, um, but I think once
like for standards that have stayed in place from year to year (*Elizabeth pauses*)
to me it helps me because I've taught this and especially if it is something that I taught in 8th grade somewhat, you know, it'll mesh
and
I've taught it enough that I know the questions students' have asked before therefore I can already see where
you're gonna have a hole in this because, you know, like I can see why some of them
don't get slope because they think it's like plotting a point I go left and right then up and down where slope is rise over run, you know, so I can already as we start teaching I can say "now let's talk about how is this different from plotting a point" you know what I mean
whereas if I was teaching that for the first time I might not think about saying that

JACQUELINE

No we did not come up with something new yes we've been moving it and I think that's what is frustrating to a lot of people is
it was here and even when I was trying to go from
seeing what was in the GPS cause I had taught Math I through Math IV then I changed to help teachers
with the Common Core I was "well this is from Math III unit whatever" so just me trying to keep up with it was kinda frustrating,

um, and then changing back to the traditional Algebra I and Geometry a lot of teachers that I deal with
now they have to rearranged it yet again
so I know that can be frustrating
but the more that you teach it
the more comfortable you are (Interview 1)

The conversation shifts to the discussion of resources to implement the changing curriculum mandates. The textbook no longer was the document that drove curriculum decisions. During their large amount of planning time in middle school, Elizabeth and her team would bring resources that they used in the past to plan. They also found items online. The county at the time of the transition also created items for teachers to use. At first they did not use much of the state created items, but soon began to incorporate them into their instruction. Highly involved and demanding parents in her community had a hard time not having a textbook for their child; kids didn't seem bothered by it. The administration suffered with respect to all the copies that would need to be made. Teachers began to use the students' notebooks as their textbook. There was a lot of trial and error those first few years.

ELIZABETH (*shifting in her seat and reflecting on her transition from the QCCs to the GPS*)

Well I guess the thing that comes to mind when I was teaching we had a textbook (*Elizabeth laughs*) and so, you know
we didn't like go through, you know, beginning to end we, you know, there were parts we used and parts that maybe weren't part of our curriculum, you know
but we, we used a textbook more and we would
it seemed that we relied (*Elizabeth pauses*)
more on that as far as
if we were learning a skill here's an example right here in the book you can look at here's some problems you can practice here's some more challenging problems
once the changes started taking place we no longer had textbooks and so
it turned into more we had to create the things, you know, I remember, I remember that really being tough because we would be in collaborative unit planning meetings and I remember we would talk about
"we don't have a book anymore," you know, "what do we do" I mean not that we couldn't come up with things but at least when you had a book you had something
but it was more we are having to create all this, you know, we're having to create the assessments we're having to create the activities we're having to create all the things, you know, that go with what we're doing
um, and so that was kinda a big change and I guess the
the plus to that is it kinda made what we were doing more suited to who we were teaching, you know
um (*Elizabeth pauses*), which can be a good or a bad thing because I remember we had discussions about
some of the things we were designing weren't rigorous enough because we had kids who were struggling
so we were kinda designing things more to help kids be successful but they weren't always

as rigorous as they could have been

JACQUELINE

Yeah I remember transitioning to GPS and no textbooks and starting to do tasks and
the students fought me the parents fought me but
we stayed with it

ELIZABETH

Yeah and we, you know, we still have no textbook and everybody's fine, you know, and I think in the end
it was just kinda bumpy I look back for those kids that we had that first year
when I look back those were some of the best discussions we had in teaching (Interview 2)

Dee has also created her own material pulling from the state frameworks, NCTM's Illuminations, or professional learning workshops. She is constantly tweaking her materials even from semester to semester being that her school is on a block schedule.

DEE (*standing to stretch her legs and agreeing with Elizabeth on the disappearance of the textbook*)

we don't rely on a book anymore, um
you know, when I first started teaching at the high school level each subject area was separate and each subject area had a book, um (*Dee pauses*)
now you don't and you've got to pull and you've got to be able to hit and know those performance standards and where can I
get the material and make it interesting enough for the kids
so
I mean I have worked
for rolling out these curricula and I have worked and worked and worked and I'm still I tweak it every time (Interview 2)

THERESA (*remembering back to her transition from the QCCs to the GPS*)

GPS definitely I really started like ok these are from the state these are the tasks we are (*Theresa laughs*) going to use them
from before though I was still just, you know, book
book was good I'm somehow covering it all
I'm still hitting the standards or whatever but
it wasn't until like
the GPS that really we put the work into we are going to make them do these tasks and fight through them and
I remember the struggle everyday but, um
it wasn't until
that time that I really, you know, jumped on board trying to do what the state recommended

JACQUELINE

Yeah I don't even remember looking at QCC standards I know that they had statistics standards we just never got to them cause it was the end of the book (Interview 1)

THERESA (*remembering back to the description she gave earlier about her initial teaching practices in the teacher's lounge and recounting some of the changes she has made*)

I did a lot of, um (*Theresa pauses*)
start (*Theresa laughs*) the class I teach they take notes and then (*Theresa pauses*)
they do practice problems
and then the next day I would go over the practice problems I'd teach they'd take notes and then it kinda went to (*Theresa laughs)* maybe 2 or 3 years in then I got my PowerPoints or and
you know, certain teachers teach through PowerPoints and so I was like "ok I'll
have these notes already made now I don't have to keep doing it every year" so, you know, I did that and then
um, as the changes started to occur I started to use more like investigations to kinda get the ball rolling or I didn't stand up there and tell them (*Theresa pauses*)
you know, word for word how to start this or a formula I started to use, you know
"well if you type this in the calculator what do you get if you type this and this and this do you notice a pattern
so what was the rule for that pattern"
so, you know, they're coming up with the rules some on their own and I still don't believe they could ever come up with all of it on their own
um, there's always going to be a time where I have to
just lecture finally say, you know, "you might be missing the point"
but I try to do different things now through videos and, um (*Theresa pauses*)
you know, something online to get them (*Theresa pauses*)
thinking when I can with math like I said we
I never used to go to the computer lab or do anything and now I go once a week, you know, if not more if I can
so just some different things that have changed (Interview 2)

Lights go out.

Scene 2: "Well you have to change believe me you have to change"

The four teachers are now meeting in Elizabeth's class. In her class, she posts a list of things for students to do or have out at the start of every period as students enter. She also starts each class with what she calls a focus; she got the idea from yoga. During the one-minute focus, calming music is playing and it is just a quiet amount of time where students can collect themselves and get ready for class. To emulate these procedures calming music is playing in the background while the four teachers meet to discuss their current teaching practices. Elizabeth's projector displays the topic of discussion for the audience.

Projector reads: Establish mathematics goals to focus learning.

This teaching practice only came up during the last interview for all three participants when we were actually discussing the NCTM teaching practices.

DEE (*starting the conversation because this is one practice she feels she has grown the most in*)

I honestly think it all starts back to the establishing mathematical goals to focus their learning because
I mean I think that through the years
you know, we were given QCCs and you had so many and you just did it because that's the way you had to do it (*Dee laughs*)
to go through them
but now I think that since we have these goals
and we this is what I want them to do what's my best way to get them there

ELIZABETH (*reflecting back to the QCCs*)

before it was just very much we just taught, you know, I don't recall us having to tell the kids "here's what we are working on", you know
I don't remember doing that maybe I did it but I don't (*Elizabeth laughs*) remember it very well it was just more we just taught, you know, we didn't really tell kids "here's what we're going to learn or here's what's in this unit" or
um, "here's standards and", you know, "what do you already know about this" I don't recall doing that

JACQUELINE

I don't even remember like with the QCCs even posting standards

ELIZABETH

I don't, I don't remember it either and I think when we started it was a requirement like I remember
it was almost like a checklist principals would come in your room it must have been something everybody was really pushing I remember
our principal would say "if I come in your classroom I should be able to ask a child can you read the standard to me and what is it you're working on today", you know, so I would even tell kids, you know, "if somebody comes in and asks you
where's the standard they would point right there" (*Elizabeth laughs*) and I would ask "do you understand it do you know what it means"
which it was good, you know, for them to know that anyway

DEE (*adding to the conversation on the influence of administration on posting standards*)

you know, it's also too a lot of your establishing those clear goals has to do with, um (*Dee pauses*)
your leadership as well I think a lot of it begins from there top down

THERESA (*giving her understanding of the teaching practice*)

I stated that once before that, um
kinda looking at the standard language when all this first rolled out it was really difficult for us (*Theresa laughs*) as a faculty to
go back and forth we went back and forth about what all the language meant and what the goals were for each
when we looked at maybe the tasks compared to the standards like trying to when it first, first came out but, um
we switched over to task-based
you know, trying to figure out how that task went with that standard and the holes and the gaps I remember that being a big challenge, um
but overall I feel it
at least now we kinda have a focus

ELIZABETH (*agreeing with Theresa about the vagueness of the standards at first and how she uses them in her classroom*)

um, for years we've had to have a standard on the board anyway
and so I'll, I'll often say "ok this is the standard we're working on" and we break it down into more kid-speak is what I call it what does that mean to you what does that sound like, you know which is helpful to me too (*Elizabeth laughs*) because sometimes they can be a little bit vague so we do that
I don't really talk a lot about (*Elizabeth pauses*)
I guess as much as I would like I don't talk as much as I should or would like to about where would we use this outside of the classroom
it, it kinda depends on what it is somethings seem to lend themselves more than others
but we do talk about that when it really seems, you know, like it's something that I can really see and they can really see
we do a lot, I do a lot of relating it to previous things we've learned "how is this like something we saw in unit one how is this like
what did you already have to know going into this what is it you already know how to do that's going to make this really easy", you know, as we go along we talk about that
um, I talk a little bit about where these ideas are going but not a lot that was something I never thought about

DEE (*explaining the process she goes through and how the students have reacted)*

it begins with me sitting down
looking at these units' standards and "ok how am I going to teach this to the students what do I want them to know and
what's the best way for me to get it for them", um
always think about what prior skills are needed and so that I can
"alright you learned this last year" or
"remember when we did this"

and then establishing every day, you know, on the board we have I have that "I can" statement where they're going to come in and they will know what they're going to be doing that day and I try to always make it
higher up on the Bloom's taxonomy I don't usually say
"I can graph a function" that's not very hard so
and things have to flow I mean
when you've been teaching long enough you know that you just can't do this
and then this and there not be any flow so you've got to have that flow where things connect cause
they don't see any purpose if they don't
but I, you know, the kids have gotten more attune I think to the "I can" statements cause they'll look up and they'll see
and because I, I'm color coordinated cause I do three different preps, you know
so I'll have what I'm doing and they're always like "well now what are they doing what does that mean" (*Dee laughs*)
and I think they've begun to look for them in every class and they see them in every class so they know
"oh ok we're doing that today"

Elizabeth walks up to the projector as Dee finishes up her discussion to post the second topic of the day.

Projector reads: Implement tasks that promote reasoning and problem solving.

This teaching practice was brought up the most and crossed over multiple interviews for all participants.

Elizabeth and Dee differ on how they use tasks with their students. Elizabeth provides scaffolding to her students before the task, whereas, Dee sometimes uses them to start a unit as a frame of reference without any teaching.

THERESA (*starts off the discussion reminiscing about the first year of utilizing tasks*)

I mean, I never taught out of the book again
it was
very task-based I remember the first year like we were trying to do them all
and we were like "how in the world can we do all of these and still get through everything" so we were really pushing, you know, to do a lot of them and
some of them I remember because
we didn't even have answer keys or it was such a pain (*Theresa laughs*) to dig through to try to find the answer keys then that
when we would read the question we wouldn't know the answer not that we didn't know the math we didn't understand like what they were asking
of the students

and, um, so I remember talking with other teachers a lot more then like collaborating a lot more with the other teachers like "what are they asking" "what are they wanting" you can answer this question a million different ways
but everything was like task-based unless it was just something we felt
they just still needed more
practice on then every now and then we might like find an old book and
you know, couldn't go in order you would just, you know, just Xerox something out of it
but, um
we never used books anymore that first year I remember we were like "no we are going to do all these tasks" and
you know
we hardly ever strayed from it and I remember that being tough because I was like "they (*Theresa laughs*) don't even understand why they're doing this like do they understand what" cause I wouldn't have
cause I'm one of the people
I wanted you to teach it but I wanted a lot of practice
like traditional or how I went to school I wanted to see it and practice it over and over (Interview 1)

ELIZABETH (*thinking back on her first year implementing tasks*)

Yeah, it was my third year at the last middle school I worked at
um, in my mind that's where we really focused more on tasks that's when that whole idea of tasks became a bigger thing
um, that we hadn't really done before like we would do little what we called mini projects
to me tasks
the good ones to me seem more exploratory, you know, seem more looking in, you know, sort of a (*Elizabeth pauses*)
kinda a discovery in some ways, you know, where as a project that we used to do in math weren't really discovery you already know how to do this now go do this (Interview 1)

JACQUELINE (*agreeing with Theresa and Elizabeth*)

And it's hard because as teachers that's what we are used to and then all of a sudden we have to transition I remember those first tasks as well
you had that (*Jacqueline pauses*)
the teacher's guide that had a lot of mistakes in there and that was it (*Jacqueline laughs*)

THERESA

Oh my gosh the mistakes (*Theresa laughs*)

JACQUELINE

Luckily it is so much better now

after what seven eight years they put a lot more resources in there but yeah those first couple years of just "hey this is what you're supposed to do"
I remember my masters
taking my masters' classes and the professor was like
"oh these kids are going to love these tasks and they're going to be immersed in the tasks" and I was like "um no" (*Jacqueline laughs*)

The discussion turns to some of the changes they saw with respect to the curricular expectations such as multiple representations, real-world applications, and the shift to a more student-centered classroom during the first few years of implementation.

THERESA

And I remember like looking at the standards and then reading the tasks and like "I can't find this anywhere in the standards" it was so broad it would just be like
I remember like really being confused and then having a lot of questions about just not knowing how far to go
in it because it wasn't like the book said do this next (*Theresa laughs*) (Interview 1)

the first year was trial and error
but the things we did like with that we had more graphs, more tables, more visuals
through it all than we had before, before I just remember having problems and now it was like you were actually seeing pictures and things to use um (*Theresa pauses*) (Interview 3)

ELIZABETH (*agreeing with Theresa about some of the benefits of the changes*)

we tend to have more of the applying whereas before I don't recall us talking as much about that it always bothers me when people say "in the real-world" cause I'm like "we are in the real world" I always call it outside the math classroom
but it seems like we sorta talk about that more now maybe then we did before (Interview 1)

we really don't do a lot of memorizing and I think
years ago I tended to do more of that not really thinking about the fact that
and I guess it's just I've been teaching so long
but a lot of times students can spit out a formula but they have no clue what it means
so I try to take a lot of time to talk with them like
you know, if I say "what's the Pythagorean Theorem" they spit out "$a^2 + b^2 = c^{2"}$ but what does it mean silence, you know, they can spit out a formula
"$y = mx + b$" but what does it mean, you know, so
we try to connect it and explain what it really is and I find when I do that, that seems to help so there's not a lot of just
memorizing of formulas and rules and things like that
um, if we do see something new like that we really break it down talk about what does it mean and why does it work the way it works
um, I don't like teaching
um, just a procedure

without connections because I think they learn better when they know why it works the way it works and how it connects to other things
um, it takes longer but
I get better understanding from students when I do that so (Interview 3)

Elizabeth trying to think of a task she did recently that applies to the world "outside the mathematics classroom" to share with the group.

We did one recently *Talk is Cheap* which those cell phone tasks are getting a little outdated because everything is unlimited (*Elizabeth laughs*) data now so whenever you bring them up they are like "nobody pays like" that I'm like "well yes but they use to and there are some still out there that do that" but
I remember we looked at
why is it that this particular plan A where you're just paying per text and per minute
why is that one maybe not as
um, cost effective
as the one where you pay a $15 flat fee but, you know
we just try to look at why, why does it work that way initially what would you think "oh I'd pick this one" well in the end after we went through the whole thing "what did you notice
why do you think it worked that way and why is it that the more you talk the more beneficial this might be" those kinds of things (Interview 3)

THERESA (*discussing the difficulties for herself and the students moving to a more student-centered classroom*)

I remember the students
initially
starting a task they were having trouble
coming up with what it was trying to get them to do
and that was a learning experience for us all (*Theresa pauses*)
um, really without me trying to take over the student thinking
I was trying to support them (*Theresa pauses*)
and it was so hard I remember discussing with the other teachers just to sit back and try to get them to
do all the thinking because before that with the QCCs we would just stand up and start the class
we would do all the examples they would take notes and they would do the work
but to get the students actually talking (*Theresa pauses*)
and the kids would get mad at us
like "why aren't you teaching"
I try to present it to them now like it's more of an investigation than
tasks like I want you to investigate this I try to always
lead it into something like that (Interview 3)

it was hard getting the students the first year to work in groups they'd never worked in groups or worked on like task-based projects before
um, GPS

so you could definitely see the struggle in that rollout year too just to
get them working in groups but now my kids work in groups all the time I mean I'd rather them work in groups and talk about it than
it's just getting the kids used to that
method and you could tell like
if they had never done it before maybe in middle school and things like that (Interview 3)

DEE (*enters the conversation about how she uses groups in her classroom*)

If it's a task and I've assigned it based upon them
I'll let them work in groups and I usually try to let
them pick the groups or I do a lot of random card drawing or
I've looked at their assessments and I've put this group because they need to work together on this skill
and that way I can adapt a task to what skill I want them to build on
but a lot of times because (*Dee pauses*)
they're more apt to discuss
with certain ones than they are with others I've tried putting them in assigned groups and they don't like me very much when I do that but, um (Interview 1)

Elizabeth feels there is a happy medium with using tasks. There is still a time and place for direct instruction, and just giving students a task without any discussion (before, during, or after) is counter-productive. She also noted how the tasks have become more manageable over the years.

ELIZABETH (*agreeing with Dee about giving students options for their groups*)

If we do one now I try to (*Elizabeth pauses*)
we do a lot of, you know, scaffolding and stuff before to get them prepared for it I don't just, you know
out of the blue here's one but we'll
do things before to kinda prepare them usually
um, and I tend to do a lot of my tasks partners tasks so you are working with someone
um, but you have the option to work alone if you want because some do they would much rather just work by themselves
I don't really do three's normally
because to me it usually ends up one person doing it all one person kinda helping one person doing nothing that's just kinda how I've experienced it
um (*Elizabeth pauses),* but I find that I embed them more now than I did before like when they first came about I think I was a little hesitant, you know, and I was kinda used to doing
the little things we had done before so I was kinda I was probably a slow person to hop on that but, um, I think it was just maybe my own nervousness about doing them
and also too I remember (*Elizabeth pauses*)
depending on schools I've been in sometimes the pressure to be on pace (*banging table*) was so great
whereas I tend to be

if a lot of us don't get it we're not moving on I'll back up and do more
and so then I tend to run out of time to do the task (Interview 1)

DEE (*differing from Elizabeth because she will use a task to open a unit instead of scaffolding it for students*)

We utilize tasks as, um, an attention getter
for the unit a lot of times, um
basically do a lot of leveled tasks based upon pre-assessments or
prior assessments, um (*Dee pauses*)
my goal I think too is
if I give them a task one of the things I will do is I won't sit down and go over the answer I will try to
you know, ask leading questions that get them thinking about "Oh, ok maybe we should try that"
you know, I don't like (*Dee pauses)*
to give them the answer they've got to look for it so

JACQUELINE

And it's interesting that you said that a lot of times you'll start a unit off with a task
why do you make that decision cause a lot of teachers are like "I can't give them a task to start off with they don't know anything"?

DEE

Well it kinda peaks their interest
"I don't know how to do this
what do I need to know to get this" (*Dee pauses*)
and so
I mean sometimes it's better to start them off with "ok we got this task how are we going to go about solving it what do we need" they say "oh ok maybe we need to
decide what are we all missing"
and then you can start the
instruction there

JACQUELINE

And what influenced you starting to use tasks?

DEE

I guess through the changes of all the standards and, and
of course the changing of the kids themselves, um
they like the tasks, um
they'll get more into those sometimes

JACQUELINE

And why do you think that is?

DEE

I think once again it's the ability to
"ok I see a use for this, I can see how I could use that"
and plus it allows them to
communicate with each other and
sometimes you've got that one that thinks outside the box
and the way that they do it may be different from anyone else but
they've reached that goal and they know how to do it so
I like the tasks because it gives those kids that don't always
think the same as everybody else a different
they can show their ideas and how they would do it (Interview 3)

I was probably the one that said "oh I can't do tasks"
but you can (*Dee laughs*)
I've adapted a lot with those and utilized those more (*Dee pauses*) (Interview 3)

Elizabeth walks up to the projector as Dee finishes up her discussion to post the third topic of the day.

Projector reads: Use and connect mathematical representations.

This teaching practice was also only mentioned in each participants' third interview. Each person had a different vision of this mathematical practice.

ELIZABETH (*starts the conversation off relating symbolic, visual, and textual representations*)

I talk a lot about numbers, pictures, words, you know, how do these relate cause I did a good bit of that in elementary
um, I've been using Nearpod, um
and they love that and there's like a draw it feature in there
and I'll say "ok now draw me
you know, a representation of" (*Elizabeth pauses*)
I'm trying to think of what one we did recently but
something they can, you know, in a few minutes just draw something on the screen and then everybody can see and when we talk we pull some out, you know, this one or that one, and those kinds of things so I think the visual for some kids the visual angle I think helps a whole bunch for some you can tell they're like "I just wanna get a number answer and move on" and then for some the visual I think helps them a whole bunch

we're in unit 3
it's linear and exponential models and so

one of the things I talk about is how an equation and a graph and a table they all mean the same thing they're just different
you know, representations of the same thing and you can tell for some kids that's hard
like "I get a graph I see a graph how could that possibly be the same thing as what you are showing me in this table", you know, so
we, we have had to do quite a good bit of that

JACQUELINE

Yeah and I don't remember
like when I was doing QCCs it was just alright well this chapter is on linear equations so we're just going to do the linear and we're not even going to talk about the transformations until we get to this instead of kinda bringing some of those things together there

Theresa saw this standard moving along the concrete, representation, and abstract continuum. She has children in kindergarten and first grade, so she is able to see the strategies they use to solve their problems.

THERESA

I struggled with this a lot in high school until Foundations[29] (*Theresa laughs*) came out this year because
I have not taught K-8 but I just see it working better there
um, just having kids myself that
by the time they get to the high school like
take for instance equations and integers I want them to already know (*Theresa pauses*)
to add that to the other side and know the rules of integers
so I don't feel like I'm having to get out these representative
pieces all the time
that being said (*Theresa laughs*) I know it can be done in high school especially with geometry now geometry is something different we do it all the time we have pictures we touch it we have objects
it's hard, hard, hard in algebra
it's just things we've not really been exposed to
and if we hadn't done that Foundations workshop, you know, where you went through all of the strategies
I mean those standards are still elementary, middle school things they should've picked up (*Theresa laughs*)
this is probably the one
that I'm still learning the most

[29] The state of Georgia created a class called Foundations of Algebra to help students that scored low on the state mandated tests in 5th, 6th, and 7th grade build up their basic skills before entering the algebra component of their high school career. The standards for the course mainly focus on elementary and middle school concepts ranging from third to eighth grade.

JACQUELINE

Well hopefully by the time your kids get to the high school we don't have to
struggle along with that as much making those representations

THERESA

I use pictures and tables and charts in math all the time just not
those other representations (*Theresa pauses*)
oh and on this too
I noted that
now that we've gone to computer-based testing
I think that hurts (*bangs on table signifying work with manipulatives*) this area
because you can't do that stuff
and time shouldn't be a big issue with these tests because
if we do this we teach them to use these
hands-on things but yet we're timing them
I'm teaching them all these ways to do some of this stuff but then I give them a test that's (*snaps fingers to indicate ticking timer*)
and I know they eventually need to get it
but we teach them all these methods but then we give them a test on a computer and they're looking at a picture
on there
and they don't really know what to do down here (*bangs on desk to emphasize hands-on*)

JACQUELINE

Yeah, yeah that's big you've brought up testing quite a few times
as one of the
the issues with all of the changes that are occurring

When discussing this standard Dee focused on students presenting multiple ways of arriving at a solution, not necessarily connecting multiple representations.

DEE

I always try to think about it cause, you know, the biggest thing they ever say is "I'll never use this" "I'd use this when" "oh ok yes that's when we'll use that" but, um
I use whiteboards a lot of times and
let the kids write the way they did it and then share it and, um
but yeah I try to use and connect as many different ways of doing it
try to show multiple ways of arriving at the same solution it's, you know
if they come up with a different way "well that yeah that one works does anybody else got another way"
let them share different ways

JACQUELINE

And I think that's one thing especially with the Common Core showing multiple strategies in elementary school
that we're starting to hopefully see trickle into the middle and high schools the kids will have a larger toolbox to be able to pull from and solve some of the problems

Elizabeth walks up to the projector as Jacqueline finishes up her statement to post the fourth topic of the day.

Projector reads: Facilitate meaningful mathematical discourse.

Dee describes how she incorporated mathematical discourse using Number Talks (this was discussed in all three of her interviews).

DEE

I've gone to a conference
just this past summer
for model schools and, um, the big thing now is Number Talks
we used to call them bell ringers then we called them warm-ups then we called them questions of the day
I try to kick off
their thinking processes by throwing up a question (*Dee pauses*)
and, you know, giving them time to process and then
"ok how did you go about getting the answer"
and then "did you think about doing it this way" or someone else said "well I did it so and so", so that's one of my teaching strategies I usually do that
depending upon the class I'm teaching, you know
um, try to draw on what they've previously learned
try to connect with something that they know about and relating it to some real-world application as well trying to apply it, you know
not just say "yes you need to learn this"
and, um, trying to say "well where would you use this" more so

we do Number Talks every day in one of my classes I don't do it so much in my, um, AP classes because
everything we do (*Dee laughs*) is a Number Talk in those
but, um, in my Accelerated Pre-calculus class we do start off with a Number Talk and
I, I usually pull an SAT question covering what we're studying
because these are the kids that are, you know, at that point where they really have to have that SAT score
and so I pull it up and then I'm saying "well ok what could we do what do we know" and so we get a lot of discussion and (*Dee pauses*)
but with my struggling learners I always tried to tie it in with something just to keep them fresh something that

you know, was previous taught skill
so that we could practice it again and not
lose it (Intermingled excerpts from Interviews 1 and 2)

Elizabeth gives an example of how she incorporates a talk in her class instead of the traditional warm-up discussed (this was discussed in all three of her interviews).

ELIZABETH

Um, I don't really do openers as much, you know
we usually have sorta like a talk like "ok what are we talking about", you know, what have we been discussing and I might jot it on the board or a graphic organizer, you know, something for them to see on the projector or we'll just, you know, talk about it
and, um, I find that now I tend to do although I kinda
think I've done that for several years but I tend to instead of saying
"here's how you do this"
I'll put something up there and say "ok where do you think we even start with this where would we even begin
and let them throw out and I'll even say "it doesn't matter", you know, "you're totally guessing", you know
um, we are doing systems right now we were solving by graphing and so I put some equations up so they were set up for elimination and I said "ok how would we solve this"
and they said "ok we would have to get it into slope-intercept form" so we did that and then we graphed it and I said "ok
do you think there might be another way do you see anything about the way they're set up" and finally somebody said "it looks like they are lined up by like terms" and I'm like "yes" and then someone said "it looks like those two cancel" so I find that I do more of that

JACQUELINE

Did they know about elimination before?

ELIZABETH

They didn't yeah and then some classes
you'll get quicker "hey"
because we have math support and they've previewed it's great for those kids "I know how to do this already" I'm like "well then tell us how to do this" and they know how to do it

JACQUELINE

Great confidence builder

ELIZABETH

It's wonderful yes and the kids are like "how'd you know that" "oh I've seen it already"

I had that happen in 7th period a little guy was in there
when I put it up there he said "I already know how to do this", I'm like, I said "well hold on" I said "don't say anything just yet let everybody else try to figure it out", you know
and then some of them were kinda struggling like "I'm not really sure could you do this" and I told him "go right ahead" and boom, boom, boom he walked us right through it

Yes, so I find that we tend to sorta do that we talk a little and sorta lead into that
whereas before I don't know if it was just my teaching style or
this we've got to hurry, hurry and get through this or a combination of both, you know, it's "ok we're going to do elimination here's how that works", you know
and it could be experience too I've done it long enough, you know
taught long enough that I feel comfortable with that whereas
maybe in my early years I wouldn't have felt as comfortable, you know, there's something about that rule of teacher I must teach them how to do this
but you can do that without literally standing up there teaching them how to do that, you know
(Intermingled excerpts from Interviews 1 and 2)

JACQUELINE

And what about, um
the discussion that happens between the kids like when they work on tasks
has that evolved over the years?

ELIZABETH

I think so but I think it just it's something that just takes practice and some kids, um
are just resistant to that, you know, I still have some "I'd just rather work alone I don't like working with somebody I don't like that
you know, discussion part of it", um
it, it takes I think training and depending on what they've had before some of them need a lot of training on how to really talk, you know, and discuss
when they are working on things
I think there's a lot more that goes into that than just "here talk about this", you know, you have to
I think give examples of what are what kind of questions, you know, would you ask your partner and what kinds of things should you be talking about you know what I am saying those kind of things so (Interview 3)

Theresa, piggybacking on students' difficulty with discussion from Elizabeth. Facilitating mathematical discourse only came up in her last interview.

THERESA

Um, again it was hard for me as a teacher to hand it over
my conversation to the kids to start it, um (*Theresa pauses*)
the kids complained that I wasn't teaching, um (*Theresa pauses*)

it just it was hard for them at the beginning to (*Theresa pauses*)
say "ok talk this out between us" but
now they're starting to I have to be very careful how I group the kids now
I changed a lot of things too from a task to an investigation
it was just a big change again (*Theresa pauses*)
for me just standing up starting the lesson

JACQUELINE

And what about when your students are doing the investigation what are you doing at that time?

THERESA

I try to sit back and watch if
I don't see a lot happening
I'll go ask a question or
I'll get them to get a calculator out and maybe graph it or look at a picture or put the data in to look at it a different way
I try to always start it with something that they can go type in the calculator "well if that gave you this"
I try to start the investigations with or
we go to the computer lab a lot and I set up
their assignments through Google classroom use USATestprep or
a video to kinda get them thinking about it
which is different

JACQUELINE

What about with your student understanding do you feel
better prepared about what they actually know now
with their discussions?

THERESA

I feel like they get it I still feel like there's a time and a place for
a lot of practice
I don't, I don't have them just practice, practice, practice as much anymore and I still feel like that's important
at times but
um, I feel like they're getting it every year I can only speak for me (*Theresa laughs*) my scores are going up so, you know, I feel like something's going right (Interview 3)

The teachers need a bathroom break so they get up as Theresa finishes discussing her increasing student achievement. Upon entering after the break, Elizabeth changes the projector topic to the fifth teaching practice.

Projector reads: Pose purposeful questions.

Both Dee and Elizabeth believe they are strong in this teaching practice.

DEE

I think one of my strengths is
my ability to
ask a deeper question
my questioning skills have improved through the years and so
I, I can get them to think higher sometimes by just, you know, those
deep essential questions that you try to get them to think about
if you get the right question then that makes them think
and then they want to know more
give them a few minutes
to think about what you've asked them
um, don't judge them on any of their answers never do that, um
and, you know, and probing deeper a lot of times is just, you know, that's
the one thing I always get rated high on is I do ask deep questions (*Dee laughs*)

JACQUELINE

Nice and when do you develop your questions?

DEE

Oh gosh I don't know
sometimes I think about a question as I'm thinking about a lesson or sometimes something may come up just in class

JACQUELINE

And what has influenced your deep questioning
practice?

DEE

(*Dee pauses*) Oh probably the desire to see that they truly do
that they do get it and that
they love that they see it
you know, I, I don't know I just love learning and I love math and I love numbers *(Dee laughs*)
and I just want to, you know, encourage them "look, look at this do you see how this connects"
(Dee laughs)

JACQUELINE

Yeah and sometimes when you get excited they get excited

DEE

Yeah and they do and that's what they always tell me is that
"you just, just love math too much you just do"
but yeah I do

JACQUELINE

Us math nerds gotta stick together

DEE

I know that's the truth that's, you know
we're the only people that get excited about numbers *(Dee laughs*) (Intermingled excerpts from Interviews 2 and 3)

Elizabeth also feels strong with this teaching practice and is able to use her collaborative planning time to develop much more thoughtful questions to use with her students.

ELIZABETH

Uh, just that I do ask a lot of questions in my classroom and I try not to ask
um, many of the lower level just memorizing questions I just ask them "how'd you get that"
"what if we did this"
"what if it changes to a negative what would this do"
um, "if I had this problem what would happen if"
and that's one thing I think I am pretty good about in discussing with them is the why, "why does it work that way", "why does that happen"
"why does it turn out to be that type of answer" "why did the graph turn out that way" those types of things
um, so yeah I think I ask
much more purposeful questions now than I used to (Interview 3)

Theresa compares her questioning techniques from the traditional QCC days. Because of her years of experience, she feels comfortable creating the questions on the fly.

THERESA

During QCCs I remember just a lot of recall facts, um
GPS, CCGPS, you know, it all went
to the depth of knowledge 3 and 4 type questioning that we use, um (*Theresa pauses*)
a big thing for me was learning to do more wait time, um (*Theresa pauses*)

give them a chance to think about it give them a chance to struggle (*Theresa pauses*)
that's a big thing even on our, um (*Theresa pauses*)
on our
observations, you know, that we're questioning and we're using critical thinking skills, you know, making them think critically about the questions not
yes/no, you know, they're having to
answer more, you know, give an explanation so a lot of that has changed (Interview 3)

Elizabeth walks up to the projector to display the sixth practice.

Projector reads: Build procedural fluency from conceptual understanding.

This teaching practice also only came up during the last interview for all three participants.

ELIZABETH

Um, this teaching practice provides students opportunities to explain reasoning and explain what procedures are working
um, and we on
all of our unit assessments and even if we give a mid-unit assessment we always have questions where they have to explain so it's (*Elizabeth pauses*)
and I had an assessment (*pulls out document*) today and I had two error analysis questions
the student did this, this answer is incorrect, you know, her answer is wrong explain what she did wrong
and I can get so much out of that

THERESA

I think we use several tools now we're getting away from just the procedural rules
you know, just the algorithm we've gotten away from that and
moved to showing multiple ways to do things like multiplying and factoring, you know
there's so many ways it's overwhelming (*Theresa laughs*) sometimes since there are so many we don't provide enough practice with a certain one
so that's sometimes where I feel like I don't get enough practice in, time being an issue
I never tell a kid anymore you've got to stick to this procedure this rule
you know, it's
however you come about it I don't care
if you don't know a way at this point I'm going to show you my way (*Theresa laughs*)

JACQUELINE

Yeah, yeah
I'm sure we're all in the profession to help kids and we want to do the best we can but
not having the time not having the
resources to do vertical teaming

and then another complaint I hear is that elementary school teachers don't have supportive parents like you they go home and parents are like "why are you doing it that way this is how you do it" and then it just undoes (*Jacqueline laughs*) everything that they do

DEE (*describing how she builds procedural fluency*)

I do flow charts and checklists "did you do this", um (*Dee pauses*)
model, you know, "what's step one what's step two"
um, my one of the biggest things too is to get them to look at the problem before they start (*Dee pauses*)
and (*Dee pauses*)
alright ask yourself
"what do I need to do to solve it"
and I'm trying to say "ok what do you notice about this"
"well it's got an $x^{2"}$ "well what does x^2 mean how do we go about doing that, you know, what are my strategies for doing it"
um, so
that's the hardest thing to do is to get students to look at the problem
and want to attack the problem
without giving up before they start
um (*Dee pauses*)
fractions still (*Dee pauses*)
at this level
they see a fraction in a problem and they skip it
because they don't
get that connection of just exactly how easy fractions are

JACQUELINE

Yeah we haven't done a good job conceptually developing the idea of fractions and decimals

DEE

We really have not
they're more prone to deal with a decimal (*Dee pauses*)
than they will a fraction (*Dee pauses*)
and I think too it goes back to so many of them have been
programmed to "well I don't really need to understand what's happening I just need to plug it in my calculator"

JACQUELINE

I'm hoping with the new curriculum in the elementary school and the conceptual development that is supposed to be happening we'll see some change but unfortunately some of the teachers that are teaching it weren't taught conceptually themselves
so they have a hard time conceptualizing it for the students

DEE

That's the thing too is if you
have a hard time understanding it yourself
and you can't communicate well to your kids, you know
that's where we fail
I guess I'm just a
math nerd enough that
I'm going to go home and I'm going to work it at least three or four different ways so I can say "ok yeah we can do that"

Elizabeth walks up to the projector as Dee concludes her thoughts.

Projector reads: Support productive struggle in learning mathematics.

This was brought up in both interviews 2 and 3 with Dee and Elizabeth, but Theresa only mentioned this teaching practice in the last interview.

Elizabeth starts the conversation since this is one of the practices she feels she has grown the most in. She promotes productive struggle using a teaching strategy called "My Favorite No", redirecting confusion, providing students options, and warm-ups using technology. In "My Favorite No" she gives the students a problem and they work it out on an index card. She then goes through the solutions and puts up her favorite wrong answer for discussion.

ELIZABETH

if I see that we're struggling with the skill I will do something called "My Favorite No"[30] and I'll give them an index card
I love "My Favorite No"
we only do it when it's necessary, you know, when it's like a skill that I can see that we
all seem to kinda making the same mistake but I like it and they like it too because I pick the best wrong answer
and they love it because they get rewarded for having the wrong answer

JACQUELINE

What a great way to show kids it's ok to make a mistake! (Interview 2)

ELIZABETH (*describing another way she promotes productive struggle)*

I try to ask in class when we're learning something "what could be confusing to someone" so I'm not saying "what could be confusing to you" but

[30] To see a video incorporating this teaching strategy visit https://www.teachingchannel.org/videos/class-warm-up-routine

"what do you think might be confusing as we're learning this"
um, and I found when I do that the kids who do struggle tend to kinda
perk up a little like "ok I'm sorta confused but you're not saying why are you confused by this",
you know what I mean I think the way I present that kinda helps
and we do a lot of think-pair-share think about it for a minute
pair up with your partner for a couple of minutes and then share, um, which I think helps and
I try to (*Elizabeth pauses*)
pair kids (*Elizabeth pauses*)
so that they kinda feel like they're with somebody
they can kinda
have that conversation with but not someone who's just so far beyond that they're like "there's
no way I can even discuss this with this person" kinda thing

Another productive struggle example.

um, I have a sign in my classroom that I saw at another
um, classroom that I was observing and it says instead of I don't know and it gives them four
options may I have more time, may I have more information,
may I ask a friend, or could you phrase the question differently
so if I ask something they have that option to say "could I ask Jackie (*Elizabeth laughs*) what she
thinks about this" or "could you phrase that in a different way" or "could you give me a little bit
more time"
and it's helpful some of them
um, will still kinda "uh" but I think if I give them those options more of them they are willing to
say "give me just a minute" or
"can you
come back to me", you know, "can you maybe ask somebody else and I can maybe piggyback on
what they say" and that's seems to help a lot
but I like that cause a lot of them are quick to go "I don't know" so when you give them those
options that does help a little bit

Another example.

oh I do give warm-ups in Nearpod and that will give me kinda an idea where kids are already
struggling
um, and when I see that something is happening like a mistake or an error
that's happening a lot I'll just put it up there and we'll talk ok I'll say "this is happening a lot
let's talk about why this is happening where's this coming from"
I'll say "a lot of people really struggle with this let's look at this", you know
and I think that's one thing I've tried to do is I've tried to make it where
they feel safe enough in there to be able to say "I don't get this" and some kids are, are really
great about that and some are getting better at that
um, but if
"if you're struggling that's ok, you're supposed to if it was easy it would be easy it's not it's ok"
(Interview 3)

Dee promotes productive struggle in many ways as well. For her high expectations, rigor, and relationships are the cornerstones of this teaching practice.

DEE

I try to always (*Dee pauses*)
make them think above and beyond and I never look at the kids
I won't dummy down material for them
and they're like "this is hard"
I wouldn't give it to you if I didn't think you could do it, you know
I don't want to talk down to them
I always want to push them to do more
and I think some of them at first they don't see that but then they eventually get to the point where "yeah
she actually is pushing us to do" so
the rigor and the high expectations and let them know that, you know
and the other thing is
one of their big complaints is, you know, they hate homework (*Dee pauses*)
so when I give them a homework assignment
I said "but guys don't you know I do it too" I do whatever I ask them to do
and I'll bring it in and, you know, sometimes I have a careless mistake and I'll leave it and they're "but wait isn't that supposed to be" "well I guess it is"
we do a lot of error analysis if we're doing something and I see careless mistakes I'll just like "ok I'm going to rewrite this problem and I'm going to throw in a mistake" and say "what's, what's wrong with this"

JACQUELINE

It's nice when they know that you're, you're human too, you know, they don't see you as this robot that just stays at school
and grades their papers

DEE

No I don't always have the right answer I make careless mistakes as well (Interview 2)

Another example.

DEE

One other thing, you know, if a kid comes up and asks me how to do something and
you know, I say "I don't know what do you think we should do"
because
so many kids become dependent and they can get an answer right away
without thinking
I don't want that

"you think about it you tell me what you should do"
because that's learning

JACQUELINE

Yep putting the problem back on them I know when I first started I was not good at that I was the disseminator of the information but
with the GPS and the Common Core all of that
I had to totally change
and reevaluate what I was doing (Interview 2)

Another factor of productive struggle.

DEE

um, if you build a relationship with the kid
and even though they're struggling say "I know you are but we can do this I have faith in you", you know
"you can do this (*Dee pauses*)
you wouldn't be here if you couldn't do it"
um, so I think that comes from, um
your relationships that you build and you have to
make them understand that you really do care and yes it is relevant for you to
learn this for preceding on and
it's that high expectations and having that accountability, um, for them
um, yeah I know you're going to struggle we all struggle
you know, but you can do it and when you can't do it you know my door is open every morning come ask me (*Dee pauses*)
I may not tell you the answer but I will push you in the right direction (*Dee laughs*)
I think if you don't struggle then you, you know, you become complacent you really aren't learning

JACQUELINE

That was my thing like with my kids when we would put problems on the board I was like "don't put the one up there that you know how to do
put the one up there as far as you got with the ones you don't know how to do"
that's how you learn
it's ok if you didn't finish the problem just go as far as you can
yeah that's where you're going to learn you already know the other stuff
but we do want to have that positive reinforcement that we can do some of it so I understand some of that but it's breaking down
and providing that supportive environment so that you aren't going to be made fun of
but its ok because you're not going to be the only one that doesn't know how to do that problem there
so but it's creating that environment for them to feel comfortable and

build relationships just like you were talking about there (Interview 3)

Theresa uses the example of tasks and the story of how she overcame using those to promote productive struggle in her classroom.

THERESA

the tasks definitely produced a struggle, um
it was just (*Theresa pauses*)
huge, huge struggle with the reading it's still a huge struggle with the reading, um
at the beginning I mean the investigations were long and that's
one thing, you know, chucking them
it's just something I've had to learn and I know which ones work and which ones don't work and um (*Theresa pauses*)
I've learned through this that students can talk to me about things better than they can write it down
um, and I, you know, I teach 140-150 something kids all day and it would be great if I could sit there and talk to every one of them and let them explain their reasoning
like they can tell me, you know, I'm adding
to each side or I'm subtracting but they could never tell me that was like the
additive property or anything like that but I'm like "you just said it you just don't know what you are saying"
there's a big gap in that but before we never, you never had to write before though so that's the struggle all in itself that you are having to write this stuff
instead of just putting down a number
that was huge they were like
"there's no numbers", you know, when it first rolled out they're doing so much writing and that just blew their minds
but, um (*Theresa pauses*)
we just had to incorporate a lot of writing in our school just across the board
reading and writing
it's still something we are really, really working on I could tell you that
my honors and my gifted kids now
can write great and explain their thoughts, you know, the middle to lower end they're still struggling
feedback is a huge part now of CCGPS they want the teachers to give so much more written feedback too
where before
that was never stressed ever

JACQUELINE

I just wrote X's and checks and a grade on the top of the paper.

THERESA

Right so that's something a big, big change too
you know, we're still learning and they're still talking to us all the time about feedback but, you know, feedback on the rubrics we never used a rubric (*Theresa laughs*) (Interview 3)

Elizabeth walks up to change the projector for the last teaching practice.

Projector reads: Elicit and use evidence of student thinking.

Elizabeth brought up this teaching strategy in interviews 1 and 3, whereas, the other two only brought it up in the last interview. Theresa only looked at this teaching strategy the day of the interview for the first time.

THERESA

I don't know why I put this down with this title I wrote down that I learned the most with just trial and error myself
and to kinda roll that in to kids thinking I've tried to push them that they learn the most though trial and error
um (*Theresa pauses*)
just by this all rolling out every year, you know, I've learned what works and what doesn't work and I try to instill that thing on the end of their pencil is called an eraser and that's how they are going to learn the most if it doesn't work out then erase it and let's go down a different path

JACQUELINE

It's ok to be wrong it's ok to fail

THERESA

right and I've tried to
you know, make them think about that and
it took a building year for me to
get down, you know, what I knew worked and what didn't it takes them time
but they're going to have to think
for themselves and learn from their mistakes
just like I had to learn from the mistakes when this all came out and, you know, from how I started to now, you know, to make myself better that's what I try to tell the students all the time if you don't ever write anything down if you don't say anything you are not going to learn
it's not going to happen for you, you've got to start somewhere and so I try to push that on them

JACQUELINE

Yeah, I mean sometimes just telling your story of change "yeah we've all gone through it and I've had to change and

try different things”

THERESA

And I fought it and I didn’t like it but, you know
here I am now so doing different things

JACQUELINE

Yeah and you got a bigger toolbox to use and more strategies and
are hopefully hitting more kids than
just those students that know how to do the algorithm

THERESA

Right (Interview 3)

Elizabeth shares a few strategies she uses to promote student thinking.

ELIZABETH

Yeah, and I try if they figure it out, you know
I’ll say “I’m calling that the Jackie Hennings’ method that works”
and so in that class, you know, I’ll say “ok what was the Jackie Hennings’ method” and they’ll go “oh yeah”, you know, and I’ll have them do it differently in every class but, you know
I’ll say “we call it elimination but I’m calling it that because you figured that out”, you know, and I think it’s all self-concept I tell them all the time
at the beginning of the year that
you know, “if you don’t think you’re good at math someone’s told you that somewhere either your parents said they weren’t good and they placed it on you or a teacher told you” and I said “I promise you
you might not have an A but you will be better at it at the end of this year you won’t hate it nearly as much as you do” (Interview 1)

I tend not to (*Elizabeth pauses*)
stop as much throughout the unit and reflect, um (*Elizabeth pauses*)
but (*Elizabeth pauses*)
I know when I do stop and reflect (*Elizabeth pauses*)
I’m better the next day or, you know, the next time I teach that or when we get back into it, um but I will change a lesson right in the middle if I see that it’s not working I guess that’s just cause I’ve been teaching a while but if I see something that isn’t working I say ok “let’s stop for a second”
and there’ve been times I say “ok let’s take a 3-minute break and let me revamp this because the way I’m doing this is not working”
and I’m fine with that and just because I’m like it’s this is not working whatever I’m doing is not getting through and

um (*Elizabeth pauses*)
Nearpod obviously I'm using that a lot
but I'll ask questions in there and (*Elizabeth pauses*)
I print out those reports and go back and look at them, you know, at the end of the day or the next day to try to let me know what it is they're thinking rather than just "ok
out of 20 people only 5 people put the right answer", you know, "where did you get this from" "why do you think that works"
"do you think the answer is positive not negative" those kinds of things and that helps a lot and I've found when I do that
I get good stuff and it helps me, you know (*Elizabeth pauses*)
as far as teaching it helps me do a better job of it (Interview 3)

Dee chimes in to finish the discussion of NCTM's eight teaching practices.

DEE

Well
that's your all of those informal and formal assessments, um,
with our big focus on differentiation there is a lot of informal assessments a lot of, um (*Dee pauses*)
you know, activities that we bring in now and group them according to some skill
or probing that you do trying to get them to think and, um
you know, any of the end products that they give you be it a project be it anything that they do
you being able to read your students (*Dee pauses*)
you know, you can read those certain students that have that questioning look
and you say "ok let's try this again
let's try it a different way what can I say"
and then it will be like "oh I see" I mean you just have to know how to read them (Intermingled excerpts from Interviews 1 and 3)

Lights dim.

Scene 3: "there's just more collaboration now"

It is the end of the day and the teachers have moved to Theresa's classroom. Jacqueline starts the discussion asking about the current influences on their teaching practices. The teachers moved desks in order to meet as a group.

JACQUELINE

What influences what you do now?

DEE

Um, well, a lot of what I do now of course has been developed because of the changing curriculum

we've become learning communities
we meet weekly during our lunches to share resources and discuss
you know, "ok this worked for me this didn't"
during the QCCs, there were certain teachers you could go to if you needed some help or clarification
but since we've began rolling out these standards
I've seen a whole lot more collaboration which makes it a whole lot easier
and scheduling times for us to have time for to work together has (*Dee pauses*)
been a big help because it gives you support and that's what you need because you cannot do this job without it especially with our (*Dee laughs*) changing curriculum
we have a math coach now which allows us to help and gives us someone to feed off of she brings great ideas to us
if she sees something that she knows that we've been working on
I use the NCTM website Illuminations a lot
of course we also have, you know, a lot of tasks by the Georgia State Department of Education that are available for us and
I've taken a lot of those I'll tweak them based upon my kids in my room or if I want to go more in-depth adding a little bit more
um, I try to, um, you know, meet
with other teachers and ask their questions I try to attend, you know
training sessions to pick up new ideas
I'm very fortunate too I have some amazing kids and
and they'll tell me what they like and what they don't like (Interwove themes from interviews 1 and 2)

JACQUELINE

They are opinionated aren't they (*Jacqueline laughs*)
they will give you some valuable feedback

DEE

They really do especially at the high school
they tell you exactly what they like and don't (*Dee laughs*) (Interview 1)

ELIZABETH

Well, I taught middle school for a quite a long while so when I came into 9th grade (*Elizabeth pauses*)
the content, you know, from 8th to 9th is very similar it's very linear equations and all that kinda stuff
so I tended to teach it very similarly to how I taught in 8th grade
but of course there was new stuff like a statistics part
so luckily for me I had a co-teacher who I still have now and she helped me a lot
with those units because she had taught those things and she would tell me

you know, when I first started teaching high school she would say "you're making this a little bit too easy", you know, "you need to have more rigor here", she said, you know
"I know it's similar to 8th grade material but", which helped me a lot because I think sometimes I viewed them as (*Elizabeth laughs*) well they are still kinda like 8th graders
so she was very helpful and I was lucky in that I had a very good department
and we, um
do collaborative unit planning so we would meet once a week and that helped me and I could sit and say ok
"here's what I'm thinking is this similar", you know, and even now we don't all teach it the same way we're not on the same place on the same day
but, you know, we're really comfortable about sharing
had I not had the co-teacher and the department it would've been extremely difficult for me (Interview 1)

JACQUELINE

And what do you think
helped you with that transition?

ELIZABETH

I do think National Board had something to do with that
cause I got my masters then I did the National Board then I did my Specialist there was nothing like that experience of (*Elizabeth pauses*)
two things reflecting
and also "why am I doing this the way I'm doing it", you know, "why, why, why did I set this lesson up" and sometimes it's just, you know, as a teacher you just innately know
I need to blah, blah, blah, blah, blah but you had to type it all out and explain it all "I set this up for this reason"
because these kids", you know, I had to specifically say because of this
whatever, you know, these levels or this ethnicity or whatever it might be, you know, or their previous scores on this
and so I think it forced me to do that and I think that made me more reflective
and made me think about ok "why do I do things this way"
and I've taught with the other teachers before who say "well that just takes too long"
and, um, "it's easy it's quicker and easier for me to" and I understand that but I also know the look on their faces and I will say "you just figured that out"
"you just figured that out", you know, and even the ones who struggle with it they are like "wow we just figured that out", you know, so

JACQUELINE

What gets me is the teacher that says "it's takes me too much time"
yet they would rather spend 6 weeks doing the same thing over and over again and the kids not doing it
or getting it

then them taking a couple of days to try something different and the kids may actually get it you don't have to do 6 weeks

ELIZABETH

Oh yeah even the strugglers I mean kids who you would think
previously you've not done so well or previously you've really had a hard time like you said whether it's the previewing
in support
or just kinda putting it up there and let's just see what happens with this
and I think like I said some of that's experience that I think too (*Elizabeth laughs*) the longer I teach the less I freak out about testing and all that stuff I know it's there
but I just don't
I don't freak about that any more (Interview 1)

THERESA (*feeling the pressure of testing influencing her teaching practices*)

There's such a bigger
push now, I mean
obviously testing and the evaluations and
you know, there's so much more to it now than what it was then there was freedom and time and you didn't feel any limits or pressure
and now it's just all those things combined, you know, like drive me day to day to be very structured
in everything I do

JACQUELINE

To make sure that you get through the curriculum is that what you are talking about?

THERESA

Yes, let's just get through it all, I mean, just everything like testing is huge, um
now we're trying to work together and stay together and, you know
there's just more collaboration now and things like that (Interview 1)

DEE

Well you have to adapt if you don't (*Dee pauses*)
you're not going I mean you're not going to reach these kids not the kids today
um, I think back to when I first started teaching I'm, I'm totally (*Dee pauses*)
different than, you know, because the kids are different

JACQUELINE

And why do you think that is?

DEE

I think technology has a lot do to with it the advances in technology, um, they're used to immediate answers
um, they have (*Dee pauses*)
a wealth of information at their hands that they didn't have before
and, um, they could, you know, sit down and work and (*Dee pauses*)
were ok with it but now these kids they've got the information right there they wanna utilize it and
they want to move with it and
they got to always be moving

JACQUELINE

Yeah, yeah I felt the same the way technology has definitely changed the way we are as as a society, you know

DEE

It has (Interview 2)

Lights fade.

Epilogue – Data Analysis

In this last section, I present findings with respect to the literature and theoretical framework. I start by sifting the data through the literature covering the topics of influences of reform and teacher change. I follow this by looking at my data through a pragmatic theoretical lens and connecting it with Connelly and Clandinin's (2000) three-dimensional narrative inquiry space.

Findings with Respect to the Literature

Influences of reform on teaching practices. My study had some consistencies with the literature. With respect to the studies dealing with the influence of reform on teaching practices, my participants used a hybrid of traditional and reform-oriented practices as well as used collaboration and multiple resources to create plans to teach the standards. The one thing in the literature that was not consistent was the emphasis on conceptual understanding.

There were several times during our interviews that the participants spoke of both traditional and reform-oriented teaching practices that they utilized. There were times in our conversations they talked about modeling or doing some direct instruction for the students. The assessments provided as documentation still had a very familiar template utilizing multiple choice and free response portions consisting of mainly low depth of knowledge type questions. However, the participants also highlighted many reform practices they have adopted since the start of the Georgia Performance Standards. All three talked about how their use of tasks or investigations has evolved over the years. Each participant produced a few documents showing a task or project they used with their students that induced more student-centered, problem-solving than just working on a set of skills-based math problems. The familiarity with the curriculum expectations also brought about more comfort in their questioning and facilitating discourse capabilities.

Collaboration was a theme consistent throughout all three participants' interviews. The loss of a textbook forced the teachers out of isolation and into a collaborative space. They spoke about that being a great benefit of the changing curriculum expectations. Their schools provided collaborative planning time for them to share resources. They used multiple resources to help them create lessons. The teachers talked about utilizing technology for everything from searching for activities (e.g. Illuminations, Nearpod, Google classroom, state frameworks) to providing students with multiple avenues to learn the material.

There were three of NCTM's teaching practices that were only discussed during the third interview after they received the book: establish mathematics goals to focus learning, use and connect mathematical representations, and build procedural fluency from conceptual understanding. When standards-based curriculum first appeared with the rollout of the Georgia

Performance Standards, there was a significant push for everyone to understand the standards as Elizabeth talks about in her third interview. Establishing mathematics goals consisted of posting standards and attending to them during conversations in the classroom. However, since the implementation of the Teacher Keys Effectiveness System (TKES),[31] there has been a shift in expectations. The TKES is the current teacher evaluation system in the state of Georgia. It has three components the Teacher Assessment on Performance Standards (TAPS), student growth percentiles (SGP), and a professional growth piece that determines the Teacher Effectiveness Measure (TEM). The TAPS is comprised of ten performance standards: professional knowledge, instructional planning, instructional strategies, differentiated instruction, assessment strategies, assessment uses, positive learning environment, academically challenging environment, professionalism, and communication. I feel the transition to this evaluation tool for teachers is one reason why establishing mathematical goals was not fully developed by the participants and only discussed in the last interviews.

Each participant interpreted the using and connecting mathematical representation teaching practice differently. Elizabeth interpreted this teaching practice along a symbolic, visual, and textual continuum. Theresa outlined how she worked along the concrete, representation, and abstract model when discussing this teaching practice. Dee focused on how her students presented multiple ways of arriving at a solution. The purpose of this practice is to strengthen student's ability to move between and among different representations to improve their overall understanding of mathematical concepts. I believe the strength of this practice is the multiple interpretations applied using their strengths.

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[31] For more information about the TKES visit http://www.gadoe.org/School-Improvement/Teacher-and-Leader-Effectiveness/Pages/Teacher-Keys-Effectiveness-System.aspx

The last teaching practice that only showed up in the final interview dealt with building procedural fluency from conceptual understanding. This practice involves a thorough understanding of mathematics on a conceptual level. During my time in the classroom, as well as my work with teachers, I have found the majority of high school mathematics teachers do not have a strong conceptual understanding of mathematics. Many teachers that have been through the curriculum changes starting with the Quality Core Curriculum were not taught how to teach mathematics conceptually, so they rely on their K-12 educational experience to develop lessons. This lack of exposure was discussed in the interviews with the participants when they described their early teaching practices and the influences.

In my work as a School Improvement Specialist, I quickly saw the disconnect between elementary and secondary education. At the elementary level, teachers expected their students to utilize manipulatives to gain an understanding of the procedures used in mathematics, however, because of the lack of training, teachers at the secondary level provided instruction at the abstract level instead of building understanding from a conceptual approach. They relied on standard algorithms instead of manipulatives and representations.

Teacher change. The other part of the literature dealt with teacher change and barriers to accomplish this in the schools. The Fourth Way of teacher change (Hargreaves & Shirley, 2009; Hargreaves & Wallace, 2015) builds a collective responsibility and collaboration between educators, parents, and the community. Unfortunately, there is still a lack of this connection between those inside and outside the school building. My participants talked about how some of their colleagues were not as open to changing their instructional strategies and how conversations occurred during their collaborative instructional time. Elizabeth gave examples of colleagues' resistance to change when she talked about a prior math coach. Theresa brought up

the influence of state-mandated assessments and school and district policies that impeded her change transformation. Dee talked about the influence of parents and colleges on the names of the mathematical subjects taught in each grade level. They also reflected on when the standards first rolled out there was much resistance from the students and the parents because they did not understand the reasons for the changes.

The participants also talked about the growth that they experienced over the years in overcoming some of the barriers to changing their instructional practices. They have been able to confront their traditional beliefs, expectations, and attitudes about teaching mathematics, which helped them adopt some reform-oriented strategies. They all still struggle with the politics of testing and curriculum development. Theresa brought up testing in all of her interviews as the reason for her having to stop some of the things she wants to do to stay on pace to prepare for the end-of-year test. The same was true for Elizabeth as she likes to stop if the students are not grasping a concept instead of marching forward to cover the material even though she stressed that she does not worry about the outcomes of testing as much. Dee did not mention testing very often other than the formative assessments she gives her students regularly; this may be attributed to the courses she was teaching during the interviews. She did not teach a course that had a state mandated assessment.

The challenges covered in the literature review of teacher preparation, student accountability, pedagogical constraints, and adequate support were also confronted by the participants during the interviews. All three participants utilized some traditional teaching practices. When initially discussing the strategies they use, they usually started with what they did instead of what the students do, to me this implied utilizing the more familiar teacher-directed approach. They also spoke of the importance of professional development in helping

them change their practices. Theresa talked about the impact of participating in the Foundations of Algebra workshop in helping her connect multiple representations for her students. Dee spoke of the impact her math coach had on the department by bring new ideas to them and supporting their work. Elizabeth mentioned how pursuing National Board certification and higher degrees helped her reflect on her teaching practices.

As mentioned above, testing was a topic brought up many times, especially by Theresa, and was an influential aspect of student accountability. The teachers had to interpret the standards and create an environment where the students led themselves to mathematical understanding. The participants talked about creating collaborative groups instead of students working individually when talking about many teaching practices.

With respect to pedagogical constraints, the participants talked about the shift of roles between the teacher and students. They continue to provide students opportunities to struggle with mathematics and develop their own understandings. Elizabeth talked about using the students' names for a mathematical concept instead of the mathematical term when they discover some pattern. Surprisingly, the participants did not talk about the lack of time to create lesson plans or implement more student-centered tasks.

The last challenge addresses adequate support outside the classroom. All the participants talked about the support they get through collaboration with their colleagues. This collaboration allowed them to create materials to use as well as share what teaching strategies work and which ones do not. Dee spoke of the positive aspects her administration has had on her changing strategies.

Findings with Respect to the Theory

Dewey's theory of experience. In many of Dewey's writings he looked for a middle ground between the extreme dualisms that are present in society. This is highlighted in the titles of his books by using the conjunction AND instead of OR. One popular dualism he addressed was between "traditional" and "progressive" education. He argued that both extremes are inadequate because neither "applies the principles of a carefully developed philosophy of experience" (Dewey, 1938, p. 10). To Dewey (1938), traditional education is imposed externally to prepare students for a remote future. Students learn isolated skills and techniques from textbooks and teachers. For Dewey,

> The trouble with traditional education was not that it emphasized the external conditions that enter into the control of the experiences but that it paid so little attention to the internal factors which also decide what kind of experience is had. (p. 42)

Progressive education, on the other hand, focuses on free activity and learning through experience. It allows for expression and cultivation of individuality. However, there must be a balance between that individuality and direction towards development. Dewey does not take sides between the two sides. He believes

> What we want and need is education pure and simple, and we shall make surer and faster progress when we devote ourselves to finding out just what education is and what conditions have to be satisfied in order that education may be a reality and not a name or slogan. It is for this reason alone that I have emphasized the need for a sound philosophy of experience. (Dewey, 1938, pp. 90–91)

The participants in this study shared their struggles between their traditional upbringing and the current somewhat progressive expectations. As stated above, and consistent with the literature, the participants showed a combination of traditional and progressive teaching strategies. They also described their difficulty of maneuvering in an outdated bureaucratic structure that focuses on evaluation at the student and teacher levels. These structures minimized their abilities to try new things, and they often returned to more traditional methods to stay on pace.

Dewey's (1938) theory of experience describes his means and goals of education and has three aspects, continuity, situation, and interaction, which parallels Connelly and Clandinin's (2000) three-dimensional narrative inquiry space. Continuity gives experience a past, present, and future relationship. For Dewey, the principle of continuity is badly distorted in traditional education because of the assumption that acquiring certain skills and subjects learned in isolation prepares students for an unknown future (Dewey, 1938). In the interviews, the participants detailed both their past and present teaching practices to show how they have grown as educators within the changing climate. They talked about the use of real-world mathematics problems used for better preparation, but Elizabeth was disturbed by this term and saw the disconnections between the mathematics classroom and the outside world.

During the discourse, the participants talked about mis-educative and educative experiences that have happened during their transitions from the Quality Core Curriculum to the Common Core State Standards. For Elizabeth, the use of traditional warm-ups used to review material and as an opener was a big mis-educative experience. She talked about them being a waste of time and usually taking a long time to finish. They took the place, early in her career, of the more thoughtful discussions and tasks. Theresa spoke of her highly, teacher-centered

structured classroom before the transition to the Georgia Performance Standards. Since this transition, she has used more investigations and technology. The educative experiences were brought up during their discussions of transforming their teaching practices. Some examples of these educative experiences are implementing investigations, using technology, doing Number Talks, and using "My Favorite No." The examples of educative experiences are the ones that align with NCTM's eight teaching practices. Non-educative experiences were not discussed. The participants did not highlight strategies or talk about students not being engaged in a lesson.

Interaction deals with the personal and social aspects of an experience, whereas, situation describes the place. The participants detailed many personal and social aspects of their experiences during a time of adopting new pedagogical techniques. Through their stories they showed how their practices took on both reform-oriented and traditional characteristics consistent with the literature. They talked about how outside social influences of administrators, colleagues, and parents were factors of instructional decisions. The situation addressed in the interviews was the classroom environment and how it transformed as the educators grew in their profession.

Summary

This chapter uses arts based research to present the data as an ethnodrama in order to highlight the stories told by the three participants and myself during the data collection process. The ethnodrama is broken up into a prologue, three acts, and an epilogue. The prologue provides the background of the research proposal. The three acts focus on the educational careers of the participants. The first act, written as soliloquies, tells the stories of how each participant became a teacher. The second act describes the early teaching practices and influences for a typical Quality Core Curriculum classroom. The third act focuses on the participants' thoughts and

feelings towards the curriculum changes and highlights NCTM's eight teaching practices and the influences on those adjustments. The epilogue concludes the ethnodrama providing the data analysis.

The move from the Quality Core Curriculum to the Common Core State Standards entailed a shift in instructional strategies. The participants in the study used both traditional and reform-oriented teaching practices. Testing and collaboration were both important factors that determined what practices were used and how often. Dewey's theory of experience positioned the participants' stories in a certain time and place as well as detail the interactions of participants and their colleagues.

6 DISCUSSION AND CONCLUDING REMARKS

The purpose of this study was to investigate the teaching practices of high school mathematics teachers during a shift in curricular expectations. Each of the three participants chose to adapt their strategies based upon local, state, and federal mandates in an attempt to better meet the needs of their students. This study broadened the research on teaching practices affected by curriculum mandates, but created a platform for the stories of high school mathematics teachers to share their journey through participant interviews and personal documents. In this final chapter, I present a summary of the study outlining its significance and limitations. In addition, I will propose future recommendations for research and implications for teacher education.

Summary of the Study

The ethnodrama developed as the participants told their stories of educational change consisting of the struggles and triumphs they faced during a time of constant adjustments in curriculum, testing, and evaluation. I was in the classroom when the state rolled out the Georgia Performance Standards, but my role shifted with the adoption of the Common Core State Standards to a curriculum support for teachers. My feelings and transformations during this tumultuous time led me to the study of how high school mathematics teacher adapt and successfully change their practices. The three high school mathematics teachers shared their professional stories in search to answer the following research question: In what ways did the mandates to implement new curriculum influence the teaching practices of high school mathematics teachers? I was able to share my experiences and learn from theirs while collecting data through interviews and personal documents as we took a narrative inquiry journey together.

The focus, using Dewey's pragmatism, was on their experiences of adopting and adapting to changing expectations. The participants shared their educational journey from entering the profession, their changing teaching strategies, and what influenced those changes. The eight teaching practices from the National Council of Teachers of Mathematics (2014) were used as the cornerstones to gauge their shifting instructional strategies. The data collected through tape recorded interviews and personal documents showed the participants incorporated the practices on different levels. Some practices such as implementing tasks, facilitating discourse, posing purposeful questions, and promoting productive struggle became a platform for the teachers to show the progress they have made over the past few years as they have moved away from the traditional teacher-directed instruction. The journey the participants traveled down as they changed these practices shows their commitment to their profession. They have grown in many ways, but there is still room for growth.

The practices of establishing mathematics goals, use and connect mathematical representations, build procedural fluency from conceptual understanding, as well as elicit and use evidence of student thinking show the progress needed to be made as the journey continues. These latter practices show the work that needs to be done at the high school level on making connections within different mathematical representations and conceptual understanding and calls for the need of vertical teaming across the K–12 spectrum. As my analysis suggest, it is through collective collaboration and professional development that assists teachers in building their instructional toolbox because each participant brought their owl level of strengths and weaknesses.

Significance in Terms of Research

As White-Fredette (2009) points out "the teaching and learning of mathematics is a politically charged arena" (p. 171). Educational reform has limits because of the bureaucratic constraints put upon schools through assessment, accountability, and/or textbook and test publication industries (Stanic & Kilpatrick, 1992). Moral and ethical questions about what should be taught, how it should be taught, and who should have access are important considerations in curriculum reform decisions that need to be addressed by reformers, government officials, administrators, teachers, parents, and students (Stanic & Kilpatrick, 1992). These bureaucratic constraints and moral and ethical concerns were evident in the failures of the previous curriculum reform movements discussed in chapter 1. For Stanic and Kilpatrick (1992)

> The point is not that curriculum reform is inevitably doomed to failure because the questions are moral and ethical ones. The point is that reformers are doomed to failure who either neglect value dilemmas or assume that empirical evidence of one sort or another is sufficient to justify reform. Changes in society, in the economy, in the school population, or in the field of mathematics may be sufficient cause to reconsider what we teach to children in schools, but such changes do not in and of themselves justify particular decisions. (p. 415)

The impact of the bureaucratic constraints put upon the participants was evident throughout the interviews. Testing was a major issue for Theresa and was brought up in all three of her interviews. For her testing took away some of her freedom and time and replaced those positive features of teaching with limits and pressure (Interview 1). The burden to stay on pace to prepare for the high stakes end-of-year assessments made Elizabeth give up on more interesting tasks. She described an uncomfortable conversation she had with her math coach

about test scores that hurt her feelings (Interview 1), but as she has gained more experience she stressed that she does what she knows to do with students and "doesn't freak out" as much about the assessments. Dee showed no anxiety with the high stakes testing because she had more flexibility in her curricular decisions being that she taught non-tested academic courses.

The changing impact and use of the textbook was also brought up by all three participants. The textbook was the driving force behind curriculum decisions during the Quality Core Curriculum, but it took a backseat during the transition to the Georgia Performance Standards and Common Core State Standards. It has been a struggle for both the teachers and parents to adapt to a mathematics classroom without the typical textbook, but the minimal use caused the participants to look elsewhere for resources and to collaborate much more with their colleagues. All three participants talked about the power of the collaboration that occurred with the loss of the textbook.

Even with the constraints put upon the teachers, they worked hard to overcome and adjust their practices to meet the needs of their students. As educational decisions have shifted between local and state control

> educational accountability has become a state and national concern, as well as a mantra of public education. Teachers, as well as administrators, are being held accountable to the public for the academic performance of students in their charge. States have created curriculum frameworks and mandated testing systems that include high stakes attached to results in order to ensure high standards and accountability. (Vogler & Burton, 2010, p. 247)

With the passage of the Every Student Succeeds Act (ESSA) by the Obama administration in 2015, educational decisions are once again prioritized within the states. Georgia is in the process

of developing its plan that requires states to "develop plans that address standards, assessments, school and district accountability, and special help for struggling schools and students" (Georgia Department of Education, 2015b, para. 6). The highly politicized educational arena is evident in the many changes that take place during transitions between administrations.

Recommendations for Further Research

During my first interviews with the participants, as they were describing how they entered into the profession, I was intrigued by their robust experiences. Two out of the three participants in my study had experience at all three levels: elementary, middle, and high school. I started to wonder if their experiences at the different levels helped them to overcome the barriers that usually come when trying to make changes. One of the recommendations for future research is to compare the instructional practices of teachers with only high school experience to those that have experiences at multiple levels in education. It would be interesting to see if the more robust backgrounds lead to trying things outside of their comfort zones.

Because there is still limited research on high school mathematics teachers, there is a need for research at that level. Developing a better understanding of the decisions they make and the resources they use on a daily basis could be a good source of information for reform decisions. With the push towards getting students college and career ready, the high school classroom is an important factor in preparation. High school teachers can be a valuable resource for future reform initiatives.

Another recommendation to consider is to do research from the perspective of the student during the transitions made from the Quality Core Curriculum to the Common Core State Standards. I believe this would give insight into the actual affects the curriculum had on students.

Implications of the Study

The results of this study demonstrate that high school mathematics teachers are capable of adjusting their teaching practices to meet curriculum mandates. Through their stories, the participants detailed their personal practical knowledge[32] (Connelly & Clandinin, 1998; Clandinin, 2015) and reform-oriented strategies they adopted since the shifting expectations of the Georgia Performance Standards as well as the traditional ones they have fallen back on for various reasons. The participants highlighted their past and present experiences in the classroom on multiple levels as well as their future plans as they maneuver the multiple contexts of their present situation. Because of the complexity of a teacher's knowledge base and taking into account both the personal and social narratives of experience, Connelly and Clandinin (1998) use the metaphor of a professional knowledge landscape to highlight the interwoven and multiple layers of a teacher's storied experience. A teachers' professional knowledge landscape can be formed by professional development, teacher education programs, and school reform which are the implications addressed in this section.

The connection between professional development and changing teaching practices was discussed in the literature review chapter of this study (Jenkins & Agamba, 2013; McGee, Wang, & Polly, 2013). Sustained professional development "resulting in meaningful and long-lasting qualitative change in a teacher's thinking and approaches to educating, is an autonomous activity chosen by a teacher in search of better ways of knowing and teaching mathematics" (Castle & Aichele, 1994, p. 3). In order for mathematics teachers to successfully use professional development to change their practices there must be a supportive and collaborative environment.

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[32] The term "personal practical knowledge" is used by Connelly and Clandinin to portray teachers as knowledgeable and allows their past and present experiences as well as their future intentions to be displayed throughout their stories (Connelly & Clandinin, 1998; Clandinin, 2015)

Addressing teachers' needs, discussing impediments to growth, modeling best practices, allowing time for planning, reflection, and feedback (Clarke, 1994) as well as addressing their feelings and beliefs (Weissglass, 1994) are all needed for teachers to start making pedagogical changes to the way they teach mathematics.

As a school improvement specialist, I provide teachers with a lot of professional development. This research has assisted me in my work with K–12 educators. To bridge the gap between elementary and secondary education, I have created workshops where teachers at the secondary level can learn how to show some mathematical concepts conceptually (i.e. integer operations, solving equations, factoring). I developed a class called Increasing Student Achievement with Instructional Strategies and Vertical Teaming and used NCTM's eight teaching practices as the template for discussion and sharing strategies. I have seen the importance of vertical teaming and have started working with school systems to identify inconsistencies in their teaching practices. Even though this study has helped me grow as a school improvement specialist, this research has implications for others who facilitate professional development to promote teacher change during mathematics reform movements.

Teacher education programs also have their role in the development of changing mathematics instructional strategies. According to Vacc and Bright (1994),

> Although much effort has been focused on preparing in-service teachers to meet these new standards, there is also a need to modify preservice teacher education programs to ensure that graduates are prepared for, and will be significant contributors to, the reform movement in mathematics education. Without modifications in preservice teacher education, we will find ourselves constantly having to 'repair' teachers' backgrounds that do not fit the changing demands of the mathematics classroom. (p. 116)

Today's mathematics teachers not only need a thorough understanding of mathematical content, but they should be equally strong in helping students "do mathematics" which is learning through problem solving, reasoning, and making mathematical connections (Even & Lappan, 1994). This is a tall task and requires teacher education programs to reflect on how they structure their programs.

The last implication of this study relates to school reform. Reformers must realize that teachers have multiple stories that create their professional knowledge landscape, and this "landscape is not a blank slate on which new stories may be written by reformers" (Clandinin, 2015). In order for teachers to adopt reform mandates, they must find the middle ground between their stories and those imposed by the reform. Incorporating teachers' concerns and helping them overcome the challenges they encounter as they transform their stories will help them start the change process.

Closing Remark

At the start of this research journey, I wanted to tell the stories of educational change as high school mathematics teachers adjusted and adapted their long-held beliefs about instruction. My personal experiences made me wonder about others' experiences. I hope this study shed some light on the importance of research at the high school level as well as the passion held by that group of teachers.

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APPENDICES

APPENDIX A

TIMELINE

18th century (1701 – 1800) – culmination of the Enlightenment, American Revolution, Industrial Revolution

Birth of the United States of America (July 4, 1776)

Common School Movement (1820 – 1860)

Normal Schools (Vermont – 1823 and Massachusetts – 1839) → Teachers' Colleges

American Civil War (1861 – 1865)

Compulsory Attendance Laws (Massachusetts 1852, 1918 all 48 states)

Modern School System (1865 – 1890)

Progressive Education Movement (1890 – WWI)

Committee of Ten (1893)

Unified (Applied) Mathematics Movement (1894 – 1920)

World War I (1914 – 1918) – US entry into war 1917

Birth of the National Council of Teachers of Mathematics (1920)

The Great Depression (1929 – WWII)

Eight Year Study (1932 – 1940)

World War II (1939 – 1945) – US entry into war 1941

First Way of Educational Change (post-WWII until mid-1970s)

Cold War (1947 – 1991)

Modern (New) Mathematics Movement (1950s and 1960s)

Sputnik (1957)

National Defense Education Act (1958)

Elementary and Secondary Education Act (1965) – reauthorized every 5 years
- No Child Left Behind (2001 – Bush Jr.)
- Every Student Succeeds Act (2015 – Obama)

Back to the Basics (1970s)

Second Way of Educational Change (mid-1970s to mid-1990s)

Standards Movement (1980s)
- An Agenda for Action (1980)
- A Nation at Risk (1983)
- Standards Documents (1989, 1991, 1995, 2000, 2014)

Math Wars (1990s) – NCTM and California

Third Way of Educational Change (mid-1990s to early part of the 21st first century)

Fourth Way of Educational Change (21st century)

Common Core State Standards (2010 – present)

American Recovery and Reinvestment Act (2009 – Obama) – Race to the Top ($4.35 billion contest)

Georgia

- Quality Core Curriculum (1985 – 2008)
- Georgia Performance Standards (2005 – 2012)
- Common Core Georgia Performance Standards (2012 – 2015)
- Georgia Standards of Excellence (2015 – present)

APPENDIX B

RECRUITMENT LETTER

Jacqueline A. Hennings
Doctor of Philosophy Student

December _____, 2015

Mr./Ms. ,

I hope this letter finds you well. I am working on my doctorate at Georgia State University, and I have recently started the research stage of my Ph.D. program.

The reason I am contacting you is that I am looking for 5 research participants for my dissertation. I have listed the tentative title, problem statement, and research question below:

Title
How Do Curriculum Mandates Influence the Teaching Practices of High School Mathematics Teachers?

Statement of Problem
Currently, the state of Georgia, along with many others across the nation, is experiencing changes in curriculum and assessment coupled with higher teacher accountability. To meet the current adjustments, it is important for teachers to adapt their instructional strategies. This study will tell the stories of high school mathematics teachers making the changes recommended by the National Council of Teachers of Mathematics and the Common Core State Standards for Mathematics. Through qualitative narrative inquiry methodology using a pragmatic philosophical orientation based on John Dewey's theory of experience, the stories of five high school mathematics teachers able to embrace the curriculum mandates of the NCTM and CCSS will be conveyed.

Research Question
In what ways did the mandates to implement new curriculum influence the teaching practices of high school mathematics teachers?

Because of my work as a high school mathematics teacher implementing new curriculum as well as my experience as a school improvement specialist working with teachers, I believe your story of transition and adaptation is valuable to the mathematics community, especially for those high school mathematics teachers that are struggling on how to adjust their instructional strategies to meet the new curriculum requirements. Details of my thinking and the scholarship I am drawing upon can be found in my prospectus that I will forward to you via electronic mail. Please do not feel you have to read the entire document, but I wanted you to have more information of my study if you so wish.

Furthermore, I have provided information below about the professors serving on my doctoral committee.

Dr. Christine D. Thomas (Major Advisor)
Georgia State University
College of Education and Human Development
Middle and Secondary Education
http://education.gsu.edu/profile/christine-d-thomas/

Dr. David W. Stinson
Georgia State University
College of Education and Human Development
Middle and Secondary Education
http://education.gsu.edu/profile/david-stinson/

Dr. Jennifer Esposito
Georgia State University
College of Education and Human Development
Educational Policy Studies
http://education.gsu.edu/profile/jennifer-esposito/

Dr. Kimberly White-Fredette
Gordon State College
School of Education
kwhite-fredette@gordonstate.edu

The involvement from you during the research process would include the following:

1. Participating in three audio-recorded, semi-structured 30 minute interviews conducted by me. I would travel to you for the interviews. The first interview would collect background information and provide you the platform to tell your story of entering into the profession and making the multiple transitions in curriculum over the past few years. The second interview will focus on how you have changed your teaching practices to match the curriculum expectations. The last interview will focus on the National Council of Teachers of Mathematics eight teaching practices outlined in their book *Principles to Actions: Ensuring Mathematics Success for All* (NCTM, 2014). I will provide you with a copy of the book.

2. Providing documents to show how your teaching practices have changed over the years (e.g., copies of tasks, lesson plans, assessments, student work samples)
3. Keeping a journal to capture your ideas about how your instructional practices have evolved. I will provide you with a composition notebook for this purpose.

The interviews will be transcribed by myself, and the recordings and transcripts will be held in a secured locked box at my residence. Your documents and journal entries will be solely in my possession. The University has a very rigorous process of approving research through its Institutional Review Board, ensuring that research with human subjects maintains the highest ethical standards. You will be able to choose your pseudonyms (e.g., participant name, school, county) which will be used on all documentation pertaining to your part in the study to keep your identity confidential. In order to accurately tell your story, I will provide you with copies of all transcripts and the final version of your story after data analysis for input.

I know as an educator you time is extremely valuable, so I will try to make the time and effort required by you during the research study to be minimal.

I look forward to hearing from you. If you have any questions about participating in the study, please e-mail and/or call to discuss your concerns.

Thank you for your consideration.

Jacqueline A. Hennings

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APPENDIX C

INTERVIEW PROTOCOL

Interview Questions for Initial Interview (tentative follow-up questions are below but may be altered based on responses during initial interview):

The purpose of initial interview is to gather background information and provide teachers a platform to tell their story of entering into the profession and making the multiple transitions in curriculum over the past few years.

1. How long have you been teaching?
2. Tell me your story of how you became a teacher.
3. What influenced your teaching practices early in your career? Now?
4. There have been many changes in the mathematics curriculum since 2008. What are your feelings/thoughts about these past eight years of transition?
5. Describe your typical class period under the Quality Core Curriculum.
6. Describe your typical class period under the Georgia Performance Standards.
7. Describe your typical class period under the Common Core State Standards.

Interview Questions for Second Interview

The purpose of second interview is to focus on how teachers have changed their practices to match the curriculum expectations, however, follow-up question from the first interview many need to be asked. Participants will also talk about the documents they brought that show changes they made.

1. What does the term "teaching strategies" mean to you? Give examples.
2. Describe how your teaching strategies have changed/evolved over the past seven years.
3. What influenced the changes in teaching your strategies?

Interview Questions for Final Interview

The purpose of third interview is to focus on the National Council of Teachers of Mathematics eight teaching practices outlined in their book *Principles to Actions: Ensuring Mathematics Success for All* (NCTM, 2014), however, follow-up question from the second interview many need to be asked. Participants will be given a copy of the book and asked to review the eight

principles in order to tell how their practices have changed. Participants will also talk about the documents they brought that show changes they made.

1. After reading about NCTM's eight teaching practices, go through each one and highlight how you have changed your strategies with respect to the curriculum mandates imposed over the past seven years.

2. Which of NCTM's eight teaching practice(s) do you feel you have changed the most as we have transitioned the curriculum?

APPENDIX D

INFORMED CONSENT

Georgia State University
Department of Education and Human Development
Informed Consent

Title: How Do Curriculum Mandates Influence the Teaching Practices of High School Mathematics Teachers?
Principal Investigator: Dr. Christine D. Thomas
Student Principal Investigator: Jacqueline A. Hennings

I. Purpose:
You are invited to participate in a research study. The purpose of the study is to examine how curriculum mandates have shaped your teaching practices. You are invited to join because you have gone through the many changes and have adapted your practices to meet the mandates. A total of five participants will be recruited for this study. Participation will require approximately 5.5 hours of your time over the months of January 2016 to April 2016.

II. Procedures:
If you decide to participate, you will take part in three audio-taped 30 minute interviews. Jacqueline will travel to you. You will also be asked to provide documents to show how your practices have changed over the years (e.g., copies of tasks, lesson plans, assessments, student work samples). The last request will be to keep a journal to capture your ideas about how your practices have evolved.

III. Risks:
In this study, you will not have any more risks than you would in a normal day of life.

IV. Benefits:
Participation in this study may not benefit you personally. Overall, we hope to gain information about how high school math teachers adapt their practices to meet curriculum mandates.

V. Compensation
You will receive a copy of NCTM's (2014) *Principles to Actions: Ensuring Mathematical Success for All b*ook for participating in this study.

VI. Voluntary Participation and Withdrawal:
Participation in research is voluntary. You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may skip questions or stop participating at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

VII. Confidentiality:
We will keep your records private to the extent allowed by law. Dr. Christine D. Thomas and Jacqueline Hennings will have access to the information you provide. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board, the Office for Human Research Protection (OHRP)). We will use your selected pseudonyms rather than your name on study records. The information you provide will be stored at Jacqueline's house in a secured locked box as well as electronically on a password-protected computer. The audio recordings, documents, and journal entries will be stored in the lock box and computer to be kept until the dissertation is complete. After that time (December 2016), they will be destroyed. Your name and other facts that might point to you will not appear when we present this study or publish its results. In order to accurately tell your story, Jacqueline will provide you with copies of all transcripts and the final version of your story after data analysis for input.

VIII. Contact Persons:
Contact Dr. Christine D. Thomas at (404) 413-8065 or cthomas11@gsu.edu or Jacqueline A. Hennings at (770) 656-4429 or jkeuler@student.gsu.edu if you have questions, concerns, or complaints about this study. You can also call if you think you have been harmed by the study. Call Susan Vogtner in the Georgia State University Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, offer input, obtain information, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.

IX. Copy of Consent Form to Participant:
We will give you a copy of this consent form to keep.

If you are willing to volunteer for this research and be audio recorded, please sign below.

_____	_____
Participant	Date
_____	_____
Principal Investigator or Researcher Obtaining Consent	Date

APPENDIX E

PERMISSION TO REPRINT FIGURE

Jackie,

I am attaching the slides from Atlanta. I think you should be able to find what you need there.

Regarding permission, I think you can just cite the source at this point.

To appear in Smith, M.S., Steele, M.D., & Raith, M. L. *Taking Action: Implementing Effective Mathematics Teaching Practices in Grades 6-8*. Reston, VA: National Council of Teachers of Mathematics.

This book will be published in April. If the book is published before you finish your dissertation, you will need to get permission from the figure.

Best,
Peg