

5-11-2011

# Formative assessment: the implementation of Learnia and the impact on students' proficiency of the New Jersey Mathematics Standards

Nicole Santora

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FORMATIVE ASSESSMENT: THE IMPLEMENTATION OF LEARNIA AND THE  
IMPACT ON STUDENTS' PROFICIENCY OF THE NEW JERSEY

MATHEMATICS STANDARDS

by

Nicole Santora

Dissertation

Submitted to the Faculty of the  
Graduate School of Rowan University  
In partial fulfillment of the requirements

for a degree of

DOCTOR OF EDUCATION

in

Educational Leadership

May, 2011

Glassboro, NJ

Approved:

Martin W. Sharp, D.Ed.  
Chair

Ralph Ferrie Ed.D.  
Committee Member

Maria Sudeck Ph.D.  
Committee Member

Date:

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## DEDICATION

I would like to dedicate this dissertation to my family for their unconditional love and support during this endeavor. Especially to my mother, for your encouragement and assistance throughout the doctoral process; you have made my goal achievable.

## ABSTRACT

Nicole A. Santora

### FORMATIVE ASSESSMENT: THE IMPLEMENTATION OF LEARNIA AND THE IMPACT ON STUDENTS' PROFICIENCY OF THE NEW JERSEY MATHEMATICS STANDARDS

2011

Martin W. Sharp, Ed.D.  
Educational Leadership

The purpose of this action research project was to afford teachers with data regarding their eighth grade students' current levels of proficiency on the New Jersey's mathematics standard. Through professional development, teachers were provided with the opportunity to use these data to create an instructional plan in which they could focus their instruction on the specific standards in which their students were not demonstrating proficiency.

The data were collected through a comparison of student performance on the pre-assessment and post-assessment of the standards, interviews, questionnaires, and a leadership attribute survey. The first conclusion was that a formative assessment program had a positive effect on student proficiency of the mathematics standards. The second conclusion was that professional development had a positive effect on changing teachers' formative assessment practices. The third conclusion was that the researcher's leadership style had a positive impact on increasing students' proficiency of the mathematics standards.

## ACKNOWLEDGMENTS

I would like to thank the following members of my dissertation committee for their valuable insight, guidance, and support during this dissertation process:

Dr. Martin Sharp, Dissertation Chair, Rowan University

Dr. Ralph Ferrie, Dissertation Committee Member, Georgian Court University

Dr. Maria Sudeck, Dissertation Committee Member, Rowan University

I would also like to thank Brian Latwis for his motivation and continual support to further my education.

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## **CHAPTER I**

### **PROBLEM STATEMENT**

#### **Introduction**

Formative assessment is “a planned process in which assessment-elicited evidence of students' status is used by teachers to adjust their ongoing instructional procedures or by students to adjust their current learning tactics” (Popham, 2008, p. 6). It is a continual process by which educators gather data about a student’s current level of learning. These data should be used by educators to modify instructional and learning techniques in order to reach the desired goals or objectives (Heritage, 2007).

The purpose of this research project was to measure the impact of formative assessment on changing teachers’ instructional techniques and improving students’ proficiency on the state standards for mathematics. This project provided eighth grade mathematics teachers with formative assessments that were based on the benchmarks set forth by the state standards. Professional development was provided to these teachers. The professional development educated the teachers about the utilization of formative assessment data to drive instruction. Review sessions were also provided to a set of students identified to be in need of intense intervention.

#### **Background for the Research Project**

Research illustrates that formative assessment is a key component of effective teaching. Black and Wiliam (1998) completed a research review of formative assessment that included 250 book chapters and journal articles. This study concluded that formative assessment produces significant learning gains, especially with low-achieving students and those with learning disabilities (Black & Wiliam, 1998).

By utilizing formative assessment, teachers can adjust instruction throughout the course of learning to ensure they are meeting students' learning objectives (Herman, Osmundson, Ayala, Schneider, & Timms, 2006, p. 2). A study completed by the Division of Applied Measurement Research of the Educational Testing Service, concluded that formative assessment is a necessary part of the learning cycle (Rassi, 1999). It found that educators believed the following steps were taking place in the teaching-learning process: they taught the necessary knowledge and skills; what they taught was learned; what was learned was retained; and what was retained was applied effectively. These assumptions were not validated, leading the researchers to reason "that the differences between what has been taught and what has been learned need to be discovered during a student's course of study when something can be done by educators and/or students to remedy the situation" (Rassi, 1999, p.3).

### **Need for the Research Project**

The New Jersey Core Curriculum Content Standards (NJCCCS) were adopted in 1996 by the New Jersey Board of Education and are revised every four years. The standards mandate what students should know and be able to do after 13 years of public education. "The standards were influenced by national standards, research-based practice, and student need" (New Jersey Department of Education, 2006a). The mathematics standards were created with the goal "to enable ALL of New Jersey's children to acquire the mathematical skills, understandings, and attitudes that they will need to be successful in their careers and daily lives" (New Jersey Department of Education, 2006a). The standards used for this research project were revised in 2004.

The federal No Child Left Behind Act (NCLB), signed into law in 2002 by President George W. Bush, was comprised of four educational reform principles. It required all states to establish standards of accountability for school districts. Additionally, it mandated that all students participate in a state standardized assessment. The assessment must be based on the mastery of that particular state's academic content standards. In New Jersey, students need to master the Cumulative Progress Indicators (CPIs) in the NJCCCS and meet the proficiency criteria of the state standardized assessment. Students in grades three through eight have to receive a score of "proficient" or "advanced proficient" in mathematics and language arts. New Jersey created Adequate Yearly Progress (AYP) indicators that evaluate schools' progression at meeting the goals of NCLB (New Jersey Department of Education, 2008). After two years of not reaching AYP, school districts are required by the state to take specific intervention actions. After four years of not meeting AYP, the state may take action ranging from replacing personnel to deferring state funding.

In 2007, New Jersey introduced Learnia, a web-based formative assessment program created by Pearson Education. Learnia is a tool that can be used for measuring learning outcomes and providing the data needed to make decisions and guide instruction. Learnia's resources include "pre-existing benchmark assessments, aligned to New Jersey standards, pre-existing smaller tests for diagnostic analysis of CPIs and common student errors, as well as test authoring and score reporting capabilities" (Davy, 2008, p. 2). This program gives educators the ability to create their own benchmarks assessments by utilizing an extensive standards based question bank. Additionally, it has extensive data-reporting and data-analysis features that give educators the ability to

analyze each student's proficiency level on specific CPIs (New Jersey Department of Education, 2009a). Data from Learnia can be utilized to: show what should have been mastered; compare mastery of one student or group with comparable students and groups; determine the needs of individual students; and determine mastery of content standards (Pearson Professional Development Group, 2008). When this research project occurred, Learnia was being utilized by approximately 200 Local Educational Agencies (LEAs) in New Jersey. A study by the publisher of "the 22-26% of New Jersey students in grades 3-8 who participated in the *Learnia* formative-assessment program showed that in LEAs that fully implemented the system, students improved over the course of the school year" (New Jersey Department of Education, 2009a, p. 12). The district in which this research project occurred was one of the school districts that had applied and received permission to utilize Learnia. The researcher had been trained to implement Learnia prior to this research project, during the 2008-2009 school year.

During the 2007-2008 school year, the school district in which this research project took place began a three year initiative to have all students in eighth grade enrolled in Algebra I. During this first year of the initiative, the district implemented a new sixth grade curriculum aimed at meeting the CPIs set forth by the NJCCCS for both sixth and seventh grade mathematics. In the 2008-2009 school year, a pre-algebra curriculum was implemented in the seventh grade. In the 2009-2010 school year, when this project was implemented, all students in the eighth grade were enrolled in Algebra I. The district's Algebra I curriculum (2009) did not align with the NJCCCS for eighth grade. A teacher with 37 years of experience expressed concern that the eighth grade students would not be proficient on the state standardized assessment for mathematics.

The administrators in the district and the other eighth grade teachers also expressed this same concern. From these discussions, it was determined that for this research project, Learnia would be utilized to determine the students' current knowledge and guide instruction to ensure the students had the ability to be proficient on the eighth grade benchmarks of the NJCCCS for mathematics.

### **Statement of Purpose**

The purpose of this research project was to provide teachers data regarding their eighth grade students' current levels of proficiency on the benchmarks set forth by NJCCCS for eighth grade mathematics. Through professional development, teachers were provided with the opportunity to use these data to create an instructional plan in which they could focus their instruction on the specific NJCCCS standards in which their students were not demonstrating proficiency. By narrowing the scope of instruction, more focus could be given to student weaknesses in the standards versus student strengths; thus increasing student proficiency on the benchmarks set forth by the NJCCCS for eighth grade mathematics. This project was designed to answer three questions:

- 1.) How does utilizing a formative assessment program, such as Learnia, affect students' proficiency of the mathematics standards set forth in the New Jersey Core Curriculum Content Standards?
- 2.) In what ways will professional development change teachers' current formative assessment practices?
- 3.) What is the impact of the researcher's leadership style on improving student proficiency of the mathematics standards set forth in the New Jersey Core Curriculum Content Standards?

### **Scope of the Research Project**

This project was completed in a pre-kindergarten through 12th grade school district in New Jersey that is comprised of eight school facilities that educate over 3,750 students and employ over 400 staff members (New Jersey Department of Education, 2009b). New Jersey has organized school districts into seven categories based on their socio-economic status. This district is ranked in the second to highest category of socio-economic status. It is a high performing school district in which the high school is ranked as one of the top fifteen New Jersey high schools in 2010 (New Jersey Monthly, 2010). This project specifically took place in the district's two middle schools and included all five of the district's full time eighth grade mathematics teachers.

In this school district, the researcher was the Supervisor of Mathematics and Science for grades six through twelve. The researcher was directly responsible for the supervision and evaluation of 40 staff members within the two departments. The job responsibilities included the development of departmental goals, supporting teachers in instruction and assessment, providing professional development, and evaluating data to improve the mathematics and science programs.

### **Framework of the Research Project**

This research project was implemented from January 2010 through April 2010 and was divided into three cycles. Cycle I occurred from January until February. Cycle II occurred from February until April and Cycle III occurred from March until April. After all three cycles were concluded the participants completed a questionnaire about the researcher's leadership throughout the implementation of the entire research project.

During Cycle I the participants received professional development on formative assessment and the eighth grade students completed four formative assessments that aligned to the NJCCCS for Mathematics. The data collected for this cycle included the students' results on the formative assessments and a questionnaire completed by the participants in regard to the professional development workshop.

To begin Cycle II, the participants received professional development on how to utilize the data from the formative assessments to guide their instructional practices. The participants used this professional development to create individual action plans to address the needs of their students. At the end of this cycle, the students completed four assessments similar to the assessments completed during first cycle. Data for this cycle included the results of the four assessments and interviews in which participants shared their implementation plans.

For Cycle III, the data from the formative assessments in Cycle I were utilized to identify students in need of intense intervention. These students were invited to attend morning and afternoon review sessions. The participants that instructed these review sessions were provided with professional development on the lessons that were implemented during the sessions. The data for Cycle III included the results of the assessments from Cycle II and interviews with the participants that instructed the review sessions.

### **Limitations**

- 1.) This study was limited to five teachers located in one school district in New Jersey.
- 2.) This study was limited to only one grade level.



- 3.) The student sample size was between 234 and 265 students depending upon specific standards.

### **Definitions**

No Child Left Behind Act (NCLB) was signed into law in 2002 by President George W. Bush. It required states to create accountability measures for school districts.

New Jersey Core Content Curriculum Standards (NJCCCS) are the New Jersey state standards that were used to create the state standardized tests. These state tests were utilized to hold districts accountable under the No Child Left Behind Act. The standards were initially written in 1996 and are revised every four years. The standards used in this research study were revised in 2004.

Curriculum Progress Indicators (CPIs) are subsets of the standards listed in the New Jersey Core Content Curriculum Standards.

Learnia is a web based formative assessment program created by Pearson Education, Incorporated. It is an on-line tool that can be used to measure students' current understanding of the New Jersey Core Content Curriculum Standards. It provides extensive data and data analysis that can be utilized by teachers to guide their instruction. The name Learnia was changed to Limelight in 2010.

## **CHAPTER II**

### **LITERATURE REVIEW**

#### **Introduction**

This chapter provides a comprehensive review of the literature relevant to the background and implementation of a formative assessment program in a public school setting. This review includes an explanation of formative assessment, the different formative assessment types, techniques, strategies, and models, and the effect of formative assessment on instruction and student learning in a public school setting. In addition, the research regarding effective implementation of formative assessment, the leader's role in implementation and the use of professional development to change teachers' formative assessment practices is identified. In conclusion, this chapter provides research regarding formative assessment and mathematics, research on the formative assessment model used during this study, and the literature on research design.

#### **Formative Assessment**

Assessment of student learning should be a continuous, recursive process (Pearson Professional Development, 2008). Decisions to determine students' level of learning should be based on four aspects: students, systems, curriculum, and instruction (Pearson Professional Development, 2008). The first aspect, students, should include the expectations and outcomes of their learning. The second aspect, systems, refers to the systems or institutions in which the learning takes place. The third aspect, curriculum, includes the processes in which the students gain knowledge and develop skills (Pearson Professional Development, 2008). The last aspect that affects the determination of student learning is the effectiveness of instruction (Pearson Professional Development,

2008). Data from assessments can be utilized: to show what should have been mastered; to compare mastery of one student or group with comparable students and groups; to determine the needs of individual students; and to determine mastery of content standards (Pearson Professional Development, 2008). Formative assessment is one tool that can be used to measure the outcomes and provide the data needed to make these decisions and to analyze how to proceed (Pearson Professional Development, 2008).

The discussion of using formative assessment to guide student instruction only began one or two decades ago and is largely based on Scriven's definition (Herman et al., 2006). According to Black and Wiliam (2003), although Scriven was the first to use the term, it is Benjamin Bloom's definition that is generally accepted. Bloom (1974) states that formative assessments are intended to determine what the student has learned and what the student still needs to learn.

In general, these formative tests are not used to grade or judge the student and their main value is in providing feedback to both teacher and students on what aspects or elements of the learning unit still need to be mastered. The success or failure of mastery learning work is clearly related to the degree of efficiency of these formative tests in pinpointing the learning needs of each student (Bloom, 1974, p. 8).

The Council of Chief State School Officers (CCSSO) created a consortium in 2007 called Formative Assessment for Students and Teachers (FAST) in which Margaret Heritage was the collaborative advisor. The consortium published the following definition of formative assessment. "Formative assessment is a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and

learning to improve students' achievement of intended instructional outcomes”(CCSSO, 2010, para. 3).

Heritage (2007) defines formative assessment as “a systematic process to continuously gather evidence about learning. The data are used to identify a student’s current level of learning and to adapt lessons to help the student reach the desired learning goal” (p. 141). Heritage (2007) lists four core elements of formative assessment. The first element is the identification of the gap between a student’s current level of learning and the desired goals for that student. The second element is teacher feedback that “provides clear, descriptive, criterion-based information that indicates to the students where they are in the learning progression” (Heritage, 2007, p. 142). The third element is that students must be actively involved in the learning process. The last element is that formative assessment must be linked to learning progressions. The learning progressions should list the sub goals that lead to the ultimate goal (Heritage, 2007).

Popham defines formative assessment as “a planned process in which teachers or students use assessment-based evidence to adjust what they currently are doing” (Popham, 2008, p. 6). It is a planned process because it utilizes a “series of carefully considered, distinguishable acts on the part of teachers or students or both” (Popham, 2008, p. 7). Popham (2008) states that the assessment must be based on students’ level of performance on specific skills and understanding of specific knowledge. Additionally, teachers utilizing formative assessment have the opportunity to make instructional adjustments while still developing those skills and knowledge. Students can also utilize formative assessment to adjust their learning tactics (Popham, 2008).

Black and Wiliam (1998) define assessment as “all those activities undertaken by the teacher – and their students in assessing themselves – that provide information to be used as feedback to modify teaching and learning activities” (p. 140). It becomes formative when that information is utilized to adapting instruction to meet student needs. Black and Wiliam (1998) completed a research review that consisted of 250 sources. The purpose of this review was to answer three questions: “is there evidence that improving formative assessment raises standards”; “if there is evidence that there is room for improvement”; and “is there evidence about how to improve formative assessment” (Black & Wiliam, 1998, p. 140). Their research found that the answer to all three questions was “yes.” They studied the average improvement in test scores of students involved in formative assessment. Learning gains were measured by comparing the average improvement of a student involved in a formative assessment practice with typical students on the same tests. Their research concluded that formative assessment produces significant learning gains, especially with low-achieving students and students with learning disabilities (Black & Wiliam, 1998).

**Formative Assessment Types and Approaches.** There are two types of formative assessment: predictive and diagnostic. A predictive assessment is based on the state’s standardized assessment. A diagnostic assessment is based on a specific district’s curriculum. Both are used by teachers to aim their instruction at improving specific student needs (Starkman, 2006). These two types of formative assessment can be implemented using two formative assessment approaches: convergent and divergent. Torrance and Pryor (2001) found that teachers see the necessity of utilizing both approaches.

In the convergent formative assessment approach the goal is to find out if the student knows, understands, or can perform a specific task (Torrance & Pryor, 2001). This form of assessment is characterized by: precise planning; an analysis of the interaction between the student and the curriculum based on the curriculum; quantitative evaluations; and the student as a recipient of the assessment (Torrance & Pryor, 2001). Convergent formative assessment is based on a behaviorist view of learning. It has the intention to “find out if the learner knows, understands, or can do a predetermined thing” (Torrance & Pryor, 2001, p. 616). Convergent formative assessment is sometimes viewed more as repeated summative assessment or continuous assessment, rather than formative. Torrance and Pryor (2001) found that teachers believed that convergent formative assessment is important due to the “convergence of the curriculum and constraints on teacher time” (Torrance & Pryor, 2001, p. 628).

In the divergent formative assessment approach the aim is at discovering what the student knows, understands, or can do (Torrance & Pryor, 2001). It is characterized by flexible planning, an analysis of the interaction between the student and the curriculum based on the student, and descriptive evaluations. This form of assessment involves the student as the initiator and recipient of the assessment (Torrance & Pryor, 2001). Divergent formative assessment views assessment as accomplished both by the teacher and the student. It relies on a constructivist view of learning, based on Vygotsky’s belief that the intent of education is to teach in the Zone of Proximal Development (Torrance & Pryor, 2001). The Zone of Proximal Development “is typically thought of as each person’s range of potential for learning, where that learning is culturally shaped by the social environment in which learning takes place” (McInerney, 2005, p. 591). Torrance

and Pryor found that teachers recognized that divergent assessment is “powerful in fostering the social and intellectual conditions in the classroom which would lead to enhanced learning” (Torrance & Pryor, 2001, p. 628).

**Formative Assessment Strategies.** There are a variety of formative assessment strategies that can be utilized to gather data. Wylie, Goe, and Lyons (2009) identified over 80 formative assessment strategies. All of these strategies can be classified into three categories; “on the fly assessment”; “planned for interaction”; and “curriculum embedded assessments” (Heritage, 2007, p. 141). According to Heritage (2007), “on the fly assessment” occurs spontaneously during a lesson. The teacher uses this form of assessment to immediately alter the lesson. “Planned for interaction” occurs when the educator plans how he or she will assess student learning during a lesson (Heritage, 2007). “Curriculum embedded assessment” occurs when educators embed assessment at key points in the learning process or through ongoing classroom activities (Heritage, 2007).

In 1998, Torrance and Pryor (2001) developed a descriptive and analytic framework of formative assessment strategies. This framework outlined the descriptions of 14 different processes of formative assessment. It also included the teacher’s intention and the possible side effects for students.

The first process occurs when a teacher communicates task criteria to the students to ensure students’ work is on task, correctly paced, and meets the assignment criteria (Torrance & Pryor, 2001). This can lead to students’ increased understanding of the task and its principles. A second process is for the teacher to communicate quality criteria to the students, with the intent to enhance the quality of future work and promote

independence (Torrance & Pryor, 2001). This assists the students' understanding of quality work and aids in self-monitoring. The third and fourth processes observe students at work and the completed works to gain an understanding of how the students approached or achieved the task (Torrance & Pryor, 2001). Both of these processes promote teacher attention to the students and on students' work. The next process is to ask the students to clarify what steps have been taken or need to be taken on a task (Torrance & Pryor, 2001). This process allows an educator to: gain an understanding of what the students have completed and understand; to rearticulate the students' understanding; and to enhance the students' skills at summarizing, reflecting, predicting, and speculating.

Another formative assessment strategy outlined by Torrance and Pryor (2001) is to give or discuss evaluative feedback. According to Torrance and Pryor (2001) the intent of this form of assessment is to influence students' attributions and results in "enhanced motivation and self-worth when realized in a content of empowerment" (p. 620). Fisher and Frey (2009) also identified feedback as a formative assessment strategy. They define feedback as a system that uses three distinct components to improve student achievement. The first component is the clarification of the learning goal (Fisher & Frey, 2009). The teachers need a clear learning goal in order to align their assessment and students are more likely to focus on the task when they have a clear understanding of the ultimate goal (Fisher & Frey, 2009). The second component is the response to student work. These responses should refer directly to the learning goal and provide students with information about their progress at reaching the goal. Additionally, it should provide students with suggested actions to assist in reaching the intended outcome. "Ideally, teachers give



feedback as students complete discrete tasks that are part of a larger project so that students can use teachers' suggestions to better master content and improve their performance on a larger project" (Fisher & Frey, 2009, p. 22). The third component is the modification of instruction. Teachers utilize their analysis of student work to modify their teaching and future lessons.

Fisher and Frey (2009) identified student talk as another formative assessment strategy. In classrooms with high levels of student talk, students excel academically (Fisher & Frey, 2009). The use of questioning techniques as formative assessment elicit student talk by providing students with the opportunity to explain, justify, and clarify their thoughts in a specific content area. The following techniques can be utilized to prompt a student to derive the correct answer: providing words and phrases to obtain recall; providing overt reminders; asking for the reasoning behind the answer; and rewording of the question to minimize misunderstandings due to language (Fisher & Frey, 2009).

Marzano (2009) identified the action of students tracking their progress on assessments as a formative assessment strategy. In 14 different studies, teachers had students track their progress in one class and taught the same content in a second class without allowing students to track their progress. Students that tracked their own progress, on average, had a 32% point gain in their achievement (Marzano, 2009). Using a rubric to score assessments, students recorded their scores on a chart after completing each assessment. This approach provided students with a rubric to increase understanding of the learning objectives and a graphical representation of their progress (Marzano, 2009). To utilize this approach effectively, teachers must: address a single goal in all of

the assessments; grade from rubrics instead of a point system; and use different types of assessments. “This strategy involves multiple types of assessments, increases interactions between teachers and students, and provides students with clear guidance on how to enhance their learning” (Marzano, 2009, p. 87).

In a study, for the National Center for Research on Evaluation, Standards, and Student Testing, reflective lessons were identified as a formative assessment strategy. The purpose of reflected lessons is to communicate to teachers and students that the activities are opportunities to reflect on the students’ learning progress, not opportunities for graded assignments (Herman et al., 2006). There are two types of reflected lessons. The first type consists of activities that include: being able to interpret and evaluate graphs, predict-observe-explain, and examine short answer. The second type of reflective lessons is concept mapping tasks that engage students in the explanation of the relationships of various terms (Herman et al., 2006).

**Formative Assessment Models.** There exist a number of formative assessment models. These models are based on one or more formative assessment strategies. Formative assessment models can be created to specifically reach individual teacher’s needs, or can be a generalized model for all teachers. The research review in this section discusses four models.

Black, Harrison, Lee, Marshall, and Wiliam (2004) completed a formative assessment study funded by the Nuffield Foundation, called The King’s – Medway – Oxfordshire Formative Assessment Project. Extensions of this study were funded by the National Science Foundation. This study included two math teachers and two science teachers from six schools (Black & Wiliam, 2003). This project utilized four formative

assessment strategies: questioning, feedback through marking, peer and self-assessment, and formative use of summative assessments (Black et al., 2004). Each teacher devised his or her own individual formative assessment action plan (Black & Wiliam, 2003).

This research was based on four principles. The first is that effective formative assessment practices can only be utilized in the classroom if the teacher discovers his or her own way of incorporating the assessment into his or her instruction. Second, students must change their roles and become active participants in their learning (Black et al., 2004). Third, the teacher's role must also change to one of shared responsibility with the students. Last, there must be attention and reflection given toward the idea that assessment can support learning (Black et al., 2004). The quantitative evidence showed that formative assessment raised the standards of achievement on standardized tests that required constructed responses and assessed higher-order thinking skills (Black & Wiliam, 2003).

The Scotland's Assessment is for Learning (AifL) initiative was introduced as a national system for assessment to be implemented in 2007 by all Scottish schools. Priestley and Sime (2005) completed a case study of a primary school that adopted a whole school assessment reform using the principles of this initiative. Five areas of evaluation were identified: classroom approaches to formative assessment; "the extent to which pedagogy evolved in response to the strategies of formative assessment; the extent to which changes in pedagogy translated into greater levels of learner participation, and improved student motivation and behaviour"; the impact on teacher motivation and enjoyment; and "the potential for long term sustainability" (Priestley & Sime, 2005, p. 482). There were four forms of data: an analysis of school documents and policies;

observations of classroom practice; short conversations with teachers discussing the assessment techniques; and long interviews with the students, teachers, and building administrators (Priestley & Sime, 2005).

The evaluation of data supported the view that the project had been a success for the school. This was due to the fact that the initiative promoted reflection among teachers and emphasized the role of dialogue in learning (Priestley & Sime, 2005). The teachers reported benefits for the students and themselves. The benefits for the students included increased motivation to learn and greater levels of independent learning (Priestley & Sime, 2005). The benefits that the teachers reported for themselves included a perception of a reduced marking workload, and more flexibility and spontaneity in the classroom (Priestley & Sime, 2005).

Nicol and Macfarlane-Dick (2006) completed a research study on formative assessment within a model of self-regulated learning. Self-regulated learning requires students to have a goal and is based on the “degree to which students can regulate aspects of their thinking, motivation, and behavior during learning” to reach that goal (Nicol & Macfarlane-Dick, 2006, p. 2). This model begins with the assignment of a learning task. The student then draws upon prior knowledge and motivational beliefs to construct an interpretation of the task and to set goals (Nicol & Macfarlane-Dick). External feedback is then provided to the student through the teacher or a peer. In order to be effective, this external feedback needs to be “interpreted, constructed, and internalized” (Nicol & Macfarlane-Dick, 2006, p. 5).

This model identified seven principles of good feedback “that address a wide spectrum – the cognitive, behavioural, and motivational aspects of self-regulation” (Nicol

& Macfarlane-Dick, 2006, p. 15). These principles include: clarifying the expectations of good performance; facilitating the development of self-assessment; delivering quality information to students about their learning; encouraging teacher and peer dialogue about learning; encouraging motivation and self-esteem; providing opportunities to close the gap between current and desired performance; and providing information to teachers about instruction (Nicol & Macfarlane-Dick, 2006).

Torrance and Pryor (2001) completed a research project called Investigating and Developing Formative Teacher Assessment in Primary Schools (TASK). Based on their research, the team created a model of classroom assessment that was “an intersubjective social process situated in, and accomplished by interaction between students and teachers” (Torrance & Pryor, 2001, p. 616). The purpose of this action research was to discuss with the teachers their theories of learning and assessment, to support the teachers in investigating their classroom practices, and developing knowledge.

This action research was comprised of two phases. The first phase consisted of seven teachers who investigated their classroom practices through audio and video recordings, research diaries, and samples of student work (Torrance & Pryor, 2001). Five teachers advanced to the second phase, which was the exploration of specific interventions and new approaches. “The project confirmed that formative classroom assessment is a key theoretical and practical interface for teachers to engage in research and development on teaching and learning” (Torrance & Pryor, 2001, p. 627).

**Implementing a Formative Assessment Program.** Heritage (2007) lists four elements of teacher knowledge and four elements of teacher skills that enable teachers to effectively implement formative assessment practices in the classroom. The first element of teacher knowledge is domain knowledge. This refers to the “concepts, knowledge, and skills to be taught within a domain, the precursors necessary for students to acquire them, and what a successful performance in each looks like” (Heritage, 2007, p. 142). Teachers use this knowledge to define learning progressions and the intended outcome. The second element is pedagogical content knowledge (Heritage, 2007). Teachers must know a variety of instruction models and be able to choose the appropriate model for the content. The third element is the knowledge of students’ previous learning. In order to build upon previous learning, teachers must understand the students’ previous knowledge of the content, their understanding of concepts, their level of skill, their attitudes about the content, and their language proficiency (Heritage, 2007). The last element of teacher knowledge is assessment knowledge. Teachers must know about formative assessment strategies and how to align these strategies to their learning goals (Heritage, 2007). The four skills that teachers need to successfully implement formative assessment include: creating a classroom culture that supports assessment; teaching students to self-assess; interpreting data; and matching their instruction to the gap between student understanding and the desired goals (Heritage, 2007).

Heritage (2007) states that in order for formative assessment to be an “integral part of professional practice, there needs to be a major investment made in teachers” (p. 145). According to Heritage (2007), all levels of educational leaders should commit to

this investment. Educational leaders should “establish structures and provide resource that support effective professional development” (Heritage, 2007, p. 145).

Priestley and Sime (2005) discovered in a case study of a whole school reform using Scotland’s Assessment is for Learning initiative (AifL) “the role of leadership, and the impact that a single motivated person can have in providing impetus and support for change” (p. 484). Strong leadership, support, and the allocation of resources are needed when changing teachers’ formative assessment practices (Priestley & Sime, 2005). They found that the enthusiasm of a school leader can be translated into the actions and activities happening in the school by providing the initial impetus and the continuing support (Priestley & Sime, 2005). The data from the study concluded that positive impetus is crucial in order to overcome the teachers’ lack of confidence (Priestley & Sime, 2005). Teachers placed value in the support that was given from the school administrators. Additionally, the availability of professional development and collaborative planning time for teachers benefited the school’s ability to change and implement formative assessment (Priestley & Sime, 2005).

Dekker and Feijs (2005) completed a research study on the influence of professional development on the implementation of a formative assessment program. The study, Classroom Assessment as a basis for Teacher Change project (CATCH), was a collaborative effort involving mathematics education researchers at the Wisconsin Centre for Educational Research at the University of Wisconsin-Madison and the Freudenthal Institute at the University of Utrecht, the Netherlands (Dekker & Feijs, 2005). This study was created to develop and implement a professional development program that would change middle grade mathematics teachers’ instruction by changing their formative

assessment techniques. Research showed that “when curriculum changed and learning goals became more process-oriented, teachers in the United States often showed limited understanding of formative assessment practices and, as a consequence, provide students with incomplete information about their progress” (Dekker & Feijs, 2005, p. 237).

Teachers and administrators, who participated in CATCH, had to complete a specific professional development program. The first step was to complete a seminar in which both teachers and administrators learned and critiqued existing assessment resources (Dekker & Feijs, 2005). Teachers used this knowledge to select and adapt assessment techniques to use in their own classroom. While using these techniques, “teachers examine the role and function of assessment instruments versus the desired learning outcomes and the potential for positive feedback” (Dekker & Feijs, 2005, p. 238).

The results of this study were found by analyzing classroom observations, structured teacher participant interviews, assessment portfolios, and an exit survey. Evidence from this study showed a change in teachers’ attitude toward assessment and their assessment practices (Dekker & Feijs, 2005). Additionally, analysis of the interviews showed that teachers require support in order to ensure change in formative assessment strategies. The most substantial support was the “frequent personal contact with colleagues, whether through professional meetings or through informal contacts (Dekker & Feijs, 2005, p. 252). Support from professional development and assessment materials also contributed to successful change (Dekker & Feijs, 2005).

Torrance and Pryor (2001) found that in order to develop effective formative assessment, pedagogical self-awareness must be developed first. Teachers “must be able



to investigate and reflect upon their own classroom practices – particularly the way they question and give feedback to students” (Torrance & Pryor, 2001, p. 629). This enables them to relate their own practices to different theories of learning and different types of formative assessment. In order to develop pedagogical self-awareness, teachers need resources to develop an understanding of formative assessment practices (Torrance & Pryor, 2001). This increases the teachers’ knowledge on the strategy and gives them a comparison to their own practices. Additionally, it provides a starting point for a change in their formative assessment practice (Torrance & Pryor, 2001).

A study funded by the National Science Foundation and The National Center for Research on Evaluations, Standards, and Testing researched the implementation of curriculum embedded formal formative assessment into an inquiry based science curriculum (Ayala et al., 2008). The formative assessments were formal and embedded because they were used at specific critical times in the curriculum sequence instead of just at the end of the unit (Ayala et al., 2008).

During the first phase the team planned, designed, and developed the embedded formative assessment (Ayala et al., 2008). This process began with the mapping of the curriculum and the identification of the learning goals. From the learning goals, the team determined how the embedded formative assessment would reflect those specific goals (Ayala et al., 2008). The team also identified critical junctures in the curriculum in which these assessments would occur.

The second phase consisted of the implementation of the embedded formative assessment. During this phase, the team learned that: teachers treated the formative assessment like any other test; feedback to the students was not immediate; and “teachers

needed increased structure on how to implement the embedded formative assessment and how to take advantage of the ‘teachable moments’ provided by these tasks” (Ayala et al., 2008, p. 321). These findings suggested that the embedded formative assessment should be: reduced in number; short and focused on key outcomes; administered in at most two class periods; provide immediate feedback; provide opportunity for students to test their explanations; and prepare the students for the next topic (Ayala et al., 2008).

The study concluded that there are six considerations that must be attended to when implementing embedded formal formative assessment. The first is the need for collaboration between the curriculum and assessment specialists to create seamless assessment tasks (Ayala et al., 2008). Second, professional development must be provided to the teachers to develop the concept of formative assessment. Third, the assessment must not only reflect the curriculum but the goal of the curriculum (Ayala et al., 2008). Fourth, the creation of a learning trajectory is an important tool to guide instruction. The fifth consideration is the understanding of the teacher’s pedagogical skills in implementing the assessment. The last consideration is that embedded formative assessment should remind teachers to reflect on the learning of students (Ayala et al., 2008).

Heritage, Kim, Vendlinski, and Herman (2008) completed a research study for the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) to measure teachers’ understanding of how to utilize formative assessments of mathematical concepts. This study was based on the concept that teachers can utilize formative assessment to determine the gap between the instructional goals and what the

student has learned. That information should be used to plan the next instructional step (Heritage et al., 2008).

The purpose of this study was to identify the effectiveness of POWERSOURCE<sup>®</sup>, a formative assessment program developed by CRESST. This program was expected “to influence teachers’ domain knowledge and pedagogical content knowledge and assessment practices in key principles” of Algebra I (Heritage et al., 2008, p. 2). This included the knowledge teachers use to interpret students’ mathematical understanding, plan instruction, provide student feedback, and explain mathematical ideas. The measure was a series of performance tasks in which teachers had to analyze student assessment responses and answer questions based on these responses (Heritage et al., 2008).

The study found that “regardless of the math principle, determining the next instructional steps based on the examination of student responses tends to be more difficult for teachers,” than “identifying the principle and drawing inferences about students’ understanding” (Heritage et al., 2008, p. 10). In order to utilize the data provided by formative assessment to plan instruction, teachers need to have a clear concept of how the learning progresses throughout the curriculum and an understanding of the precursor skills and knowledge. Additionally, teachers need to have exemplars of good performance on the desired goals and an understanding of how the learning goal will continue to develop (Heritage et al., 2008).

### **Learnia**

Learnia was created in response to New Jersey’s Department of Education’s request for a diagnostic assessment. The request outlined four specific goals: to foster assessment literacy at the district level and promote formative assessment as an

instructional tool; to provide the tools and resources for this formative assessment; to provide resources for districts to create benchmark assessments; and to provide resources to assist both teachers and students in preparing for the state standardized assessment (Twing, Young, Shimko, & Schmidek, 2010). Learnia offers teachers the tools they need to create a profile of students' progress, throughout an academic year, toward mastering the New Jersey Core Curriculum Content Standards (NJCCCS). Learnia has multiple choice and constructed response items that reflect the NJCCCS standards and are at the same level of difficulty as the test questions utilized on the state standardized assessment (Twing et al., 2010). This formative assessment is internet based and automatically scores the assessment. It provides teachers with data that outline individual student progress toward mastery of the standards and classroom assessments.

Pearson Education Incorporated analyzed existing Learnia data to determine the efficacy of the formative assessment program. Because this study was not conducted as a controlled experiment, it does not constitute a complete efficacy study (Twing et al., 2010). The Learnia program provides two pre-created formative assessments in both mathematics and reading for grades three through eight. They are referred to as Form A and Form B. To determine the efficacy, the researchers used the data from an initial or pre-assessment (Form A) and the data from a conclusive or post-assessment (Form B). In the study, 7,956 eighth grade students completed both forms of the assessment (Twing et al., 2010). To measure the effect size, the mean difference of the two forms of assessment was divided by the standard deviation difference. For the eighth grade, the effect size was 0.532 (Twing et al., 2010). The researchers used Cohen's criteria to interpret the effect sizes. In this criteria model, an effect size of 0.20 demonstrates a small effect, 0.50

demonstrates a medium effect, and 0.80 demonstrates a large effect (Twing et al., 2010). Based on Cohen's criteria, utilizing Learnia in eighth grade had a medium efficacy.

### **Research Design**

Research design refers to the plans and procedures used in a research project to collect and analyze data (Creswell, 2009). Mixed methods research is a combination of both qualitative and quantitative research. Qualitative research "is a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem" (Creswell, 2009, p. 4). The data are usually collected in the participants' settings and data analysis is based on the researcher's interpretation. Quantitative research "is a means for testing object theories by examining the relationship among variables" (Creswell, 2009, p. 4). The data are usually collected numerically and data analysis is based on statistical procedures. The mixed methods research design was created to neutralize the limitations and biases created by only utilizing a qualitative or quantitative approach. Creswell (2009) identifies three mixed method research design strategies: sequential mixed methods, concurrent mixed methods, and transformative mixed methods. The mixed method design strategy for this research project will be concurrent mixed methods. In this strategy, the researcher merges both the quantitative and qualitative data for analysis. The researcher "collects both forms of data at the same time and then integrates the information in the interpretation of the overall results" (Creswell, 2009, p. 14).

## **CHAPTER III**

### **METHODOLOGY**

#### **Introduction**

This research project was completed using the practical action research paradigm. Action research “is a process of systematic inquiry, usually cyclical conducted by those inside a community rather than by outside experts; its goal is to identify action that will generate some improvement the researcher believes is important” (Hinchey, 2008, p. 4). Practical action research is a process in which a local problem is identified and systematic inquiry is utilized to develop methods to improve the problem. Specifically, this project is known as process-product research and can also be referred to as prescriptive research. Process-product research identifies the relationship between a process and the outcomes (Hinchey, 2008). This project analyzed the relationship between the process of utilizing formative assessment and the outcomes of the students’ proficiency on the New Jersey Core Content Curriculum Standards (NJCCCS). This action research project involved the development of a plan, the identification of research questions, and a cyclic process using this basic model: plan, act, observe, and reflect.

#### **The Development and Identification of Research Questions**

The research plan was developed based on a reflection of four components. The first component entailed the school setting including district goals and objectives for the academic school year. The second component was the researcher’s position in the school district and the scope and sequence of the job responsibilities. The next component was the identification of an area of concern within both the scope and sequence of the researcher’s position and the school community. The last component was the

consideration of the participants involved this project. From these components, the research questions were developed.

### **The Setting**

The district for this research project, located in Union County New Jersey, is a PreK-12 school district that is comprised of eight school facilities that serve over 3,750 students and employ over 400 staff members (New Jersey Department of Education, 2009b). The goals of the district include personalized learning and the fostering of higher order thinking skills. “Personalized learning is a critical district focus as student learning styles, interest inventories, and individual student talents are identified and addressed” (New Jersey Department of Education, 2009b). All teachers in the district had training in the Teaching for Understanding model of curriculum design and teaching. The purpose of this model was to “facilitate enduring concept understanding and the transfer of knowledge in real-life situations” (New Jersey Department of Education, 2009b). The district recognized the need for staff development opportunities and its positive effect on both teacher and student growth. It was teamed with Seton Hall University in a professional development initiative in which teachers worked with college professors on a variety of action research projects. This research project took place at two of the district’s schools.

Alpha School was comprised of grades kindergarten through eight. The school’s mission was “to create a learning environment that encourages individual as well as interpersonal growth, a love of learning, and a commitment to improving and caring for the community” (New Jersey Department of Education, 2009b). Over 91% of the students participated in one or more school related extra-curricular activities.

Beta School was comprised of grades three through eight. The school was “committed to nurturing students while involving them, along with their parents and teachers, in an educational environment that emphasizes cooperation, discovery, and the enjoyment of learning” (New Jersey Department of Education, 2009b).

Both schools had a middle school program for students enrolled in grades six through eight. This program used a team approach in which “teachers from each academic area meet daily to plan interdisciplinary units, review student progress, identify problems students are facing and to confer with parents when the need arises” (New Jersey Department of Education, 2009b).

### **Participants**

The participants in this research project consisted of the two eighth grade mathematics teachers at Alpha School and the three eighth grade mathematics teachers at Beta School. All five full time teachers were asked to participate in this research project on a voluntary basis. These teachers differed in experience and were male and female. The classes in which they taught varied in levels and student ability.

### **Research Questions**

The purpose of this research project was to provide teachers data regarding their eighth grade students’ current levels of proficiency on the benchmarks set forth by NJCCCS for eighth grade mathematics. Through professional development, teachers were given the opportunity to use these data to create an instructional plan in which they could focus their instruction on the specific NJCCCS standards in which their students were not demonstrating proficiency. By narrowing the scope of instruction, more focus could be given to student weaknesses in the standards versus student strengths; thus



increasing student proficiency on the benchmarks set forth by the NJCCCS for eighth grade mathematics. This project was designed to answer three questions:

1. How does utilizing a formative assessment program, such as Learnia, affect students' proficiency of the mathematics standards set forth in the New Jersey Core Curriculum Content Standards?
2. In what ways will professional development change teachers' current formative assessment practices?
3. What is the impact of the researcher's leadership style on improving student proficiency of the mathematics standards set forth in the New Jersey Core Curriculum Content Standards?

### **The Cycles**

Action research is comprised of a cyclic approach. Each cycle follows the same course of action: plan, act, observe, and reflect. This research project consisted of three cycles. Cycle I included professional development on formative assessment, and the implementation of Learnia. Cycle II included professional development, the utilization of formative assessment to drive instruction, and another implementation of Learnia. Cycle III included professional development and the implementation of specific review sessions based on the data collected from Learnia during Cycle I.

**Cycle I (January 2010-February 2010).** In January 2010, the researcher used Learnia to create four assessments. These assessments were created to formatively assess students' proficiency of the benchmarks set forth by the NJCCCS. The NJCCCS for mathematics consists of five standards: Number and Numerical Operations; Geometry and Measurement; Patterns and Algebra; Data Analysis, Probability, and Discrete

Mathematics; and Problem Solving. Each assessment was based on a specific standard except for the Problem Solving standard. This standard was able to be woven into the assessments of the other four standards.

Once the assessments had been generated, the researcher created and facilitated a 45 minute professional development session at each middle school for all of the participants in this project. To begin the professional development workshop, the teachers were given an overview of formative assessment and its implications. Afterward, the teachers were provided with directions for implementing Learnia as a teacher and utilizing Learnia as a student (Appendix A). The researcher assisted the teachers as they learned the program from both perspectives.

At the end of January 2010, the four Learnia assessments were administered to the students during their regularly scheduled mathematics class period over a two day time span. The students completed two assessments per day. Each student was required to complete the Internet based assessment by utilizing either a desktop computer in the media center or a laptop computer in the classroom. The students were given calculators, writing utensils, and blank sheets of paper to assist them in solving the problems.

After the assessments were administered, teachers were provided with another 45 minute professional development workshop. The focus of this workshop was to provide the teachers with directions and assist them in accessing the data provided by Learnia.

The data collected for this cycle consisted of the students' performance on the four Learnia assessments and a questionnaire (Appendix B) completed by the participants on the effectiveness of the professional development sessions. The results of the students'

performance on the Learnia assessments were utilized in Cycle II to guide teachers in the development of standards based lessons. The feedback received from the questionnaires on the professional development workshops was used to plan the next professional development workshop.

**Cycle II (February 2010-April 2010).** In February 2010, after the completion of Cycle I, all eighth grade teachers received a three hour professional development workshop on utilizing Learnia data to formatively assess students' proficiency on the benchmarks set forth in the NJCCCS for eighth grade mathematics and use these data to guide their classroom instruction (Appendix C). Each teacher analyzed the Learnia data specific to individual student's and individual class's proficiency of the different NJCCCS mathematics standards. The teachers identified the specific Curriculum Progress Indicators (CPIs) in the standards where they needed to focus their instruction to increase student proficiency. The researcher assisted each teacher with developing an individual plan for addressing these identified areas in his or her classroom instruction. The analysis of the data from Cycle I showed that the majority of students regardless of their ability level and their teacher were not meeting the proficiency benchmarks from the Data Analysis, Probability and Discrete Mathematics Standard. All teachers developed a plan to increase the proficiency of that particular standard in every one of their classes. Over the next 60 days, teachers utilized these plans to guide their classroom instruction.

In April 2010, the researcher created another four Learnia assessments. These assessments were modeled after the formative assessments that were previously given in Cycle I. These assessments were comprised of different questions than the assessments from Cycle I; however they consisted of the same number of questions, addressed the

same CPIs, and had the same level of difficulty. During the second week of April 2010, the Cycle II Learnia assessments were administered to the students following the same procedures as when the Cycle I Learnia formative assessments were administered.

The data collected for Cycle II consisted of the results from the Cycle II Learnia assessments, interviews with the participants, and a questionnaire completed by the participants. The individual student data from the Cycle II Learnia assessments was compared with the individual student data from the Cycle I Learnia assessments to determine the effect of formative assessment on student proficiency of the benchmarks set forth by the NJCCCS for eighth grade mathematics. The teachers were interviewed during the last week of March 2010 to determine how they were using the data from Cycle I to guide their classroom instruction and to interpret the teachers' thoughts in regards to utilizing information provided by formative assessment to guide their instruction (Appendix D). The teachers were asked to complete a questionnaire and a Leadership Attribute Survey at the end of Cycle II (Appendix E). Both the questionnaire and the survey were created to interpret the impact of the researcher's leadership style on this project and to interpret whether this project will lead to sustainable change in the teachers' instructional methods to ensure the students are proficient in the NJCCCS.

**Cycle III (March 2010-April 2010).** The purpose of Cycle III was to provide students identified as needing intense intervention with review sessions specific to the standards. With authorization from the district, two of the participants and one of the seventh grade teachers in the district were approved to provide these students with six morning and afternoon review sessions on specific NJCCCS eighth grade mathematics standards. To identify which students were going to be invited to these review sessions,

three criteria were utilized: individual student data from the Cycle I Learnia assessments, students' proficiency of the seventh grade NJCCCS standards based on their performance on the seventh grade state standards based assessment; and teacher recommendations. Students that were not proficient on either of the assessments and were recommended by their teachers were designated to attend the review sessions. The parents and/or guardians of the identified students received a letter inviting their students to attend these review sessions.

The review sessions were designed to consist of three different lessons. Each lesson was presented at two of the review sessions, one in the morning and one in the afternoon, in order to accommodate students' extra-curricular obligations. The Cycle I Learnia assessments were analyzed to determine which standards needed to be addressed in these lessons. The analysis showed that the students needed extra support in meeting the benchmarks set forth in these three standards: Number and Numerical Operations; Geometry and Measurement; and Data Analysis, Probability, and Discrete Mathematics. The Geometry and Measurement standard was identified as the standard most in need of intense intervention. The researcher created two lessons to address this standard and a third lesson to address Number and Numerical Operations. Although, the Data Analysis, Probability, and Discrete Mathematics standard was identified, a lesson was not created to address this standard because it was already being addressed by every participant in Cycle II. Before the review sessions began, each of the Cycle III participants attended a professional development workshop. The focus of this workshop was the implementation of the lessons for the review sessions.

The data utilized in Cycle III were the data from the Cycle I Learnia assessments, the data from the Cycle II Learnia assessments, and interviews with the participants of Cycle III (Appendix F). The data from the Cycle I Learnia assessments were compared with the data from the Cycle II Learnia assessments for the students that attended the review sessions and the students that were invited to attend sessions and did not. This analysis was used to determine the effectiveness of these review sessions on improving student proficiency on the benchmarks set forth by the NJCCCS for eighth grade mathematics. The participants of Cycle III were interviewed to determine their thoughts in regards to the effectiveness of the review sessions.

## **CHAPTER IV**

### **FINDINGS**

#### **Introduction**

This chapter is divided into two sections. The first section explains the findings of the study. Specifically, it analyzes the students' proficiency levels on the Cycle I and Cycle II assessments, the data from the Cycle I interviews, the results from the questionnaires in Cycle I and Cycle II, and outcomes of the Leadership Attributes Survey. The second section is a discussion of these findings in relation to the research questions.

#### **Findings**

During Cycle I from January 2010 until February 2010, students completed four Learnia assessments based on the standards in the NJCCCS for mathematics. Each assessment focused on one of the standards. The first assessment was based on the Number and Numerical Operations standard. Twelve questions that pertained to this standard were chosen from the Learnia test bank to create the assessment. For the second assessment, which focused on Geometry and Measurement, 19 questions were chosen. The third assessment had 16 questions that assessed the Patterns and Algebra standard. The last assessment had seven questions that pertained to the Data Analysis, Probability, and Discrete Mathematics standard.

To begin Cycle II, which lasted from February 2010 until April 2010, teachers were provided with the data from the formative assessments and were given professional development on how to utilize that data to drive their classroom instruction. After 12 weeks, at the end of Cycle II, the students took four more Learnia assessments. These

Learnia assessments were modeled after the assessments from Cycle I. They were comprised of the same number of questions as the first assessments and addressed the same standards. In the seventh week of Cycle II, each teacher was interviewed. During this interview, the teachers were asked to explain the change, if any, in their instructional methods after being provided with the Learnia data. They were asked to state their opinion of the data provided by Learnia. The teachers also completed a questionnaire regarding the professional development workshops and a leadership attributes survey about the researcher.

Cycle III, which began in March 2010 and ended in April 2010, focused on creating and implementing review sessions that provided intense intervention for students deemed in need. To analyze the results of this cycle, the change in score of the Cycle I assessments and the Cycle II assessments for the students that attended the review sessions was compared with the change in score for those students that were recommended to attend the sessions, but did not. The teachers that facilitated the review sessions were interviewed at the end of the sessions in regards to their views about the effectiveness of implementing the review sessions.

The data presented in the first five subsections were organized by teacher. The data show the percentage of students assigned to each teacher that had an increase in score, no change in score, and a decrease in score between the first and second Learnia assessment. Additionally, the data show the number of students that had a change in proficiency level from the first to second assessment. Learnia assigned students to four levels of proficiency based on their assessment score. If a student scored between 0 and 54 on a Learnia assessment they were classified as below basic. A score between 55 and



70 classified the student as basic. Students were proficient if they scored between 71 and 85, and students that scored between 86-100 were classified as advanced proficient. The data from the teacher interviews were also explained.

The subsequent subsection provides data regarding those students that were identified as needing intense intervention and recommended to attend review sessions. The data were used to analyze the increase in scores between the first and second assessments for the students that attended the review sessions and the students that were recommended to attend and did not. The data from the interviews with the teachers about the review sessions are also in this subsection.

The next subsection explains the data regarding a questionnaire on professional development. Two professional development workshops were given. The first workshop occurred during the beginning of Cycle I, to provide teachers with information regarding formative assessment and the Learnia program. The second professional development workshop occurred at the beginning of Cycle II, to assist teachers in analyzing the data and utilizing the data to guide their instructional plan.

The last subsection analyzes the data from the Leadership Attributes Survey. This survey had nine questions in regards to the researcher's leadership style and its impact on this study. This survey was collected anonymously from the participants and was completed at the end of Cycle II and Cycle III.

**Teacher AC.** Teacher AC had two years of experience and taught two sections of eighth grade mathematics when this study occurred. The first section was a standard level Algebra I course. The second section was called Small Group Algebra I. This section was

comprised primarily of students that have been identified to struggle in mathematics. Teacher AC co-taught this section with a special education teacher.

During the interviews in Cycle II, Teacher AC stated that in the past, he would utilize test preparation books for the state standardized test to ensure his students were proficient on the NJCCCS standards. With the Learnia data, Teacher AC changed his practice. He discussed with his classes their deficiencies in regards to the specific standards. He then created problems similar to those on the Learnia assessment to better reach his students' needs. He felt that Learnia allowed him the opportunity to hone in on key topics.

In Teacher AC's classes, of the students that completed the Learnia assessment for Standard One in both Cycle I and Cycle II, 36% had an increase in score, 24% had no change in score, and 40% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For Standard Two, 75% of the students had an increase in score, 8% had no change in score, and 17% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Of the students that completed both assessments for Standard Three, 31% had an increase in score, 19% had no change in score, and 50% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For the fourth standard, 54% of the students had an increase in score, 29% had no change in score, and 17% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Table 1 shows the number of students in Teacher AC's classes whose proficiency level increased from the first assessment to the second assessment.

Table 1

*Number of Students whose Proficiency Increased by Standard (Teacher AC)*

Level of Proficiency Change	Standard 1: Numbers & Numerical Analysis	Standard 2: Geometry & Measure	Standard 3: Patterns & Algebra	Standard 4: Data Analysis, Probability & Discrete Math
Below Basic to Basic	2	7	3	6
Below Basic to Proficient	1	0	0	4
Below Basic to Adv. Proficient	0	0	0	0
Basic to Proficient	0	3	2	0
Basic to Adv. Proficient	1	0	0	0
Proficient to Adv. Proficient	1	0	0	0
<b>Total Number of Change</b>	<b>5</b>	<b>10</b>	<b>5</b>	<b>10</b>
Total Number of Students	25	24	26	24

**Teacher AN.** Teacher AN had 37 years of experience in teaching mathematics. During this study he taught five sections of eighth grade mathematics. Three of those sections were a standard level Algebra I course. The other two sections were Honors Algebra I, for students that have been identified to be advanced proficient in mathematics.

During the interviews in Cycle II, Teacher AN stated that he felt Learnia provided him with extensive data. In the past, to ensure students were proficient on the standards, Teacher AN used review problems. These problems address all standards and were not geared at students' individual deficiencies. Teacher AN utilized the data from Learnia to

create a whole group analysis. He then created questions that focused on the areas in which the whole group analysis showed student difficulty. Additionally, Teacher AN reviewed the answers from the questions in the Cycle I assessments with his students.

In Teacher AN's classes, of the students that completed the Learnia assessment for Standard One in both Cycle I and Cycle II, 36% had an increase in score, 27% had no change in score, and 37% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For Standard Two, 61% had an increase in score, 16% had no change in score, and 23% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Of the students in AN's class that completed the assessments for Standard Three, 49% had an increase in score, 19% had no change in score, and 32% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For the fourth standard, 48% had an increase in score, 26% had no change in score, and 26% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Table 2 shows the number of students in Teacher AN's classes whose proficiency level increased from the first assessment to the second assessment.

Table 2

*Number of Students whose Proficiency Increased by Standard (Teacher AN)*

Level of Proficiency Change	Standard 1: Numbers & Numerical Analysis	Standard 2: Geometry & Measure	Standard 3: Patterns & Algebra	Standard 4: Data Analysis, Probability & Discrete Math
Below Basic to Basic	3	19	6	14
Below Basic to Proficient	0	5	2	8
Below Basic to Adv. Proficient	0	0	0	2
Basic to Proficient	15	11	15	12
Basic to Adv. Proficient	2	1	1	4
Proficient to Adv. Proficient	2	1	1	4
<b>Total Number of Change</b>	<b>22</b>	<b>37</b>	<b>25</b>	<b>40</b>
Total Number of Students	123	119	123	125

**Teacher DS.** Teacher DS, a special education teacher with 11 years of experience, taught one section of resource room eighth grade mathematics. This class was for special education students that have been identified to need more support than provided in a regular education classroom. This course follows the Algebra I curriculum.

During the interviews in Cycle II, Teacher DS stated that in the past she utilized questions from practice state assessments to ensure her students would be proficient on the benchmarks set forth in the NJCCCS. The data from Learnia gave her the ability to assess her students' proficiency on a smaller level. She was able to follow-up with each of her students and provide them with the instruction they needed. Teacher DS also used

the questions from the Learnia assessments as review problems in her instruction. DS believed that Learnia was a great resource. It gave her the ability to ensure she was covering the standards and the type and level of understanding that the NJCCCS required. DS felt that with Learnia, she did not have to create her own questions on the standards; she was given them.

In Teacher DS's class, of the students that completed the Learnia assessment for Standard One in both Cycle I and Cycle II, 37% had an increase in score, 13% had no change in score, and 50% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For Standard Two, 60% of the students had an increase in score, 7% had no change in score, and 33% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Of the students in DS's class that completed the assessments for Standard Three, 62% had an increase in score, 19% had no change in score, and 19% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For the fourth standard, 60% of the students had an increase in score, 27% had no change in score, and 13% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Table 3 shows the number of students in Teacher DS's class whose proficiency level increased from the first assessment to the second assessment.

Table 3

*Number of Students whose Proficiency Increased by Standard (Teacher DS)*

Level of Proficiency Change	Standard 1: Numbers & Numerical Analysis	Standard 2: Geometry & Measure	Standard 3: Patterns & Algebra	Standard 4: Data Analysis, Probability & Discrete Math
Below Basic to Basic	3	2	3	3
Below Basic to Proficient	0	0	0	2
Below Basic to Adv. Proficient	0	0	0	0
Basic to Proficient	1	1	3	1
Basic to Adv. Proficient	0	0	0	0
Proficient to Adv. Proficient	0	0	0	0
<b>Total Number of Change</b>	<b>4</b>	<b>3</b>	<b>6</b>	<b>6</b>
Total Number of Students	16	15	16	15

**Teacher JC.** Teacher JC had 27 years of experience as special education teacher. She taught one section of resource room eighth grade mathematics. This class was for special education students that have been identified to need more support than provided in a regular education classroom. This course follows the Algebra I curriculum.

Teacher JC stated, during the Cycle II interviews, that in the past she utilized practice state assessments to ensure her students were proficient of the NJCCCS mathematics standard. This year she implemented a new method. After the students completed the Cycle I Learnia assessments, she had the students complete the assessments again, during class. When the students were taking the re-assessment,

Teacher JC provided the students with the accommodations they required based on their disability. She utilized this instructional time to inform the students of the accommodations they could receive and to show the student the difference the accommodations could make on their performance. Teacher JC found that the level of student proficiency was higher on the re-assessment. Additionally, Teacher JC reviewed each problem the individual student did not answer correctly with that student. She identified the student errors and provided strategies for each student based on his/her error. Teacher JC appreciated the immediate feedback that Learnia provided about her students' proficiency.

In Teacher JC's class, of the students that completed the Learnia assessment for Standard One in both Cycle I and Cycle II, 82% had an increase in score, 0% had no change in score, and 18% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For Standard Two, 100% had an increase in score, 0% had no change in score, and 0% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Of the students in JC's class that completed the assessments for Standard Three, 46% had an increase in score, 18% had no change in score, and 36% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For the fourth standard, 67% had an increase in score, 11% had no change in score, and 22% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Table 4 shows the number of students in Teacher JC's class whose proficiency level increased from the first assessment to the second assessment.



Table 4

*Number of Students whose Proficiency Increased by Standard (Teacher JC)*

Level of Proficiency Change	Standard 1: Numbers & Numerical Analysis	Standard 2: Geometry & Measure	Standard 3: Patterns & Algebra	Standard 4: Data Analysis, Probability & Discrete Math
Below Basic to Basic	2	4	4	1
Below Basic to Proficient	1	1	0	1
Below Basic to Adv. Proficient	0	0	0	1
Basic to Proficient	3	1	1	0
Basic to Adv. Proficient	2	0	0	0
Proficient to Adv. Proficient	2	0	0	0
<b>Total Number of Change</b>	<b>10</b>	<b>6</b>	<b>5</b>	<b>3</b>
Total Number of Students	11	9	11	9

**Teacher JH.** Teacher JH had three years of experience and taught five sections of eighth grade mathematics when this study occurred. One of the sections was Honors Algebra I, for students that have been identified as advanced proficient in mathematics. Three of the sections were standard Algebra I. The fifth section was Small Group Algebra I, for students identified as not proficient in mathematics.

During the interviews in Cycle II, Teacher JH stated the results of Learnia were helpful, but they could be overwhelming. In the past she used problems from practice state assessments to ensure her students were proficient on the NJCCCS mathematics standard. This year, Teacher JH analyzed the data provided by Learnia to find the

students' weak points. She used this information during whole group and individual student instruction. Based on the data, JH decided to spend one week before the Learnia assessments in Cycle II, reviewing geometry and probability. These were the areas she identified as her students' weaknesses.

In Teacher JH's class, of the students that completed the Learnia assessment for Standard One in both Cycle I and Cycle II, 48% had an increase in score, 24% had no change in score, and 28% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For Standard Two, 85% had an increase in score, 9% had no change in score, and 6% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Of the students in JH's class that completed the assessments for Standard Three, 49% had an increase in score, 12% had no change in score, and 39% had a decrease in score from the Cycle I assessment to the Cycle II assessment. For the fourth standard, 50% had an increase in score, 30% had no change in score, and 20% had a decrease in score from the Cycle I assessment to the Cycle II assessment. Table 5 shows the number of students in Teacher JH's classes whose proficiency level increased from the first assessment to the second assessment.

Table 5

*Number of Students whose Proficiency Increased by Standard (Teacher JH)*

Level of Proficiency Change	Standard 1: Numbers & Numerical Analysis	Standard 2: Geometry & Measure	Standard 3: Patterns & Algebra	Standard 4: Data Analysis, Probability & Discrete Math
Below Basic to Basic	8	13	6	12
Below Basic to Proficient	5	6	2	6
Below Basic to Adv. Proficient	1	1	0	2
Basic to Proficient	7	6	10	5
Basic to Adv. Proficient	2	4	3	1
Proficient to Adv. Proficient	2	4	3	1
<b>Total Number of Change</b>	<b>25</b>	<b>34</b>	<b>24</b>	<b>26</b>
Total Number of Students	87	66	86	80

**Review Sessions.** The Cycle III review sessions were created for students that were identified as being in need of intense intervention. These students were identified based on the scores on the Cycle I Learnia assessment, the scores from the previous year on the state standardized assessment, and teacher recommendation. Based on the Learnia assessments for Cycle I, it was determined that the focus for these sessions would be Standard 1: Number and Numerical Operations and Standard 2: Geometry and Measurement. Of the students that completed both the Cycle I and Cycle II Learnia assessments for those standards, 91 students were recommended to attend the Number and Numerical Operations sessions and 75 students were recommended to attend the

Geometry and Measurement sessions. Thirty of the recommended students attended the review session for Number and Numerical Operations and 26 of the recommended students attended the session for Geometry and Measurement. Table 6 shows the percentage of students that attended whose score increased, had no change, or decreased from the assessments in Cycle I to the assessments in Cycle II and the percentage for the students that did not attend, but were invited.

Table 6

*Percentage of students recommended to the review sessions whose score changed from the assessment in Cycle I to the assessment in Cycle II*

	Standard 1: Numbers & Numerical Analysis	Standard 2: Geometry & Measure
<i>Students who attended</i>		
Increase in score	63%	73%
No change	17%	15%
Decrease in score	20%	12%
<i>Students who were recommended and did not attend</i>		
Increase in score	40%	86%
No change	26%	4%
Decrease in score	24%	10%

At the end of Cycle III the three teachers that facilitated the review sessions were interviewed. The benefits of the review sessions, according to the teachers, included: additional review, more exposure to topics, small class sizes allowing for more individual

instruction, and more time to practice and study with a teacher. All three teachers felt that the correct students were identified to attend the sessions and the topics chosen for the sessions were those in which the students had difficulty. All three teachers also felt that the lessons that were provided to them for the review sessions were helpful and appropriate. The suggestions to improve the review sessions varied amongst teachers. One teacher felt that the review sessions should have two teachers that co-teach the session in order to better address students' individual needs. The second teacher felt there could have been more time given to analyze the specific content in the standards with which the students had difficulty. He believed this could better reach the students' needs. The third teacher felt the students would benefit from increasing the number of review sessions. She also stated that she received positive feedback from the parents and students in regards to these sessions.

**Professional Development Questionnaire.** Over the course of this study, the teachers participated in two professional development workshops. At the end of Cycle I and Cycle II, the teachers completed questionnaires pertaining to the workshops. This section outlines the data collected from those questionnaires.

The first questionnaire was in relation to the professional development workshop at the beginning of Cycle I. This workshop focused on defining formative assessment and the implementation of an online formative assessment program. It also guided the teachers through the elements of the Learnia program from the teachers' perspective and the students' perspective. The data from this questionnaire showed that teachers felt that the time was well spent during the workshop and they were provided with the information they needed to implement Learnia. The teachers also felt that the handouts

provided were helpful. One teacher stated that they were especially helpful afterward to refresh her memory about the information provided in the workshop. Suggestions about improving the professional development included: completing the Learnia assessments to experience Learnia and providing more time for the teachers to explore the program.

The second questionnaire pertained to the professional development session that occurred at the beginning of Cycle II. This professional development taught teachers how to analyze the data provided by Learnia and use the data to drive their instructional plan. Each teacher was given the opportunity to create an instructional plan based on the data. The first question asked the teachers if they found the professional development helpful in analyzing the data and creating an action plan. The teachers stated that they found the professional development helpful. One teacher stated that she would not have done this without the support. Another teacher stated that although it was helpful she felt the amount of data that Learnia provides was overwhelming. The questionnaire also asked the teachers to state how they believed the professional development could be improved if it was implemented with another group of teachers. The participants recommended more collaboration with colleagues in regards to the Learnia results and more collaboration in the creation of the instructional action plans.

**Leadership Attributes Survey.** At the end of Cycle II and Cycle III the participants were asked to take an anonymous survey regarding the impact of the researcher's leadership style on the study. Table 7 shows the results of this survey.

Table 7

*Leadership Attributes Survey Results*

Leadership Attributes	Strongly Agree	Agree	Disagree	Strongly Disagree
The researcher had sufficient knowledge of Learnia	4	1		
The researcher inspired you to utilize Learnia.	3	2		
The researcher inspired you to utilize other forms of formative assessment.	1	3	1	
You understood the reasoning behind the utilization of Learnia.	4	1		
You understood the expectations associated with the implementation of Learnia.	3	2		
The researcher effectively implemented Learnia in 8 <sup>th</sup> grade.	3	2		
The researcher was flexible in working within your schedules and time lines.	4	1		
You would like to continue utilizing Learnia next year.	2	3		
You feel you can continue utilizing Learnia next year, in the researcher's absence.	2	3		

**Discussion**

This section discusses the results of the finding in respect to each of the research questions. The first research question pertains to effect of formative assessment on student proficiency. The second research question pertains to the effectiveness of professional development on changing teachers' formative assessment practices. The last

research question pertains to the impact of the researcher's leadership on improving student proficiency of the NJCCCS for mathematics.

**Research Question #1.** The first research question in this study pertains to the effect of utilizing a formative assessment program, such as Learnia, on students' proficiency of the benchmarks set forth in the NJCCCS for Mathematics. The findings show that utilizing a formative assessment program can increase a student's level of proficiency of the standards. Each teacher had students whose scores increased from the Cycle I assessments to the Cycle II assessments. The amount of students with an increase and the percentage of increase were dependent on the teacher and the standard. Table 8 shows the number of students that increased in score on each standard for each teacher.

Table 8

*Percentage of Student Increase by Standard Per Teacher*

Teacher	Standard 1: Numbers & Numerical Analysis	Standard 2: Geometry & Measure	Standard 3: Patterns & Algebra	Standard 4: Data Analysis, Probability & Discrete Math
Teacher AC	36%	75%	31%	54%
Teacher AN	36%	61%	49%	48%
Teacher DS	37%	60%	62%	60%
Teacher JC	82%	100%	46%	67%
Teacher JH	48%	85%	49%	50%

During the Cycle II professional development workshop, the teachers discussed the Learnia data collaboratively. The data collected for the Cycle I Learnia assessment



showed that the majority of students had low proficiency levels in Standards Two and Four. Additionally, the curriculum that was being implemented already focused on Standard One and Standard Three. It was decided by the group that focusing on Standards One and Three would be redundant. All of the teachers decided to focus their instructional action plan on Standard Two and Standard Four. It is evident that each teacher was able to utilize their data to increase the majority of their students' scores in Standard Two. The teachers were able to increase around half of their students' scores in Standard Four. Although the curriculum for eighth grade focused on Standards One and Three and the participants followed the curriculum in addition to their instructional action plan, those standards did not show a consistent increase. The increase in those standards differed depending on the teacher. The data show that each teacher had a similar percentage of scores increase on Standards Two and Four regardless of his or her individual instructional action plan.

The data do not show that the intense intervention review sessions had an effect on increasing the students' proficiency levels of the standards. Based on the Learnia assessments from Cycle I, the results on the state standards assessment from the previous year, and teacher recommendations, students were identified to be in need of intense intervention. These students were invited to attend six 1-hour review sessions. The increase in proficiency of the students that attended was compared with those students that were recommended and did not attend. The results of this comparison did not show a greater increase in proficiency for those that attended versus those that did not attend. In some instances, the increase for those that did not attend was greater than that for those who did attend. For Standard One, the percentage of student scores that increased for the

students that attended the session was 63% while the percentage of increase in score for those students that were recommended but did not attend was 40%. For Standard Two, the percentage of scores that increased for students that attended was 73% and the percentage of increase for students that were recommended and did not attend was 86%. From these data, it is shown that the teachers' individual action plans had more of an effect on increasing the students' levels of proficiency than the intense intervention sessions.

**Research Question #2.** The second research question in this study was to find the effect of professional development on changing teachers' current formative assessment practices. The data from the interviews in Cycle II show that all five teachers changed their methods to ensure that the students were proficient on the benchmarks set forth by the NJCCCS for mathematics. During the Cycle II interviews, all five teachers said that in the past they did not use formative assessment to ensure students were proficient on the NJCCCS for mathematics; instead they used review problems or practice state assessments that addressed all the standards. With Learnia, each teacher stated that they either analyzed whole classes' proficiencies on the specific standards or individual student proficiencies on the standards. They utilized this information to create an instructional action plan that addressed their students' weaknesses.

According to the questionnaires on the professional development workshops, the teachers felt that the workshops were helpful in their implementation of Learnia as a formative assessment tool. One teacher stated that she would not have utilized the data that Learnia provided without the support that was provided during the professional development sessions. The results of the Leadership Attribute Survey showed that two

teachers strongly agreed and three teachers agreed that they would like to continue to utilize Learnia as a formative assessment tool. Two teachers strongly agreed and three teachers agreed that the researcher inspired them to utilize Learnia; however one teacher strongly agreed, three teachers agreed, and one teacher disagreed that the researcher inspired them to utilize other types of formative assessment.

**Research Question #3.** The third question pertains to the impact of the researcher's leadership style on improving student proficiency of the mathematics standards set forth in the NJCCCS. Based on the Leadership Attributes Survey, three teachers strongly agreed and two teachers agreed that the researcher effectively implemented Learnia in this study. The teachers involved in this research study had never utilized Learnia or any online formative assessment program in the past. The discussion for the second research question shows that the teachers changed their formative assessment practices based on the professional development workshops facilitated by the researcher. It also shows that teachers felt the researcher supported this change and were inspired by the researcher to utilize Learnia. Two teachers strongly agreed and three teachers agreed that they would be able to continue to utilize Learnia in the researcher's absence. The findings in the discussion for the first research question show that the teachers' utilization of Learnia as a formative assessment program increased the majority of students' proficiency on the NJCCCS for mathematics.

## CHAPTER V

### LEADERSHIP AND IMPLICATIONS FOR FURTHER RESEARCH

This research study examined the effectiveness of providing teachers with data from a formative assessment program of student proficiency on the New Jersey Core Content Curriculum Standards (NJCCCS) for mathematics. As this study was implemented, the researcher utilized a variety of leadership theories and beliefs leading to a change in the researcher's leadership style. The chapter discusses the leadership theories that guided this study, the change in the researcher's leadership style, and the implications for further research.

#### **Leadership Theories Informing this Study**

Fullan (2001) created a framework for implementing change in an educational organization. This framework is based on a convergence of theories, ideas, and strategies. It is composed of three personality characteristics, and five components of leadership. The researcher integrated the theories that informed this study into the five leadership components of this framework to create her leadership platform. The five components of leadership include: moral purpose, understanding change, relationship building, and knowledge creation and sharing, and coherence making.

**Moral Purpose.** Moral purpose is “acting with the intention of making a positive difference in the lives of employees, customers, and society as a whole” (Fullan, 2001, p. 3). Leaders need to use moral purpose as their guide. Value-based leadership, moral leadership, and servant leadership are three leadership theories that promote acting with a moral purpose.

As cited in Burns, values are defined in the International Encyclopedia of Social Sciences as a “criteria for judgment, preference, and choice” (Burns, 2003, p. 205). Using values for decision-making guarantees that a leader makes her decision not only based on past experiences but also by her vision for the future. There are many values that are shared amongst all types of people. Although many values are personal to specific people, a person can use public values to be an effective leader. “When organizations unite around a shared set of values, they become more flexible, less hierarchical, less bureaucratic, and they develop an enhanced capacity for collective action. Shared values build trust, and trust is the glue that enhances performance” (Barrett, 2005, p. 1). Value-based leaders ensure that their decisions are based on their values as well as the values of their school community.

According to Wren (1995), moral leadership is the creation of a relationship with the staff and a transformation of the organizational environment which results in the staff feeling a desire to be successful. Moral leadership is based on the premise that the group goals are moral and ethical. “If either the ends of leadership or the means to achieve it be improper, the ultimate goal of leadership – the betterment of society – is compromised” (Wren, 1995, p. 481). Moral leaders have a relationship with their staff built on common needs, aspirations, and values.

The belief in servant leadership is essential to having a moral purpose. A leader begins with a need to serve people, and this transforms into an aspiration to lead. A servant leader is “always searching, listening, expecting that a better wheel for these times is in the making” (Greenleaf, 1995, p. 20). *Good to Great* identifies every leader, in a company that made a transformation from good to great, as a servant leader. These

leaders “channel their ego needs away from themselves and into the larger goal of building a great company. They are incredibly ambitious - but their ambition is first and foremost for the institution, not themselves” (Collins, 2001, p. 21).

This study was developed with moral purpose. The participants expressed a need for a method to ensure their students would meet the benchmarks set forth by the NJCCCS for mathematics. From their need, this research project was created. The goal of this project was to provide the participants with the necessary materials and support to effectively education their students.

**Understanding Change.** An effective leader must know the purpose behind his or her organization and every decision or change effort must be made based on that purpose. There are two different types of change: first order and second order (Evans, 1996). First order change tries to improve the effectiveness of what the organization is already implementing. Second order change aims to modify the organization by “altering its assumptions, goals, structures, roles and norms” (Evans, 1996, p. 5). An effective leader understands these two types of change and makes the appropriate decision on which type is most beneficial for the organization.

**Implementing change.** Kotter’s (1996) eight step change process was utilized to provide the guidelines of implementing change in this research project. The first stage in Kotter’s eight stage change process is to establish a sense of urgency. In an organization where complacency is high, it is crucial to gain cooperation by establishing this urgency (Kotter, 1996). When this study occurred, the eighth grade district curriculum was not aligned with the eighth grade benchmarks set forth in the NJCCCS. The eighth grade

teachers were very concerned about how this misalignment would affect the state standardized test scores. In this study, the teachers initiated the sense of urgency.

The second stage in Kotter's eight stage change process is to create a guiding coalition. There are four key characteristics to an effective coalition: members in a position of power, members with different expertise, credible members with good reputations, and members that have been proven as leaders (Kotter, 1996). Additionally, the coalition must have mutual trust and a common goal. This implementation plan included the eighth grade teachers who varied in experience and taught different level students. These were also the teachers in the district that felt the sense of urgency. It was the only grade level in which the curriculum did not align with the standards.

The third stage in Kotter's process is to develop a vision and strategy. A vision is essential to: clarify the direction of the change, motivate people for the change, and coordinate the actions of the members of the organization (Kotter, 1996). An effective vision consists of six characteristics: imaginable, desirable, feasible, clear and focused, flexible, and communicable (Kotter, 1996). To create an effective vision, the leader must begin with an initial goal that can be modified by the guiding coalition. The initial vision for this change process was for teachers to use Learnia to guide instruction. The members of the guiding coalition received professional development on formative assessment and Learnia. They used this information to create their own strategy or implementation plan.

The fourth stage in Kotter's eight stage change process is to communicate the change vision to the organizational community. In order for this phase to be successful, there cannot be any failure in the previous stages. The first important aspect of this stage is to keep the vision simple and direct. The vision should be communicated frequently in

many different forums and inconsistencies that may undermine the credibility of communication should be addressed (Kotter, 1996). This project was discussed with other teachers in the district during faculty meetings and informally. Members of the faculty showed an interest in the study and were asking for Learnia to be implemented at their grade level.

The fifth stage in Kotter's process is the empowerment of the members of the organizational community. The successful completion of the first four stages of this process will have already begun the empowerment process. The purpose of this stage is to "empower a broad base of people to take action by removing as many barriers to the implementation of the change vision as possible at this point in the process" (Kotter, 1996, p. 102). As the researcher would not be with the district when it was time to implement the program in other grade levels, the guiding coalition would have to continue the implementation. The members of the guiding coalition were provided with all the information they would need to train the rest of the district faculty on the implementation of Learnia.

The sixth stage of Kotter's change process outlines the necessity of short term wins. It should provide evidence that the vision is worthwhile to the employees as well as the leadership team, motivate and build the morale of the staff, undermine cynics, and build momentum (Kotter, 1996). The members of the guiding coalition found that utilizing Learnia increased their students' proficiency of the NJCCCS for mathematics.

The next two phases would occur during the following school year, after this study had already been completed. The seventh stage in the change process is to consolidate gains and produce more change. The last stage in Kotter's eight stage



change process is to anchor the new approaches in the organizational culture. This stage must be the last stage and should not be attempted until the end of the change effort. In order to anchor change, there must be significant evidence that the change has been effective. This validity should be supplied through constant verbal dialogue and support for the staff.

*Factors affecting and motivating change.* “Educational change is the dynamic process involving interacting variables over time, regardless of whether the mode of analysis is factors or themes” (Fullan, 2007, p. 86). The more these factors support implementation, the more likely the change project will be successful. This research project addressed the factors that Fullan (2007) outlines that can affect change and motivate change.

The first category that can affect change, characteristics of change, includes four factors: need, clarity, simplicity, and quality and practicality (Fullan, 2007). In this project, the first characteristic, need, was demonstrated when the teachers expressed a concern and asked for an action plan to address their concern. Clarity was addressed when the teachers were given a clear action plan by utilizing the Learnia program. These teachers were already trying to ensure that their students reach the benchmarks set forth by the NJCCCS. This research project gave the teachers a deeper understanding of the students’ prior knowledge and a clearer direction. This project should be less complex than what they had originally been doing. In order to improve the quality and practicality of this research project, the teachers involved were given workshops on how to utilize the program, the necessary planning time to implement the project, and support from administration as well as their colleagues.

The second category that can affect change, local factors, include the school district, the community, the principal, and the teachers (Fullan, 2007). This research project is based on assisting the teachers in ensuring that the students are proficient in the benchmarks set forth in the NJCCCS. The state measures the students' proficiency through the use of standardized tests. The scores of these standardized tests affect school districts in a multitude of ways. It was in the best interest for all members of the school community that the students had a high level of proficiency. This ensured that all members of the school community had a vested interest in this study.

The last category that can affect change, external factors, refers to the influence that this research project has in context of the broader society. Learnia was provided to the school districts of New Jersey through a state funded pilot program. This is a five year program that began in 2008. The state's decision to continue paying for the program would have a major effect on whether this research project produced lasting change.

According to Fullan (2007), one element that can motivate change is to treat those involved in the change process with respect. In this study, the professional development sessions occurred during the school day, exhibiting to the teachers that the researcher respected their busy schedules. Teachers were not required to use their personal time to change their formative assessment practices. According to the questionnaires discussed in Chapter IV, the teachers felt that their time was well spent during these sessions and the information was useful.

The second element that can motivate change is for the new change initiatives to be socially based and action oriented (Fullan, 2007). "For most teachers' daily motivation, good solid social support is essential" (Fullan, 2007, p. 50). In this study, the

teachers were given the ability to work collaboratively with each other and the researcher. During this collaborative time, the teachers utilized the data results to create instructional plans that could be implemented immediately. There was open dialogue amongst the group about their implementation plans.

The third element to motivate change is capacity building. This is defined as “a policy, strategy, or action taken that increases the collective efficacy of a group to improve student learning through new knowledge, enhanced resources, and a greater motivation” (Fullan, 2007, p. 58). During the initial workshop teachers were exposed for the first time to Learnia and the data it had to offer. This wealth of data, which they never had access to in the past, motivated the teachers to use Learnia. Once the students had taken the pre-assessment on Learnia, the teachers were given time during professional development to analyze the results and to create instructional plans that utilized the data.

The last element to motivate change is the need for internal accountability. Fullan (2007) explains that data can be utilized to either empower or disable teachers. In order to empower teachers, the data from Learnia were only utilized formatively. During the workshops, the teachers and the researcher worked collaboratively to utilize the data. Teachers were not evaluated based on the results of their students. The results were used in a collaborative effort to improve student proficiency. Teachers were only accountable to themselves and their classes.

**Relationship Building.** Organizations with successful change initiatives have improved relationships. “Leaders must be consummate relationship builders” and “constantly foster purposeful interaction and problem solving” within the organization

(Fullan, 2001, p. 5). In order to effectively implement change, there must be a positive relationship between the leader and the staff.

“Behind every successful leader are effective followers. They are dependent upon their leaders to provide them with goals and objectives and the proper ways and means to achieve them” (Sergiovanni, 1990, p. 27). Leaders that create a common goal with their staff and motivate them have a better chance at fulfilling their goals. The best way to accomplish this is to work with the staff to create a vision and have a shared decision making process. It is important the staff be attuned with the vision versus aligned with the vision. Staff attuned to the vision believe in it and will work harder to attain it.

Creating positive relationships can be accomplished by utilizing the principals of emotional intelligence. “Great leadership works through the emotions” (Goleman, Boyatzis, & McKee, 2002, p. 3). “Leaders execute a vision by motivating, guiding, inspiring, listening, persuading - and most crucially, through creating resonance” (Goleman et al., 2002, p. 27). There are four domains of emotional intelligence; self-awareness, self-management, social awareness, and relationship management. Self-awareness is the ability to recognize one’s own emotions; it is the foundation. The next stage, self-management, is when a person can “see both what’s causing it and how to do something constructive about it” (Goleman et al., 2002, p. 30). Social awareness occurs when a person is able to understand the emotions of others. These domains lead to relationship management, the ability to behave in a way that achieves the goals set forth.

Positive relationships can also be built through the creation of effective teams. “It is teamwork that remains the ultimate competitive advantage, both because it is so powerful and so rare” (Lencioni, 2002, p. vii). An effective team has “shared tasks,

collective beliefs, valued behaviors, and common goals” (Stowell & Mead, 2007, p. 19).

The members of the team must possess trust, healthy conflict, commitment, accountability, and a need for results (Lencioni, 2002). The structure, roles, and relationships of members of the team can either hinder or enhance the effectiveness of the group. In order to make committee decisions, it is imperative to create an effective team. According to Boleman and Deal (2003), a leader utilizes these six characteristics to create a highly effective team: purpose that originates from higher management; specific measurable performance goals; a manageable size; established roles, guidelines, and schedules; a correct mix of expertise; and shared collective accountability.

During this research project an effective team was created around a common goal. The teachers involved in this research project were attuned to the vision of utilizing Learnia to ensure their students were proficient on the benchmarks set forth by the NJCCCS. This goal was created collaboratively to address a common concern amongst all members of the team. The team worked together and assisted one another with analyzing data and creating action plans.

**Knowledge Creation and Sharing.** An effective leader understands the need to create and share knowledge in their organization. According to Fullan (2001), turning information into knowledge is a social process. Effective leaders understand that a great deal of importance must be placed on generating and increasing knowledge. Additionally, effective leaders must foster an environment where organizational members continually share knowledge with each other. This can be accomplished by utilizing the aspects of transformational leadership.

Transformational leaders created a shared vision with members of the organization (Lussier & Achua, 2010). They include members of the organization in the decision making process. The staff believes in the leader's vision and is motivated to achieve it. When staff is included in the decision making process, their knowledge of topics related directly to the organization increases. It is imperative to provide these members with extensive professional development pertinent to the decision. Members of the organization are given the ability to use their knowledge to contribute to the decision making process.

For this study, the teachers were the most knowledgeable about their classroom practices and would better be able to analyze how the change would affect those practices; therefore it was imperative that they were involved in the decision making process. The participants were involved in making most of the decisions. They were provided with adequate time to work together and plan how they were going to modify their classroom instruction based on the data from Learnia.

**Coherence Making.** When complexity and change are present, there is a chaotic edge where creativity and anarchy reside (Fullan, 2001). An effective administrator must create a balance between change and consistency. Coherence is a necessity to keep the organization moving toward the change initiative without inspiring anarchy (Fullan, 2001). Leadership has the ability to create and change culture. A leader cannot change the culture unless she fully understands its current state. The four steps outlined to encourage cultural change include: defining what will not change, recognizing the importance of actions, using the right change tools, and showing the value of every member of the

school community's (Fullan, 2001). Coherence making is attainable by understanding school culture and utilizing transactional leadership.

Fullan (2001) explains that members of a school community are often overwhelmed when many change projects are being initiated or operating simultaneously. Administrators must understand a school culture before they can effectively build cohesion and implement change. In order to achieve coherence, Collins (2001) recommends creating a culture of discipline. Schein (2004) outlines three aspects of an organization that enable a leader to develop a better understanding of the culture of the organization. Boleman and Deal (2003) explain four frames that enable a leader to appreciate the culture from different perceptions.

Collins explains that every organization that went from good to great had self-disciplined workers that work within a system of rules, but were allowed the freedom and responsibility to make decisions within these boundaries. A culture of discipline is about “getting disciplined people who engage in disciplined thought and who then take disciplined action” (Collins, 2001, p. 143).

According to Schein (2004) an organization is comprised of artifacts or symbols, espoused beliefs or visions, and underlying assumptions. If a leader understands the culture of the organization, she can better predict how the members of the organization will handle new initiatives, tasks, and relationships. That leader can use her knowledge to manipulate the situation and increase the likelihood of success. A leader who does not understand the organization's culture may not approach situations in the correct way for that specific organization and thus receive resistance from organizational members (Schein, 2004).

Boleman and Deal (2003) outline four frames of an organization: structural, political, human resource, and symbolic. Leaders must be situational and apply different frames depending on the situation. The structural frame is based on the hierarchy of the organization. Rules, policies, and procedures are created in order to achieve organizational goals. The political frame addresses the competition, aggression, and occasionally status of members of an organization. All members of the organization are trying to reach their goals using such tactics as bargaining and coercion. The human resource frame is founded on the premise that members of the organization should be treated like an extended family. This frame is deeply rooted in the same principals of emotional intelligence. The symbolic frame is based on the culture, rituals, and artifacts of the organization. Aspects of the organization's past practices and beliefs drive the progress.

Transactional leadership can also lead to coherence in a change process. A transactional leader believes in defined roles (Lussier & Achua, 2010). Administration makes the decisions and the staff's job is to implement and follow the leader's instructions. When decisions need to be made regarding the safety and well-being of the members of the school community, a leader must be transactional. Additionally, a leader should be transactional when implementing school rules and policies that relate to effective management of the school's operational systems. Being consistent with safety issues, school rules, and policies help build a form of cohesion in an organization.

In this study, the theories of coherence making were utilized to gain district approval for this project and to make management decisions about the project. To gain district approval to implement this research project, there had to be an understanding of



the culture of the school district. The district had to provide substitutes in order to train the teachers, provide compensation for the teachers instructing the review sessions, and devote a lot of administrative time to this project. The knowledge of the district's culture was used to ensure them that this project and their commitment would be worthwhile to the district and the students. Transactional leadership was applied to ensure that there was consistency amongst the teachers completing this project. Any decision that dealt with the creation of the Learnia assessments, the timeline, or the implementation of the assessments was made by the researcher.

### **Emerging Leadership**

“True leaders use leadership to fit the situation, benefit the organization, and inspire the workforce” (Nderu-Boddington, 2008, p. 2). These leaders are prepared to confront resistance from the staff as well as other administrators and are able to influence others through thoughts and actions. “Leaders take charge, project concepts into images, develop concepts into substance, and motivate subordinates” (Nderu-Boddington, 2008, p. 2). The researcher defines educational leadership as based on the goal to create and maintain a successful learning environment for all students. Hersey and Blanchard (1995) state, “empirical studies tend to show that there is no normative (best) style of leadership; that successful leaders are those who can adapt their leader behavior to meet the needs of their followers and the particular situation” (p. 148). Hersey and Blanchard continue by saying, “in managing for effectiveness a leader must be able to diagnose his own leader behavior in light of his environment” (p. 148).

The researcher had written her leadership platform previous to implementing this study. Fullan's (2001) leadership framework for change was the base for this platform. It

was an organizational tool to connect the different theories that guided the researcher's leadership style. Although it represented what the researcher believed, it was conceptual. Completing this research study provided the experience the researcher needed to reflect and relate this platform to professional practice.

A journal was kept by the researcher throughout implementation of the cycles. This journal was comprised of the actions taken during the cycles and the researcher's feeling in regards to those actions. After the researcher had finished implementing the cycles in this study, she reflected on this journal. The researcher began to connect these entries to her leadership platform. Discovering this interconnection brought the leadership platform from theoretical to practical. From this study, the researcher has learned the importance of being a servant leader (Greenleaf, 1995). She has learned to listen to the members of the school community and use the stages of emotional intelligence to understand and relate to their feelings (Goleman et al., 2002). She has learned about effective decision making skills, such as the importance of data driven decision making, and the need to make value based and moral decisions. She has learned the steps needed to create an effective team and the importance of including those members in the decision making process. Lastly, the most important element of leadership that the researcher has learned is how to understand and create change in an educational organization. Not only did she learn how to apply the different processes to make change; she learned how to motivate change and the factors that need to be considered when creating change. This study has also taught her about organizational cultural and the important role it has in implementing change. An effective leader can analyze the cultural of an educational organization by using Boleman and Deal's (2003)

four frames and Schein's (2004) three aspects of culture and use this analysis to drive a change initiative in an organization. All of these leadership skills have been gained through this research study.

This study has provided the researcher with the foundation of who she is as a leader. As she continues on her administrative journey she will continue to build on this foundation. Her traits, behaviors, and skills were continually being improved and reformed based on her learnings through experience and her studying of leadership theory. As the researcher continues to study leadership and gain experience, she will continue to reflect and grow as an educational leader.

### **Implications for Further Research**

Based on this study, it is recommended that the following questions be researched further.

- 1.) Would this study exhibit the same results in a community of a lower socio-economic status?
- 2.) Would this study yield similar results with other subject areas, such as Language Arts?
- 3.) The study of Learnia by Twing et al. (2010) found that third grade had the greatest efficacy, if this study was implemented in grades three through eight, would it yield the same results?
- 4.) Would a larger sample of teachers change the results shown in this study?

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Appendix A

Cycle I Professional Development Handout

**User name:**

**Password:**

## **Intro**

### *Wording*

Teachers and administrators are the users

Students are enrollment

### *Websites*

Teacher site: admin.learnia.net

Student site: student.learnia.net

No www!

### *Test Information*

- This is an on-line, untimed, benchmark assessment. It is to be used for formative purposes only. It is not a summative exam.
- There are four multiple choice tests. Each test focuses on one specific standard.
- Each test has at least one problem from each curriculum progress indicator that is listed as an area of focus.
- The amount of problems per test correlate percentage wise to the number of questions on the NJ ASK for that specific standard.
- Calculators will be permitted!

## **Student Mode**

### *Beginning*

- Before your students begin: bookmark the website and disable the pop-up blocker
- When logging in, you do not have to put in the site code, it will be done automatically
- There is one password for every student in the district. You can personally change the passwords.
- Once you log in the exams will appear automatically.
- Assigned - the students can open
- Submitted - they cannot open

### *Using the program*

- Make sure you tell the students to scroll down to see all the options
- Make sure the students have access to scrap paper
- Students use the → to go to the next question, not the word finish.
- If they click on finish, they have the choice to finish later. This allows the students to take the test in parts. If they choose the finish test, they will no longer be able to continue the test. You can fix this.
- “Go To” tells which questions were answered and which were not.

## Teacher Mode

### *Info*

- In the left navigation bar, any time you get lost or need to get back to where you started click on main view.

### *Print Test Tickets*

- Click Report Results → Group Reports → Test Tickets
- Check the checkbox → click on create → click on Test Ticket depending on your class
- Download and save. It will save as a pdf. Open and print.

### *Print Test, Grading Rubric, and Answer Key*

- Click Manage Assignments → Pick Assignment → View Test
- Look at the Print Options
- Teacher Scoring Key is just a bar at the bottom of the constructive response questions
- Be patient, choose different options, and then scroll down and look at the print preview

### *Reopen Finished Tests*

- Manage Assignments
- Change submitted to in progress

Appendix B  
Cycle I Questionnaire

Before Learnia was administered, we had a 45 minute professional development workshop in regards to the program and its administration.

Please answer the following questions in regards to this professional development opportunity.

- 1.) Was the time well spent?*
- 2.) Did you gain the knowledge needed to implement Learnia?*
- 3.) Were the handouts useful?*
- 4.) If this was offered again next year, to a different group of educators, how could it be improved?*

## Appendix C

### Cycle II Professional Development Handout

The directions below detail how to access the following reports on Learnia:

- 1.) Item Analysis
- 2.) Item Rationale
- 3.) Proficiency Level

To print Item Analysis:

- Go to Report Results
- Go to Group Reports on the Left side
- Click on Item Analysis
- Select classes ( and check all options)
- Click on Create Report
- Print Report

To print Item Rationale:

- Go to Report Results
- Go to Group Reports on the Left side
- Click on Item Rationale
- Select classes ( and check all options)
- Click on Create Report
- Print Report

To print Proficiency Level:

- Go to Report Results
- Go to Group Reports on the Left side
- Click on Proficiency Level
- Select classes ( and check all options)
- If pop up message occurs click ok
- Click on Create Report
- Print Report



Appendix D

Cycle II Interview Questions

*1.) Before Learnia, how did you prepare students?*

*2.) How are you using the results of Learnia?*

*3.) What do you think of Learnia?*

Appendix E  
Cycle II Questionnaire

After Learnia was administered, we have a ½ day professional development on analyzing the results.

Please answer the following questions in regards to this professional development opportunity.

- 1.) Time was given to analyze data and develop an action plan. Did you find this helpful?*
- 2.) Did you acquire the knowledge needed to effectively use the Learnia data?*
- 3.) If this was offered again next year, to a different group of educators, how could it be improved?*

Appendix F

Cycle III Interview Questions

- 1.) *What are the positive benefits of the review sessions?*
- 2.) *Did the right students come?*
- 3.) *Were the topics appropriate?*
- 4.) *Were the provided review sheets helpful or would you have preferred creating your own?*
- 5.) *If these sessions were offered again next year, how can they be improved?*