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Effective Practices for Student Success in Algebra

Michelle M. Ginkins
Indiana State University

VITA

Michelle M. Ginkins

EDUCATION

2015	Indiana State University, Terre Haute, Indiana Ph.D. in Educational Leadership
2007	Indiana University Southeast, New Albany, Indiana M.S. in Education
2004	Indiana University Southeast, New Albany, Indiana B.S. in Mathematics and B.S. in Education

LICENSES

2004	Secondary Mathematics Teacher
2007	Building Level Administrator

PROFESSIONAL EXPERIENCE

2011	New Albany High School, New Albany, Indiana Assistant Principal
2010-2011	New Albany High School, New Albany, Indiana Dean of Students
2004-2010	New Albany High School, New Albany, Indiana Mathematics Teacher

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Michelle M. Ginkins

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COMMITTEE MEMBERS

Committee Chair: Bradley V. Balch, Ph.D.

Professor of Educational Leadership and Dean Emeritus

Indiana State University

Committee Member: Bobbie J. Monahan, Ph.D.

Instructor of Educational Leadership

Indiana State University

Committee Member: Susan J. Kiger, Ph.D.

Professor of Curriculum, Instruction, and Media Technology

Indiana State University

ABSTRACT

The purpose of this quantitative study was to better understand the instructional strategies of Algebra I teachers and leadership characteristics of administrators among secondary public schools with high and low performance on Algebra I End-of-Course Assessments (ECAs). The impact of poverty on student achievement was also investigated in relation to first-time test taker Algebra 1 ECA passing rates. The study south to determine if schools' free and reduced lunch rates, teacher characteristics, and/or principal characteristics were significant predictors of first-time test taker Algebra 1 ECA passing rates. Whether there were significant differences in implementation of Marzano, Pickering, and Pollock's (2001) research-based instructional strategies and/or prioritization of McREL's (Waters & Grubb, 2004) 21 leadership responsibilities based on school ECA performance levels was also investigated. The data used for these determinations was collected via teacher surveys that were sent to Indiana public high school Algebra 1 teachers and principals and data on 2012-2013 Indiana public high school free and reduced lunch rates and first-time test taker Algebra 1 ECA passing rates.

Following a linear regression being run on the school free and reduced lunch rates and first-time test taker Algebra 1 ECA passing rates, it was determined that there was a significant, negative relationship between the two variables. Descriptive statistics were run and analyzed on data from both teacher and principal survey results related to implementation of Marzano et al.'s (2001) instructional strategies (teachers) and McREL's (Waters & Grubb, 2004) leadership responsibilities (principals). Independent samples t-tests were run on the instructional strategies

and leadership responsibilities composite scores for high- and low-performing schools. No significant difference was found between high- and low- performing schools for either of those areas. Multiple regressions were run on teacher characteristics and on principal characteristics and Algebra 1 ECA residual scores. For teachers, the characteristics were not found to be significant predictors of the ECA scores. For principals, the characteristics of school locale and principal educational degree attainment were found to be significant predictors of first-time test taker Algebra 1 ECA residual scores.

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dedication to education, and perseverance for them.

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CHAPTER 1

INTRODUCTION

Students beginning their freshman year in the 2007-2008 school year or later are now required by the Indiana General Assembly to complete the requirements for a Core 40 diploma. Consistent with heightened student learning and college and career readiness expectations, the Core 40 diploma requirements include challenging coursework and prepare students for post-secondary education, apprenticeship programs, military training, or workforce certification (Indiana Department of Education [IDOE], 2013b). The Core 40 diploma requirements also include the completion of Algebra II (IDOE, 2013a). This is in addition to the Indiana Statewide Testing for Educational Progress-Plus (ISTEP+) requirements to pass the Algebra I End of Course Assessment (ECA) in order to graduate. ISTEP+ is a program implemented "to measure student achievement in the subject areas of English/language arts, science, and mathematics. ISTEP+ reports student achievement levels according to the Indiana Academic Standards that were adopted in November 2000 by the Indiana State Board of Education" (IDOE, 2014, para. 1). Student proficiency in Algebra I is the key to their success at both passing the Algebra I ECA and earning credit in Algebra II.

The level of learning for mathematics students in the United States is significantly determined by the students' teachers, and the stakes have never been higher to evidence continuous improvement in mathematics teaching and learning. Inconsistencies in teachers'

professional development lead to inequities in instruction and assessment learning experiences (Zimmermann, Carter, Kanold, & Toncheff, 2012). With the importance of teacher instruction being ever-present in literature related to student academic achievement, better understanding mathematics teachers in high- and low-performing schools can benefit all students.

According to Waters and Grubb (2004), "the goal of leaving no child in the United States behind necessitates that school leaders also have the knowledge and skills to lead change effectively " (p. 6). A significant meta-analysis study, conducted by the Mid-Continent Research for Education and Learning (McREL), "identifies specific leadership responsibilities and practices that are correlated with student achievement" (as cited in Waters & Grubb, 2004, p. 1). Determining relationships among administrators and student success in high- and low-performing schools will benefit both students and educators.

Factors from outside of the school environment also impact student achievement. Much research exists on the effects of poverty and educational attainment. Payne (1996) discussed the multiple ways in which poverty plays a role in student learning. It is stated that "numerous studies have documented the correlation between low socioeconomic status and low achievement" (Payne, 1996, p. 87). Rothstein (2004) discussed the influence of social class on student achievement, pointing out that giving attention to this influence is important in evaluating the effectiveness of schools.

According to Fullan (2011) in his discussion of whole system reform, "tTransparency of results and practice will be key to securing public commitment to education, and to elevating the status of the profession" (p. 9). As DuFour and Fullan (2013) explained, systems encompass multiple schools and communities that are working toward a common goal. Extending the focus of collaboration from single schools or districts to entire states and countries, DuFour and Fullan

cautioned that “if the overall system is not the focus of ongoing improvement, it will be extremely difficult for schools or districts to sustain continuous development” (p. 4). Educators must look both within and outside of the walls of their schools and districts. Districts that have been successful at district-wide reform within all of their schools have been “committed to larger-scale reform efforts within their states” (DuFour & Fullan, 2013, p. 7). This study of the implementation of Marzanoet al.’s (2001) nine instructional strategies and prioritization of McREL’s (Waters & Grubb, 2004) 21 leadership responsibilities, as well as teacher and administrator characteristics, in schools throughout the state of Indiana supports DuFour and Fullan’s (2013) framework.

As referenced by Egan (2008), combining the beliefs of Plato and Rousseau, the importance of both knowledge in education and the recognition of students' stages related to when they can best learn different kinds of knowledge, and in what ways they can learn, is essential to educational reform. As the importance of both of these beliefs was recognized, educators began to recognize that students' lack of learning the curriculum might be due to more than student defiance. It might be due, instead, to factors such as teaching methods or the developmental stage at which the topic was taught.

Statement of the Problem

Although “there are no fail-safe solutions to educational and organizational problems” (Waters, Marzano, & McNulty, 2003, p. 14), the chances of providing effective educational leadership can be increased with “research findings that are organized, accessible, and easily applied by practitioners” (Waters et al., 2003, p. 14). The McREL study (Waters et al., 2003) specifically identified 21 leadership responsibilities that demonstrate “a substantial relationship between leadership and student achievement” (p. 3).

Marshall (2006) stressed the importance of teaching math for understanding and, more specifically, teacher understanding of mathematics. "So, for mathematics teaching to be effective, major changes are essential: a new generation of materials must be created that are truly reality-based, and new attitudes must be adopted by everyone involved in the mathematical education of our children" (Marshall, 2006, p. 362). Marshall included references to a study by Stigler and Hiebert (2009) about poor math teaching experienced by many American students, compared to Japanese students. In the study, zero percent of lessons that were analyzed in the United States were rated to have high-quality mathematics content. According to Marshall (2006),

> Teachers need guidelines that truly advocate an understanding approach, they need contemporary materials that help rather than hinder the learning process, they need professional support that really understands understanding mathematics, they need to have assessment procedures that support their desire to develop a profound understanding of elementary mathematics as the teacher, they need to be free of excessive paperwork that takes time from lesson preparation, and they need a supply of delightful students. (p. 363)

Goya (2006) focused on the teacher's role in student success in mathematics. Quoting Richard Askey from the *Milwaukee Journal Sentinel,* Goya (2006) wrote that Askey argued "that the biggest problem with how math is taught isn't the choice of curriculum. It's whether the teachers are able to do their jobs effectively" (p. 371). According to Indiana Education Insight (2014), the Indiana Department of Education is participating in 100Kin10, a network collaborating to provide professional development for 100,000 science, technology, engineering,

and math (STEM) teachers by 2021. It is important that training addresses research-based strategies for teacher effectiveness.

"Principal leadership is significantly correlated with student achievement" (Waters & Grubb, 2004, p. 2) according to the quantitative research from McREL's *Balanced Leadership Framework* (Waters et al., 2003). This is evident in the increasing recognition of the principal's role as an instructional leader. Knowledge about leadership responsibilities and their impacts on student achievement is important for policymakers to facilitate administrator preparation and licensure. The results of Waters et al.'s (2003) analysis "reinforce the importance of the principal's ability to lead changes that are needed to dramatically improve the performance of America's schools" (Waters & Grubb, 2004, p. 6). Waters and Grubb (2004) reiterated that

> when school leaders identify and focus on the school and classroom practices that are most likely to enhance student achievement and when they understand the magnitude of "order" of change they are leading and adjust their leadership practices accordingly, their leadership practices are likely to positively influence student achievement. (p. 14)

"Understanding poverty effects has been an important part of the mathematics education research literature for several decades" (Hogrebe & Tate, 2012, p. 12). With the majority of states including mandated algebra courses in their graduation requirements, opportunity gaps have occurred between minority and low socioeconomic (SES) students. Gassama (2012) stated that the belief that children of poverty achieve at lower levels than other students is well established. Schools, however, "can play an important role in the success and academic achievement of children by considering them as capable of achieving, instead of failures and setting them up to achieve to the utmost" (Gassama, 2012, p. 8).

As algebra requirements increase for Indiana high school diploma recipients, educators must concern themselves with graduation rates and Algebra I ECA passing rates. Table 1 reports the percentage of students in the state of Indiana passing the Algebra I ECA in 2010 and 2011. The passing rates from students in Grades 9 through 12 range from 20.0% to 73.6%. With a state graduation rate of 88.38% in 2012, and recent policies implemented to decrease the number of waivers granted to students who have not met the Algebra I ECA and Algebra II Core 40 diploma requirements, educators must analyze instructional strategies, teacher characteristics, and administrative instructional leadership capacity in secondary schools with high and low passing rates on the Algebra I ECA to ensure best-practice teaching and optimal learning. The information in this study will inform educators and positively impact student achievement.

Table 1

Percentage of Students Who Passed Algebra I ECA in 2010 and 2011 in Indiana

	Algebra I 2010			Algebra I 2011		
Grade Level	Test *N*	Pass *N*	% Pass	Test *N*	Pass *N*	% Pass
Grade 5	***	***	***	***	***	***
Grade 6	99	94	94.9%	175	155	88.6%
Grade 7	2,288	2,132	93.2%	2,449	2,352	96.0%
Grade 8	23,136	19,991	86.4%	23,096	21,006	91.0%
Grade 9	41,700	25,509	61.2%	42,448	31,243	73.6%
Grade 10	14,333	4,822	33.6%	15,096	7,105	47.1%
Grade 11	1,679	377	22.5%	4,124	1,905	46.2%
Grade 12	470	94	20.0%	766	158	20.6%
Grade 12+/Unknown	78	26	33.3%	319	146	45.8%
Total	83,788	53,050	63.3%	88.481	64,078	72.4%

Note. Indiana Department of Education (2014)

The Indiana Chamber of Commerce included increasing the number of students considering STEM fields in their goals for Indiana Vision 2025. The importance of encouraging students in Indiana to pursue STEM-related degrees is stressed (Beasor, 2014). Speaking about unfilled jobs, James Dworkin, Chancellor, Purdue University North Central, shared that the push for people to consider STEM careers comes from the fact that “we have people that don’t have the skills to fill those jobs” (as cited in Beasor, 2014, p. 33). Jim Heck, executive director of Grow Southwest Indiana Workforce, also saw the need for growth in the STEM areas. He

stated, “It appears to me that there needs to be an increase in those skill levels coming out of both high school and postsecondary” (as cited in Beasor, 2014, p. 33).

Purpose of the Study

The purpose of this quantitative study is to better understand the instructional strategies of Algebra I teachers and leadership characteristics of administrators among secondary public schools with high and low performance on Algebra I ECAs. Research conducted by Coleman and Jencks shows the significant impact that individual teachers can have on student achievement, even if the school does not (Marzano et al., 2001). Marzano et al.’s (2001) nine instructional strategies are research-based, with strong effects on student achievement. McREL’s *Balanced Leadership Framework* (Waters & Grubb, 2004) found a significant correlation between principal leadership and student achievement, with “21 responsibilities that have statistically significant relationships with student achievement” (p. 3). With the existence of research supporting the significant impacts of specific instructional strategies and leadership responsibilities on student achievement, additional research into differences in their presence and implementation among high- and low-performing schools on the Algebra I ECA should guide professional development and collaboration in schools. This study will collect data to answer the following research questions.

Research Questions

1. Does a school’s free and reduced lunch percentage serve as a significant predictor for first-time test takers Algebra 1 ECA passing rate percentage?
2. What is the current implementation level of Marzano et al.’s (2001) research-based instructional strategies in Algebra I classrooms and McREL’s (Waters & Grubb,

2004) leadership responsibilities among high school principals in Indiana public high schools?

3. Is there a significant difference on Marzano et al.'s (2001) research-based instructional strategies composite score based on school performance type?
4. Do the teacher characteristics of gender, educational degree attainment, years of experience, and locale serve as significant predictors of Algebra I ECA residual score?
5. Is there a significant difference on McREL's (Waters & Grubb, 2004) research-based leadership responsibilities composite score based on school performance type?
6. Do the principal characteristics of gender, educational degree attainment, years of experience, and locale serve as significant predictors of Algebra I ECA residual score?

Null Hypotheses

$H_0$1. A school's free and reduced lunch percentage does not serve as a significant predictor for ECA passing rate percentage.

$H_0$2. There is no significant difference on Marzano et al.'s (2001) research-based instructional strategies composite score based on school performance type.

$H_0$3. The teacher characteristics of gender, educational degree attainment, years of experience, and locale do not serve as significant predictors of Algebra I ECA residual score.

$H_0$4. There is no significant difference on McREL's (Waters & Grubb, 2004) research-based leadership responsibilities composite score based on school performance type.

$H_0$5. The principal characteristics of gender, educational degree attainment, years of experience, and locale do not serve as significant predictors of Algebra I ECA residual score.

Delimitations

1. The time frame established for data collection.
2. Only public high school principals and teachers were surveyed.
3. Additional out-of-school factors that research indicates may impact student achievement were not researched and included in the study.

Definitions of Terms

The terms commonly used in or related to this study are defined below:

Algebra I residual score is the difference between the actual Algebra I ECA pass rate for a school and the predicted pass rate, factoring in the free and reduced lunch rate.

Composite score, in this study, pertains to a composite score for each survey. For the teacher survey, it was the sum of the ratings teachers give to implementation of Marzano et al.'s (2001) nine research-based instructional strategies. For the principal survey, it was the sum of the ratings principals assign to the prioritization of McREL's (Waters et al., 2003) 21 leadership responsibilities.

Educational degree attainment is the highest college degree earned by a teacher or principal. In this study, teachers were given the options of a bachelor's or master's degree. Principals were given the options of bachelor's, master's, or beyond master's degree.

End of Course Assessment (ECA) was "developed specifically for students completing their instruction in Algebra I, Biology I, or English 10" (IDOE, 2014, para. 1).

*Indiana Statewide Testing for Educational Progress-Plus (*ISTEP +) is the program implemented "to measure student achievement in the subject areas of English/language arts, science, and mathematics. ISTEP+ reports student achievement levels according to the Indiana Academic Standards that were adopted in November 2000 by the Indiana State Board of

Education" (IDOE, 2014, para. 1).

A school was considered a *high-performing school* when the Algebra I ECA pass rate was more than .3 standard deviations above the norm, as determined by the linear regression on school Algebra I ECA passing rates and school free/reduced lunch rates in the state.

Instructional strategies are systematic methods implemented in Algebra I classrooms.

Leaders are building- and district-level administrators that are tied to the curriculum, programs, teacher professional development and data collection for their schools.

Locale is categorized as urban, suburban, or rural for both principals and teachers.

Low-performing school was when the Algebra I ECA pass rate was more than .3 standard deviations below the norm, as determined by the linear regression on school Algebra I ECA passing rates and school free/reduced lunch rates in the state.

Pass rate success is when students in a school, on average, pass the Algebra I ECA at a rate that is equal to or greater than that projected based on their free/reduced lunch rate, according to the linear regression prediction for pass rate and free/reduced lunch rate for Indiana state data.

Student achievement is success on the Algebra I ECA.

Student enrollment is calculated as the average daily membership (ADM) by how many students are enrolled at the school on days fixed by the state board, one day in September and one in February (Indiana Code 20-43-4-2, 2010).

Years of experience reflect the number of years teachers have taught Algebra I. For principals, years of experience reflects the number of years served as an administrator in their current buildings. They also provide years of experience administrators had as teachers.

Summary of the Study

Although the specific assessments implemented and accountability measures created for schools will change over time, algebra will continue to be a required course with increased expectations for success in a culture of high-stakes accountability. As higher-level math courses increasingly become part of the basic high school requirements and preparation for success in college becomes more closely tied to a robust high school mathematics curriculum, basic algebra skills are essential for student success. Schools must share results, effective instructional strategies, desirable teacher and principal characteristics, and important leadership responsibilities that lead to student success in Algebra.

CHAPTER 2

REVIEW OF THE LITERATURE

According to Clarkson, Fawcett, Shannon-Smith, & Goldman (2007), 70.0% of Americans saw "math and science as *very important* for all graduates" (p. 74). Forty-four percent of those surveyed believed "students avoid math and science because the subjects are *too difficult"* (Clarkson et al., 2007, p. 74). The focus on student achievement in mathematics is apparent in the creation of and work completed and continuing to be completed by the following laws, assessments, and organizations: No Child Left Behind Act (NCLB; U.S. Department of Education, 2010), National Council of Teachers of Mathematics (NCTM), National Assessment of Educational Progress (NAEP), National Mathematics Advisory Panel (NMAP), National Center for Education Statistics (NCES), and Trends in International Mathematics and Science Survey (TIMSS). These, as well as many other initiatives and committees formed to gather data, set standards, and reform curriculum in math education, particularly algebra, shed light on the weight being placed on students and educators in relation to student achievement in algebra. The focus comes from local, state, national, and international levels.

A review of a presentation by Mullis and Martin at the International Association for the Evaluation of Educational Achievement resulted in the following "list of the essential ingredients of a successful education system: a strong curriculum; experienced teachers; effective instruction; willing students; adequate resources; and a community that values education" (as

cited in Ravitch, 2010, p. 224). A review of the related literature will be presented through four areas related to student achievement in Algebra: teachers, curriculum and instruction, leadership, and poverty.

Teachers

Ravitch (2010), in her discussion of school reform efforts, included the focus that was placed on teacher excellence in a report by the National Commission on Teaching and America's Future (NCTAF). The commission set a goal for the following by 2006 which stated, "All children would be taught by excellent teachers. To reach this goal, the commission proposed higher standards for teacher education programs, high-quality professional development, more effective recruitment practices, a greater commitment to professionalism, and schools that support good teaching" (as cited in Ravitch, 2010, p. 178).

Ravitch (2010) also referenced Professor William Sanders, a statistician who concluded through his studies on teacher contribution to student gains as compared to other factors, who stated, "The most important factor affecting student learning is the teacher" (p. 179). In addition, Ravitch's research included the work of Hanushek and Rivkin of Stanford University, who concluded "that having five years of good teachers in a row could overcome the average seventh-grade mathematics achievement gap between lower-income kids and those from higher-income families" (Ravitch, 2010, p. 181).

In "From Arithmetic to Algebra" (Ketterlin-Geller, Jungjohann, Chard, & Baker, 2007), much emphasis is placed on teachers' impacts on student learning. As the NMAP and NCTM place increasing emphasis on the importance of students developing algebra-related skills as early as kindergarten, educators recognize the need for teacher awareness and abilities to teach algebra across the grades. As algebra-related skills are being formed in elementary grades,

attention is being paid to teachers' understanding of mathematics, as it influences the quality of instruction. Elementary teachers are often required to complete minimal college-level mathematics courses, though attention to this area has increased (Ketterlin-Geller et al., 2007).

The research of Sanders placed emphasis on the impact of the individual classroom teacher on student achievement.

> The results of this study will document that the most important factor affecting student learning is the teacher. . . . The immediate and clear implication of this finding is that seemingly more can be done to improve education by improving the effectiveness of teachers than by any other single factor. (as cited in Marzano et al., 2001, p. 3)

Acknowledging the relationship between effective teachers and student achievement, Marzano et al. (2001) presented research-based strategies for teachers to implement. "If we can identify what those highly effective teachers do, then even more of the differences in student achievement can be accounted for" (Marzano et al., 2001, p. 3).

Teachers' attitudes impact students' attitudes towards mathematics. According to Steele and Arth (1998), students have positive attitudes about math until fourth grade. After these years, teachers begin to focus more on drill and practice and written assessments. As the attitude that math is not applicable and is more than information to be memorized increases, so does student anxiety (Steele & Arth, 1998).

Teachers' weaknesses in mathematics preparation are often uncovered during math reform efforts. Teachers could once avoid addressing math weaknesses by focusing on computational procedures. High-stakes exams change this, as student understanding must meet higher expectations than previously necessary. Depending on teachers' knowledge and training

in mathematics, professional development may not make a significant enough impact (Briars, 1999).

On their website, the National Council of Teachers of Mathematics (NCTM) stated, "The improvement of mathematics education for all students requires effective mathematics teaching in all classrooms" (as cited in Haynie & Kellogg, 2008, p. 1). Studies on student gains on standardized tests from year to year have found that students' teachers are the most influential factor. The importance of teacher impact on student success is also supported by NCLB's (2002) requirement "that all students will be taught by a *highly qualified teacher*" (Haynie & Kellogg, 2008, p. 2). The most effective teachers in Haynie and Kellogg's (2008) study

> actively participated in the development and use of an instructional plan; planned with other teachers; were concerned about pacing; used a spiraled curriculum that introduced new material while remediating prerequisites; created a structured but positive classroom culture; emphasized problem solving; had a positive attitude toward student performance; and used materials and class time thoughtfully. (p. 25)

The top teachers had strong content knowledge, allowing them to use high-level questioning.

"The foundation of public education rests upon the student recognition of a caring teacher" (Islip, 2009, p. 23). In Islip's (2009) study as to why students fail at algebra, she emphasized the importance of a personal, caring relationship between children and teachers and attention to students' needs and attitudes to create a positive climate and student involvement. Gassama (2012) also spoke to the importance of relationships between teachers and students, specifically those of poverty. "In order to help children deemed at-risk, teachers must develop cordial and caring relationships between them and the students" (Gassama, 2012, p. 3). Teachers' cultural sensitivity, according to Gassama, plays a significant role in working with

children from low socioeconomic backgrounds. Teacher understanding of the needs of poor students and attention to social context is important in child development.

In a 12-year comprehensive approach to improve student learning, supporting 40 school districts with technical and financial resources in the Silicon Valley Math Initiative, Foster stated that teaching is "the most significant factor in student learning" (Foster, n.d., p. 5). Referring to Stigler and Hiebert's (2009) *The Teaching Gap,* Foster shared that "teachers must be the primary driving force behind change" (p. 6). Paraphrasing Dr. Heather Hill, Foster stated that "good teaching can make a significant difference in student achievement" (Hill as cited in Foster, n.d., p. 7), equivalent to that of demographic classifications. In contrast to Briars (1999), teacher professional development was determined to be the focus for improving student learning, supported by research that "teacher quality trumps virtually all other influences on student achievement" (Foster, n.d., p. 10).

The Center for Educator Compensation Reform (2006) completed a research synthesis on two characteristics that are prevalent in traditional teacher salary determinations—teachers' educational attainment and experience. The relationship between these teacher characteristics and student achievement was then researched. "The majority of studies conclude that teacher education and experience are not strong predictors of teacher effectiveness, as measured by student achievement gains" (Prince, Koppich, Azar, Bhatt, & Witham, 2006, p. 1). Though the research shows teacher skill increases through experience, the "evidence suggests, however, that teacher experience matters most during the first several years of a teacher's career" (Prince et al., 2006, p. 2). "The preponderance of evidence suggests that teachers who have completed graduate degrees are not significantly more effective at increasing student learning than those with no more than a bachelor's degree" (Prince et al., 2006, p. 1). At the secondary level,

specifically, some “advanced degrees may have a positive effect on student achievement” (Prince et al., 2006, p. 1).

In a discussion on purposeful community, Waters and Cameron (2007) pointed to the importance of colleague competence. Faculty members need to believe their colleagues to be competent in instructional strategies to increase collective efficacy. “Collective efficacy is diminished when faculty members perceive their colleagues as incompetent in particular curricular or instructional areas” (Waters & Cameron, 2007, p. 51). Research shows that schools have higher student achievement in schools with a high sense of collective efficacy.

Curriculum and Instruction

In a review of short-term interventions to assist in accelerating students who were far behind academically, Ravitch (2010) concluded that “only sustained quality education makes a difference” (p. 4). With assessment being the means for determining student proficiency of standards and results used to gauge school accountability, educators struggle to help students obtain mastery on the assessments. Millions of dollars are spent on materials that are expected to prepare students for the assessments. Educators should act with caution in spending their time and financial resources on test-prep activities. Although preparing students for assessments can have positive outcomes, it can also result in students who are able to pass the state test, but unable to pass a different test over the same subject. Students should be prepared for the test through their understanding of the content, not their understanding of how to answer questions of a particular test format (Ravitch, 2010).

Examining the Trends in International Mathematics and Science Study and the Third International Mathematics and Science Study-Repeat, it was concluded that U.S. eighth-grade mathematics curriculum was “comparable to the average seventh-grade curriculum in other

participating countries" (Spielhagen, 2006, p. 37). The resulting changes to the NCTM standards introduced "rigor and challenge for all students throughout middle school" (Spielhagen, 2006, p. 37). Additionally, differentiated "curriculum for mathematically talented students in eighth grade was emphasized" (Spielhagen, 2006, p. 37). The NCTM also emphasized "the development and study of algebraic concepts starting in prekindergarten and continuing throughout elementary and secondary school" (Spielhagen, 2006, p. 39). Spielhagen's (2006) study on closing the achievement gap in algebra showed that "restricting access to eighth-grade algebra [did not make] a significant difference in the performance of students on the state algebra tests" (p. 53). Studying algebra in eighth grade did, however, lead to "benefits in terms of [enrollment in] additional [math] courses and college attendance" (Spielhagen, 2006, p. 53).

In their study of three schools with success in student algebra achievement, Roberts and Flores (2009) found the following aspects of instruction and collaboration common among the schools:

- Teachers teaching "the same concepts and standards" (p. 37). They did so at the same time and found collaboration and sharing strategies to be important.
- Professionals knew the standards, using the textbook "as a resource, and not always as the primary instructional guide" (p. 37).
- "Teachers who had high content knowledge, great knowledge of algebra standards, [and knowledge] of exactly what appeared" (p. 37) on the state assessment.
- "Teachers who bought in to the math program" (p. 37).

According to Burris, Heubert, and Levin (2004), the focus is on accelerating instruction being supported by research that shows "an enriched, accelerated curriculum does more than a low-track, remedial curriculum to enhance the performance of low achievers and students who

are at risk of failure" (p. 68). A longitudinal study noted by Burris et al. (2004) was completed on "student achievement data from six student cohorts: the last three sixth grade cohorts at South Side Middle School that did not receive universal math acceleration and the first three sixth grade cohorts that received it" (p. 69). Students at South Side Middle School in New York had taken accelerated math in heterogeneously grouped classes. For every measure, students benefited from the accelerated math groups. Statistically, it significantly increased "the percentages of all students who took math courses beyond Algebra II in high school. . . [and] helped close the achievement gap associated with poverty" (Burris et al., 2004, p. 70) and narrowed the achievement gap associated with ethnicity. When investigating the impact of heterogeneous grouping on high achievers, the study found that more of the high achievers took upper-level math courses and maintained high math achievement in the courses. "In other words, high achievers are doing better, and more students have become high achievers" (Burris et al., 2004, p. 71). This supports the importance of a rigorous curriculum, as well as the benefits of heterogeneous math classes.

The nine research-based instructional strategies for increasing student achievement described in *Classroom Instruction That Works* (Marzano et al., 2001) are the following:

1. Identifying similarities and differences—This is referred to as the "*core* of all learning" (p. 14). This strategy has been shown to lead to a "45 percentile gain" (p. 7) in student achievement.
2. Summarizing and note-taking—This strategy has been shown to lead to a "34 percentile gain" (p. 7) in student achievement. "A strong relationship was found between the amount of information taken in notes and students' achievement on examinations" (p. 45).

3. Reinforcing effort and providing recognition—This area can be strengthened when there is a belief that success is attributed to effort, rather than ability, other people, or luck. This strategy has been shown to lead to a "29 percentile gain" (p. 7) in student achievement.
4. Homework and practice—This strategy stems from the knowledge that mastery requires focused practice and adapting what is learned through practice. It has been shown to lead to a "28 percentile gain" (p. 7) in student achievement.
5. Nonlinguistic representations—This strategy has been shown to lead to a "27 percentile gain" (p. 7) in student achievement. Engaging students in creating nonlinguistic representations stimulates and increases activity in the brain, according to Gerlic and Jausovec (as cited in Marzano et al., 2001).
6. Cooperative learning—Whether or not there is competition involved, this leads to a powerful effect on learning. This strategy has been shown to lead to a "27 percentile gain" (p. 7) in student achievement.
7. Setting objectives and providing feedback—This strategy has been shown to lead to a "23 percentile gain" (p. 7) in student achievement. This is "the most powerful single modification that enhances achievement" (Hattie as cited in Marzano et al., 2001, p. 96).
8. Generating and testing hypothesis—This strategy has been shown to lead to a "23 percentile gain" (p. 7) in student achievement. It involves the application of knowledge and is done naturally in many situations.

9. Cues, questions, and advance organizers—These strategies activate prior knowledge essential to learning. These have been shown to lead to a "22 percentile gain" (p. 7) in student achievement.

These instructional strategies, according to Marzano et al. (2001), are a step toward addressing the change from schooling and teaching being an art to them being a science. The other studies and references cited in this section provide additional support for Marzano et al.'s strategies.

Haynie and Kellogg (2008), in their study of the use of Marzano et al.'s (2001) strategies to identify practices of effective instruction, explained that reporting the use of these strategies does not ensure that they are implemented as defined by Marzano et al. From their study, the research supports that

> most teachers were providing recognition and asking questions, providing cues, and using advanced organizers. Most top teachers were also reinforcing effort, using guided practice, and providing meaning to homework. Less than one-third of the teachers were using similarities and differences, summarizing, using note taking, using cooperative learning, providing objectives, or generating and testing hypotheses. (Haynie & Kellogg, 2008, p. 18)

Research aside from that of Marzano et al. supported the use of homework and practice. The U.S. Department of Education stated that "student achievement rises significantly when teachers regularly assign homework and students conscientiously do it" (Heitzmann, 2007, p. 42). A significant amount of practice is beneficial to math students, especially those who are struggling. The homework should be focused on understanding, in addition to skills (Burns, 2007).

The positive impact of cooperative learning can also be found among additional studies. Steele and Arth (1998) stated that working in cooperative groups of three or four students reduces math anxiety. This allows students to share ideas and, in turn, the responsibility of coming up with the answer. "Giving students opportunities to voice their ideas and explain them to others helps extend and cement their learning" (Burns, 2007, p. 19). Wright (2013) supported the use of cooperative group work to assist them as they grapple with content and their learning processes, constructing arguments and giving one another feedback. Student interaction can increase student understanding in mathematics. Star and Rittle-Johnson's (2009) research found that students benefit from sharing and comparing solution methods was "a central tenet of effective instruction in mathematics" (p. 8). Gassama (2012) also encouraged a focus on cooperative learning, in his research on how to best assist students of poverty. The cooperative learning classroom environment supports a sense of belonging and connectedness.

In the review of literature, several authors discussed the importance of verbal feedback. Verbal feedback is important during the stages when students can offer responses and solutions in class discussions, providing guidance and redirection (Burns, 2007). Providing students with feedback should teach students that wrong answers are a helpful part of the learning process (Wright, 2013).

Double-period (i.e., two classes) Algebra courses are being implemented in many schools to provide students with additional instructional time. The intensified algebra program developed and studied in The Urban Mathematics Leadership Network (UMLN, 2009) districts have the following design features:

1. Algebra core.

2. Efficient review/repair strategies—Connecting new learning to prior knowledge through student engagement in appropriate activities. This is based on research supporting that "learning increases when common mistakes and misconceptions are systematically exposed, challenged, and discussed" (UMLN, 2009, p. 2).
3. Ongoing, distributed practice—Provide extra practice opportunities for students who are struggling. The program incorporates homework assignments and daily short problems assigned to review previously learned material and prerequisite skills.
4. Social-psychological interventions—Students' beliefs about their intelligence influence their motivation and engagement. This, in turn, impacts their success, especially in challenging subjects.
5. Supports for enactment of high cognitive demand tasks—The extent to which students are actually cognitively engaged with a task is critical to their learning. Students' responses should lead class discussions and advance the mathematical learning of the class. This is done by embedding questions and prompts in course materials. This is mainly done via partner work to promote reflection, discussion, and explanations.
6. Tools that help students organize information and support metacognitive awareness-Support students in becoming self-directed learners. Struggling learners have difficulty organizing and interpreting information.
7. Enhanced formative assessments strategies—Use formative assessments to gather evidence about students' learning and to adjust instruction accordingly. Use of effective questions, high-quality discussions, tasks that elicit evidence of learning, and providing feedback that assess students are essential.

8. Explicit supports for literacy and language development—Research supports that there is an impact on mathematical learning by literacy and language issues. Language notes, journals, reading comprehension strategies, connecting different representations of mathematical situations, reflecting, and communicating understandings are supported by the program. (UMLN, 2009, pp. 2-4)

The UMLN design features are tied to Marzano et al.'s (2001) strategies as follows: "efficient review/repair strategies" (UMLN, 2009, p. 3) is associated with providing feedback; "ongoing, distributed practice" (UMLN, 2009, p. 3) is associated with homework and practice; "social-psychological interventions" (UMLN, 2009, p. 3) is associated with reinforcing effort; "supports for enactment of high cognitive demand tasks" (UMLN, 2009, p. 3) is associated with cues and questions, as well as with cooperative learning; "tools to help with organizing and supporting metacognitive awareness" (UMLN, 2009, p. 3) is associated with cues, questions, and graphic organizers; "enhanced formative assessments" (UMLN, 2009, p. 4) is associated with cooperative learning, providing feedback, and cues, questions, and graphic organizers; "explicit supports for literacy and language development" (UMLN, 2009, p. 4) is associated with summarizing and note-taking, nonlinguistic representations, and cooperative learning.

Student engagement can be enhanced by basing learning and problem solving on real-life problems. Incorporating teacher knowledge of students' diverse backgrounds, focusing on cultural relevance and content quality, is essential. Assisting students by providing a link for understanding and recall of new information is beneficial for students of poverty (Gassama, 2012).

Leadership

Political leaders at all levels have been focused on school accountability, which gained momentum in the 1990s. NCLB (2002) extended the focus on accountability to contain one goal; for "making every student proficient in math and English by 2014" (Ravitch, 2010, p. 21). It is a goal that is federally mandated and tied to significant consequences for schools whose students do not reach that goal. The high standards and serious consequences have generated a system that produces illegal behavior. Educators have been found cheating in various ways to show increasing test scores. Although this is not excusable, it does lead to questioning the validity of assessment data. If schools are presenting data that has been distorted, how are we measuring ourselves toward the common goal? Educators at all levels of leadership must hold themselves and others accountable for accurate data reporting (Ravitch, 2010).

Principals, who are responsible for the evaluation of teachers, should have prior experience as teachers, allowing them to better understand and recognize good teaching. They should know which teachers are effective in teaching their students reading and mathematics. Although test data will be accounted for, principals must consider evaluations important, also. "The best principals have had a long apprenticeship as educators, first as teacher, then as assistant principals, and finally as principals" (Ravitch, 2010, p. 228).

The importance of experience is also noted in the discussion of the "history of supervision and evaluation" (Marzano, Frontier, & Livingston, 2011, p. 12) in *Effective Supervision: Supporting the Art and Science of Teaching*. Supervision and evaluation were a focus of education from the start, with increasing focus on instruction. "Rather than simply understanding the mores of the community, the supervisor now needed to have subject area knowledge and teaching skills" (Marzano et al., 2011, p. 13).

Administrators must be informed about and able to respond to the math strategies being implemented in their buildings. They must review district policies and practices that can hinder reform efforts, focusing on student learning when making decisions. One policy being reviewed and researched is the change from traditional to standards-based assessments. Administrators should review the related research and ensure appropriate professional development and resources are available to teachers as standards-based assessments and instruction gain support in math reform (Briars, 1999).

"Fixating on the format of a state test and practicing for it is like practicing for your physical exam as a way of becoming healthier" (Richardson, 2008, p. 33). Principals should encourage teachers to focus on student learning of the content of the tests, not focus on the test itself. They must lead teachers in determining what it is that students should learn, how student learning will be assessed, and in collaborating to address areas in need of improvement. When observing teachers and classrooms, principals should gauge student understanding of learning goals and assessment measures (McTighe, 2008).

Singapore has made significant gains in student mathematical achievements in the past couple decades (Leinwand & Ginsburg, 2007). The "five elements [that] have contributed to the success of Singapore Math [are] an organizing framework. . .alignment. . .focus. . .multiple models. . .rich problems" (Leinwand & Ginsburg, 2007, pp. 33-35). In the United States, the NCTM created a framework where content and process are separate, whereas in Singapore's framework these are connected. In the United States, alignment is lacking between textbooks, local curriculum, state standards, and state tests. Singapore's success with having fewer topics per grade level, as well as the evidence that states in the United States with the fewest number of topics (i.e., North Carolina and Texas) have been successful on the NAEP, support the

importance of focus. Singapore textbooks provide multiple representations to assist in skill building and conceptual understanding, but consistently use the same single powerful models to maintain unity, whereas U.S. textbooks jump from one model to another. Unlike Singapore, textbooks from the United States contain too many one-step exercises that are not demanding enough. It is important that leaders not look for quick fixes to the United States' problems in mathematics, but look to the Singapore program to guide mathematics education reform in the United States (Leinwand & Ginsburg, 2007).

Stakeholders in education from various areas, including professional organizations and policymakers, place emphasis on the importance of Algebra preparation for students in the early years of their education. Graduation requirements in mathematics have been rising in many states to include Algebra II. This is due, in part, to research that shows students who pass Algebra II are more likely to graduate. Higher requirements in mathematics are seen as supportive of the need for students to be prepared for college. With research to support the importance of success in Algebra, educational leaders must focus resources of time, money, staff, and professional development in this area (Ketterlin-Geller et al., 2007).

In the Haynie and Kellogg (2008) study, strong, experienced course leaders were noted as being prevalent in the top-performing schools. The Algebra leaders supported implementation of state standards and curriculum, supported teachers, and expressed pride in their department and team. Those schools that performed in the bottom of the study lacked strong leadership. Different from a professional learning community where the focus is on collaboration and a positive school climate, these schools complained and gave excuses as to why their students were not being successful (Haynie & Kellogg, 2008).

Haynie and Kellogg (2008) recommended that building-level leaders do the following to foster student success in Algebra I:

- Develop a school plan that aligns to the standard course of student, emphasizes problem solving, and supports new teachers.
- Support meaningful common planning for teachers.
- Share results data with teachers, including effectiveness rosters and indices.
- Develop a scheduling plan that maintains stability in Algebra I while adjusting to performance results over time and giving teachers opportunities to grow.
- Support a school culture that promotes open discourse at all levels. (p. 28)

Additionally, Haynie and Kellogg (2008) recommended the following to district leaders:

- Make observations of the most effective schools and teachers that can be shared district wide.
- Provide workshops on implementing Marzano's strategies.
- Support school-wide improvement efforts based on top school models.
- Support teacher improvement efforts.
- Provide data to teachers and schools on their effectiveness. (p. 28)

Chicago's double-dose algebra reform and its impact on improving student learning were attributed to the instructional supports. This includes "extended instructional time, curricular resources, and professional development on instructional practice" (Durwood, Krone, & Mazzeo, 2010, p. 7). The success is more likely to occur when "they include the kinds of deep supports for teaching provided in this instance" (Durwood et al., 2010, p. 7). The study on Chicago's reform also emphasized the importance of policymakers examining school culture and organization to address related issues that impact the success of programs (i.e., methods to

improve academic behaviors, facilitating student participation and engagement) (Durwood et al., 2010).

In response to state legislation in Michigan, mandating that all graduating seniors successfully pass Algebra I and II, principals created a study group to determine the leadership moves for algebra teaching (Carver, Stelle, & Herbel-Eisenmann, 2010). Their work was guided by the construct of leadership content knowledge, which "argues that effective instructional leaders need a deep and flexible understanding of at least one subject area, including how it is best learned and taught, in order to effectively assess teacher performance and guide teacher development" (Carver et al., 2010, p. 31). Their program included a focus on Stein and Nelson's *post-holing*, which argued for the benefits to leaders from "in-depth exploration of representative slices of subject areas in which they are not familiar" (Carver et al., 2010, p. 32). The Michigan principals' program focused on leaders understanding what it is like to learn algebra, what is known about how children learn algebra, and the best instructional methods for the subject. This education for principals led to confidence when talking with teachers about mathematics and a renewed commitment to students who struggle. Data from the program suggests that "the development of leadership content knowledge (i.e., knowledge of the subject, knowledge of teaching, and learning the subject) among participants coincided with their ability to envision leadership practices that extended beyond supervision to include teacher support and development" (Carver et al., 2010, p. 33).

In their study into what happens in schools with sustained achievement in algebra, Roberts and Flores (2009) focused on the importance of leadership structures and how school leaders manage resources to increase and sustain math results. In the schools they studied, the following aspects of leadership were common:

- Actively engaged department chairs who exhibited leadership qualities and were respected as leaders by all or most of the teachers in the department.
- An administration that supported and empowered their department chair and teacher leaders within the department.
- Department leaders who taught both higher level math classes (Calculus) and lower level math classes (Algebra).
- Professional development at the schools that was organized around department and team collaboration.
- A 'school leader' who was not necessarily an administrator who possessed an administrative credential. (Roberts & Flores, 2009, pp. 34-37)

In addition to seeing "early access to algebra as a means of increasing mathematics literacy, [educational policymakers] must also provide equitable access to that literacy" (Spielhagen, 2006, p. 38). Further, "Research must continue to inform [them] of the benefits of early access to algebra, the availability of eighth-grade algebra to all students, and the implications of algebra study among diverse populations" (Spielhagen, 2006, p. 38). Leaders must be and stay informed (Spielhagen, 2006).

With an emphasis on the importance of children's preparation in early childhood and elementary school for algebra, Oishi (2011) shared advice from Mike Shaughnessy, president of the NCTM. That advice is for district administrators to assess what kids can do, using formative assessment, to ensure they have mastered basic topics and encourages schools to introduce algebraic thinking, concepts, and subskills from early elementary grades. The importance of professional development and its support for implementation of a variety of curricula or programs is also stressed in the article. Resources to support programs are a must.

Waters et al. (2003) discuss the leadership framework based on the meta-analysis, stating that "Many early studies on school effectiveness, for example, reported that leadership, specifically instructional leadership, was one of several defining characteristics of successful schools" (p. 2). Quantitative data was lacking, which led to the creation of the leadership framework. In addition to data supporting the idea that there is a "substantial relationship between leadership and student achievement" (Waters et al., 2003, p. 3), the data also found that concentrating "on the wrong school and/or classroom practices or [miscalculating] the magnitude or *'order'* of the change they are attempting to implement" (Waters et al., 2003, p. 5) can lead to a negative impact on achievement. The two "variables that determine whether or not leadership will have a positive or negative impact on achievement" (Waters et al., 2003, p. 5) are focus of change and magnitude of change. Understanding of first order and second order change is also essential. First order changes "are consistent with existing values and norms" (Waters et al., 2003, p. 7). Change is second order when "it is not obvious how it will make things better for people with similar interests" (Waters et al., 2003, p. 7). This understanding allows leaders to implement the appropriate leadership practices and strategies.

In *The Leadership We Need: Using Research to Strengthen the Use of Standards for Administrator Preparation and Licensure Programs,* Waters and Grubb (2004) stated that "the principal's role as instructional leader has been increasingly recognized as a critical factor for improving student achievement" (p. 1). McREL developed the *Balanced Leadership Framework* (Waters et al., 2003), identifying specific leadership responsibilities that have a statistical relationship with student achievement. The study reviewed over 5,000 studies that examined the relationship between school leadership and student achievement. A total of 2,894 schools, 14,000 teachers, and 1.1 million students made up the sample for the study. Among the findings

from the study was the idea "that principal leadership is significantly correlated with student achievement" (Waters & Grubb, 2004, p. 2), "21 specific leadership responsibilities . . . have statistically significant relationships with student achievement, leaders can have a positive . . . or negative impact on achievement" (Waters & Grubb, 2004, p. 3) and changes can have either positive or negative associations with leadership responsibilities. The article discussed the importance of policymakers being knowledgeable in leadership responsibilities and their impacts on student achievement. The 21 leadership responsibilities that have statistically significant relationships with student achievement are shown in Table 2.

Table 2

Principal Leadership Responsibilities: Average R and 95% Confidence Intervals

Responsibilities	The extent to which the principal . . .	Avg. *R*	*N* Schools	*N* Studies	95% Conf. Int.
Culture	fosters shared beliefs and a sense of community and cooperation	0.29	709	13	.23-.37
Order	establishes a set of standard operating procedures and routines	0.26	456	17	.17-.35
Discipline	protects teachers from issues and influences that would detract for their teaching time or focus	0.24	397	10	.14-.33
Resources	provides teachers with materials and professional development necessary for the successful execution of their jobs	0.26	570	17	.18-.34
Curriculum, instruction, and assessment	is directly involved in the design and implementation of curriculum, instruction, and assessment practices	0.16	636	19	.08-.24

Table 2 (continued)

Responsibilities	The extent to which the principal . . .	Avg. *R*	*N* Schools	*N* Studies	95% Conf. Int.
Focus	establishes clear goals and keeps those goals in the forefront of the school's attention	0.24	1,109	30	.18-.29
Knowledge of curriculum, instruction, and assessment	is knowledgeable about current curriculum, instruction, and assessment practices	0.24	327	8	.13-.35
Visibility	has quality contact and interactions with teachers and students	0.16	432	11	.06-.25
Contingent rewards	recognizes and rewards individual accomplishments	0.15	420	7	.05-.24
Communication	establishes strong lines of communication with teachers and among students	0.23	245	10	.10-.35
Outreach	is an advocate and spokesperson for the school to all stakeholders	0.28	478	14	.19-.35
Input	involves teachers in the design and implementation of important decisions and policies	0.30	504	13	.21-.38
Affirmation	recognizes and celebrates school accomplishments and acknowledges failures	0.25	345	7	.14-.35
Relationship	demonstrates an awareness of the personal aspects of teachers and staff	0.19	497	12	.10-.24
Change agent	is willing to and actively challenges the status quo	0.39	479	7	.22-.38
Optimizer	inspires and leads new and challenging innovations	0.20	444	9	.11-.29

Table 2 (continued)

Responsibilities	The extent to which the principal . . .	Avg. *R*	*N* Schools	*N* Studies	95% Conf. Int.
Ideals/beliefs	communicates and operates from strong ideals and beliefs about schooling	0.25	526	8	.17-.33
Monitors/evaluates	monitors the effectiveness of school practices and their impact on student learning	0.28	1,071	30	.23-.34
Flexibility	adapts leadership behavior to the needs of the current situation and is comfortable with dissent	0.22	151	2	.05-.37
Situational awareness	is aware of the details and undercurrents in the running of the school and uses this information to address current and potential problems	.33	91	5	.11-.37
Intellectual stimulation	ensures that faculty and staff are aware of the most current theories and practices and makes the discussion of these a regular aspects of the school's culture	0.32	321	5	.22-.42

Note. Waters et al. (2003, p. 4)

Further work from McREL in the area of leadership recognizes that "simply knowing what to do is often not enough to transform schools and classrooms" (Waters & Cameron, 2007, p. 1). "Leaders also must know why certain practices are important, when they should be used, and how to apply them skillfully" (Waters & Cameron, 2007, p. 1). Strong leaders can actually fail to have a positive impact on student achievement, according to several studies. This is considered the "*differential impact of leadership*" (Waters & Cameron, 2007, p. 22) and could be

due to lack of "focus on the right classroom and school practices" (Waters & Cameron, 2007, p. 10) or lack of understanding of the implications for stakeholders. Of the 21 leadership responsibilities displayed in Table 1, all are positively correlated with first-order change. That is, change that fits with existing norms and values. Eleven of the leadership responsibilities correlated, with statistical significance, with second-order change, seven positively and four negatively. Second-order change is change that questions current norms. "Balancing when and how to maintain the status quo with when and how to challenge it is often the difference between effective and ineffective leadership" (Waters & Cameron, 2007, p. 19).

Poverty

"The condition of poverty, however, may be the most important of all student differences in relation to high achievement, although not all schools have racial diversity, nearly all schools have at least some students living in poverty" (Burney & Beilke, 2008, p. 171). Satisfactory completion of mathematics courses beyond Algebra II and rigorous courses have been shown to be the greatest predictor of postsecondary success. The opportunity and background preparation for such rigorous academics, however, is often lacking in the households of students living in poverty. Studies have shown "that low income explains a much larger percentage of the variance in academic achievement than ethnicity" (Burney & Beilke, 2008, p. 179).

According to one study,

> Nearly 90.0% of the variance in students' math scores on some tests can be predicted without knowing anything about their schools. One only needs to know the number of parents in the home, the level of the parents' education, the type of community in which the family lives, and the state's poverty rate. (Evans, 2005, p. 584)

Evans (2005) discussed the small amount of time students spend in school compared to being at home (only 10.0% of their lives are spent in school when they graduate as seniors) and the data that indicates the "achievement gap begins well before kindergarten" (p. 585), with low income students typically starting "school at least a full year behind others in reading and [significantly smaller] vocabulary" (p. 585). In addition to the initial setback for children, the "achievement gap appears to grow over the summer, not during the school year" (Evans, 2005, p. 585), supporting the idea that schools do not have the control over out-of-school factors such as poverty.

Mathis (2005) covered similar concerns, discussing that adequate yearly progress (AYP) overlooks our research on "schools with high concentrations of poor and minority students will fail to make AYP in disproportionate numbers" (p. 592). "It is well established that poverty explains more of the variation in test scores than does any education reform" (Mathis, 2005, p. 592). In the analysis performed by Mathis (2005), "socioeconomic status and participation in ESL were the most significant factors for all groups of students" (p. 602). "The potential effectiveness of any education reform is seriously limited by poverty" (Rotberg, 2005, p. 615), which is often overlooked in test-score rankings. The socioeconomic status of students strongly influence their test scores. Rothstein (2004) also discussed concerns about policy makers failing to attend to the issues related to social-class characteristics when assessing schools and student achievement. "Many social and economic manifestations of social class also have important implications for learning" (Rothstein, 2004, p. 106). Rothstein went so far as to state that "the influence of social-class characteristics is probably so powerful that schools cannot overcome it" (Rothstein, 2004, p. 107).

Payne (1996) discussed various ways in which poverty impacts students' lives including "hidden rules of the class in which he or she is raised" (p. 3), schools operating from the norms, hidden rules of the middle class, sacrifices that must be made to move to a different SES, and all state tests using formal register while "poor students do not have access to formal register at home" (p. 28). "Regardless of race or ethnicity, poor children are much more likely than non-poor children to suffer developmental delay and damage, to drop out of high school, and to give birth during the teen years" (Payne, 1996, p. 4). "Low achievement is closely correlated with lack of resources, and numerous studies have documented the correlation between low socioeconomic status and low achievement" (Payne, 1996, p. 87).

Howley and Bickel (2000) summarized studies analyzing 29 sets of scores from multiple grades in four states, which found that the "correlation between poverty and low achievement is much stronger in larger schools than in smaller schools" (p. 10). The studies were completed following research that "clearly established that poverty negatively affects student achievement" (Howley & Bickel, 2000, p. 3). The studies, according to the authors, imply that policies supporting research on poverty and reform, such as their data about poverty and school size, should be used if narrowing the achievement gap between children from high and low SES is a goal.

In her study into the effects of school-level characteristics on students' reading and math achievement, Southworth (2010) stated that "increasing teacher quality and school resources reduces but does not eliminate the effects of school racial and poverty composition on student achievement" (p. 1). "Regardless of their individual race or poverty standing, all children who attend middle-class schools are more likely to score higher on standardized tests than those in low-income schools" (Southworth, 2010, p. 5). The study attributes this lack in student

achievement to teacher quality differences among high and low SES schools, peer effects, and parental involvement.

Blazer and Romanik (2009) reviewed studies on the relationship between poverty (individual and school concentration) and student achievement. A summary of their conclusions is that lower levels of academic achievement tend to be reached by low income students and the number of disadvantaged students in a school affects the achievement of all students. "Researchers have found that income level is one of the most powerful predictors of students' academic performance" (Blazer & Romanik, 2009, p. 1). This study is yet another that discusses NCLB being flawed by its lack of attention to out-of-school factors when assessing schools. Though schools should be held accountable for increasing student achievement, many entities besides the schools must support closing the achievement gap. Income, alone, may not be the cause of lower student achievement, but it tends to be combined with "prenatal disadvantages, increased illness and injury, nutritional problems, exposure to pollutants, hazardous neighborhoods, struggle to survive, family violence, lack of adult attention, residential instability, and lack of educational activities and materials" (Blazer & Romanik, 2009, p. 1). Combining multiple factors leads to a higher negative impact on student achievement and the achievement gap. The Coleman report concluded that, as opposed to school funding and student race, "family economic status was far more predictive of academic success" (as cited in Blazer & Romanik, 2009, p. 5). "Low income students have been found to have significantly lower test scores in core subjects than their more advantaged peers" (Blazer & Romanik, 2009, p. 6). "Studies have demonstrated that student achievement falls as the poverty level of a school rises" (Blazer & Romanik, 2009, p. 7). This included a study that reported that the 2007 TIMSS showed decreases when the percent of disadvantaged students increased; a study on fourth grade

math test scores from the NAEP showing that "low income students attending middle class schools . . . scored higher, on average, than middle class students attending high poverty schools" (Blazer & Romanik, 2009, p. 8); data from the National Education Longitudinal Study of 1988 showing "a steady decrease in average test scores as the school poverty level increased, [and] the greatest declines were found at schools with the highest concentrations of low income students" (Blazer & Romanik, 2009, p. 8); test score data from the Florida Office of Program Analysis and Government Accountability showing that students in "high poverty schools were more likely to have lower standardized writing, reading, and math test scores than [those in] more affluent schools" (Blazer & Romanik, 2009, p. 8); analysis of "combined writing, reading, and math test scores of students in seven school districts within the state of Florida . . . [showing that] 60 to 80 percent of differences in school performance were associated with . . . the percent of students eligible for free or reduced price lunch" (Blazer & Romanik, 2009, pp. 8-9); a study on North Carolina end-of-grade (EOG) test scores showing that the "EOG test scores decreased as schools' poverty concentration increased" (Blazer & Romanik, 2009, p. 9); a study by The Piton Foundation that found higher performance among low income students when they were in schools made up of less than 50.0% poor students (Blazer & Romanik, 2009). Although some strategies were identified that may help schools increase student achievement among students in poverty, it is stated that "even the most well-designed and well-supported interventions rarely allow poor students to catch up to their more advantaged peers or meet the increasingly high standards for achievement required by state and federal accountability standards" (Blazer & Romanik, 2009, p. 12).

In an analysis of poverty and achievement in Maine, it was stated that "historically children from higher income households have scored better on standardized tests than students

coming from less affluent households" (Silvernail, Sloan, Paul, Johnson, & Stump, 2014, p. 1). The report stated that "high school seniors from low-income families are, on average, four years behind their higher-income peers" (Silvernail et al., 2014, p. 2). In the report, the correlation between poverty and achievement was negative and moderate, with the correlation increasing in higher grade levels. The report refered to school poverty as "the single best predictor of student performance" (Silvernail et al., 2014, p. 29). Further, the level of poverty in schools impacts students who are not in poverty, as well as those who are. A conclusion from the study was

> without question, the evidence examined in this study indicates that levels of school poverty and student achievement are related. The magnitude of the relationship varies, and other factors are related to poverty and achievement, but the single best predictor of performance is school poverty. (Silvernail et al., 2014, p. 30)

After researching the relationship between family income and ethnicity and high-stakes tests, Orlich and Gifford (2006) stated that "poverty appears to play a major role in depressing test scores with both state sponsored criterion-referenced and national norm-referenced tests" (p. 1). They cite multiple studies that conclude poverty to be a predictor of lower achievement on tests, including several different state exams, American College Testing (ACT) and Scholastic Assessment Test (SAT) exams.

According to Thomas (2011), "overwhelming evidence shows that student outcomes in education are connected to out-of-school factors—from about 60 percent to as much as 86 percent" (p. 1). Thomas (2011) discussed "decades of evidence that test scores reflect more significantly the lives of children than the quality of teachers or schools" (p. 1) and that poverty issues are overlooked in the comparison of the educational systems in the United States, where 20.0% of children live in poverty, and Finland, where only 3% to 4% of children are in poverty.

The National Center for Fair and Open Testing (n.d.) also spoke to the impact of poverty on student achievement. Based on a study from Education Trust, although teacher quality and school resources do have an impact on student achievement, they cannot overcome the effects of poverty. According to data projections, providing all students with strong teachers would only decrease the achievement gap among students in poverty by about six percent compared to providing them with weak teachers (National Center for Fair and Open Testing, n.d.).

Pollard (2002) reviewed the use and history of tests. With increasing emphasis on test results, it is important to question if standardized tests are measuring that which they are stated to measure or other factors, such as test-taking ability. Pollard stated that

> test results don't necessarily indicate achievement, but rather, tend to be much more accurate indicators of the size of a student's house or the income of the student's parents. Research has indicated that the amount of poverty found in a community, and other factors that have absolutely nothing to do with what happens in the classroom, account for the great majority of differences in test scores from one area to another. (Pollard, 2002, p. 2)

The idea that community poverty impacts student achievement is extended in the analysis completed by the New America Foundation (2012). Student poverty rates for 2009 in the 50 states and District of Columbia were analyzed and it was determined that "states with higher student poverty rates tend to have lower math and reading proficiency rates on national tests" (New America Foundation, 2012, p. 1).

Focusing on a school's educational imperative for low-income students, Rose (2013) noted,

> If we're serious about helping more students succeed in school, then we'll have to provide the kind of ongoing support for low-income students that will give them at least a prayer of a chance of competing on the modestly level playing field we as a nation claim we value. (p. 14)

Though the risk of student failure increases as multiple factors come together to impact a student, with no single factor being the one to blame, poverty nonetheless remains a major risk factor to be considered (Gassama, 2012). The factors known to be related to poverty, leading to the impact of multiple factors, "include: unemployment, homelessness, mobility, exposure to inadequate educational experiences, substance abuse, dangerous neighborhoods, malnutrition, poor health, exposure to environmental toxins, inadequate child care, lead poisoning, television watching, and birth weight" (Gassama, 2012, p. 3). These related factors also compound to negatively impact parenting abilities, due to stress on the part of parents. This stress can lead to decreased parent involvement and support for students, less consistency in parenting, and less attentiveness to children's needs. Beasor (2014) shared that parental involvement and out-of-school learning experiences affect increasing student interest in STEM.

Summary

A review of the literature exemplifies the resources being spent on increasing student achievement in mathematics, most notably in algebra. Stakeholders at all levels are involved in reform efforts and researching what is linked to positive outcomes in mathematics instruction. Teachers' training, attitudes, and levels of experience and effectiveness are tied to student achievement in mathematics. Research in curriculum and instruction emphasize the methods that will lead to increased success for students. Leaders at all levels must be well-versed in the related research and the emphasis at all levels being placed on algebra success.

CHAPTER 3

RESEARCH METHODOLOGY

Purpose of the Study

The purpose of this quantitative study was to better understand the instructional strategies of Algebra I teachers and leadership characteristics of administrators among secondary public schools with high and low performance on Algebra I ECAs. A quantitative design was selected because, as discussed in Creswell's (2009) explanation of a qualitative study, there was a description of "trends, attitudes, or opinions of a population by studying a sample of that population" (p. 12). Research conducted after studies by Coleman and Jencks, found "that individual teachers can have a profound influence on student learning even in schools that are relatively ineffective" (Marzano et al., 2001, p. 3). Marzano et al.'s (2001) nine instructional strategies are research-based, with strong effects on student achievement. McREL's *Balanced Leadership Framework* found a significant correlation between principal leadership and student achievement, with "21 specific leadership responsibilities . . . [that] have statistically significant relationships with student achievement" (p. 3). With the existence of research supporting the significant impacts of specific instructional strategies and leadership responsibilities on student achievement, additional research into differences in their presence and implementation among high- and low-performing schools on the Algebra I ECA should guide professional development

and collaboration in schools. The study collected data to answer the following research questions.

Research Questions

1. Does a school's free and reduced lunch percentage serve as a significant predictor for first-time test taker Algebra 1 ECA passing rate percentage?
2. What is the current implementation level of Marzano et al.'s (2001) research-based instructional strategies in Algebra I classrooms and McREL's (Waters & Grubb, 2004) leadership responsibilities among high school principals in Indiana public high schools?
3. Is there a significant difference on Marzano et al.'s (2001) research-based instructional strategies composite score based on school performance type?
4. Do the teacher characteristics of gender, educational degree attainment, years of experience, and locale serve as significant predictors of Algebra I ECA residual score?
5. Is there a significant difference on McREL's (Waters & Grubb, 2004) research-based leadership responsibilities composite score based on school performance type?
6. Do the principal characteristics of gender, educational degree attainment, years of experience, and locale serve as significant predictors of Algebra I ECA residual score?

Null Hypotheses

$H_0$1. A school's free and reduced lunch percentage does not serve as a significant predictor for ECA passing rate percentage.

$H_0$2. There is no significant difference on Marzano et al.'s research-based instructional strategies composite score based on school performance type.

$H_0$3. The teacher characteristics of gender, educational degree attainment, years of experience, and locale do not serve as significant predictors of Algebra I ECA residual score.

$H_0$4. There is no significant difference on McREL's (Waters & Grubb, 2004) research-based leadership responsibilities composite score based on school performance type.

$H_0$5. The principal characteristics of gender, educational degree attainment, years of experience, and locale do not serve as significant predictors of Algebra I ECA residual score.

Survey Design

For the purpose of this study, surveys were sent to all public high school Algebra I teachers and principals for whom email addresses were obtained through a directory provided by the Public Records Department of the Indiana Department of Education. The teacher self-assessment survey (Appendix A) included five questions regarding respondent demographics and one question related to prioritization and implementation of Marzano et al.'s (2001) nine instructional strategies. The principal self-assessment survey (Appendix B) included six questions regarding respondent demographics and one question related to the prioritization of the 21 leadership responsibilities included in the meta-analysis research conducted by McREL (Waters & Grubb, 2004).

In order to ensure the validity of the surveys, a review was conducted in July 2014 by 11 members of my doctoral cohort at Indiana State University. The reviewers were educational leaders with years of teaching experience and most with years of experience as both teachers and principals. Their experiences as teachers, assistant principals, and principals, as discussed by

Ravitch (2010), spoke to their strengths as reviewers of the surveys. These participants were not included in the study. They answered the following questions regarding the surveys:

1. How long did it take to complete the survey?
2. Are the instructions easy to follow?
3. Do the questions seem clear?
4. Is there anything missing that should be considered?

Based on the feedback received, no changes were made to the surveys.

To test for reliability of the survey, a Cronbach's alpha test was run following collection of the survey results, to test for internal consistency. Cronbach's alpha is used to assess the reliability of psychometric tests and the creation of questionnaires.

Data Collection and Procedures

For this study, Algebra I ECA passing rates and free/reduced lunch rates for the 2012-2013 school year were gathered in an Excel database from the Public Records Department of the IDOE. The same department provided a directory of public high school Algebra teachers and principals, which was used to distribute surveys. The directory listed a total of 1,418 email addresses for public high school Algebra I teachers and 421 email addresses for public high school principals. The cover letter found in Appendix C was emailed to the Algebra 1 teachers and principals. The teacher survey was emailed to all of the provided Algebra I teachers' email addresses and the principal survey was emailed to all of the provided public high school principals. The follow-up letter found in Appendix D was emailed 10 days after the initial letter, for those who had not yet participated in the surveys. In preparation for the statistical analysis of the data collected, survey responses were downloaded from Qualtrics to SPSS and Microsoft Excel.

In order to determine whether each school included in the study had a low or high ECA pass rate, a linear regression was run with the Algebra I ECA passing rates and free/reduced lunch rates for each public high school in Indiana to create a prediction equation. The Algebra I ECA passing rates of individual schools participating in the study were then compared to the predicted score from the linear regression, which predicted the ECA passing rate based on the free/reduced lunch rate of each school. The Algebra I residual score for each school was calculated as the difference between their actual and predicted passing rates. The residual scores were then converted to *z* scores to create the groups (high or low performers). Schools were considered low performers when their ECA passing rates were below the predicted rate by more than .3 standard deviations and high performers when their ECA passing rates were more than .3 standard deviations above the norm. The prediction equation and residual score calculations removed the negative impact of poverty.

Poverty was considered in the statistical analysis due to the significant amount of research, as included in the problem statement of this chapter and in Chapter 2 of this study, supporting the existence of an inverse relationship between poverty and student achievement. Burney and Beilke (2008) indicated lack of opportunity and lack of background preparation for rigorous academics among the challenges for students living in poverty. Evans (2005) described multiple out-of-school factors, including poverty, which can explain approximately 90.0% of the variance in students' math scores on some tests.

To analyze survey responses to Question 6 on the teacher survey and Question 7 on the principal survey, individual participants' responses to those questions were added together to obtain composite scores.

Statistical Analysis

For the first research question, linear regression was performed to determine if free and reduced lunch percentage served as a significant predictor for ECA passing rate. The additional research questions were entertained since the first null hypothesis was rejected due to free and reduced lunch percentage being a significant predictor of ECA passing rate.

Once schools participating in the study were determined to be low-performing (Algebra I ECA pass rate was more than .3 standard deviations below the norm, as determined by the linear regression on school Algebra I ECA passing rates and school free/reduced lunch rates in the state) or high-performing (Algebra I ECA pass rate was more than .3 standard deviations above the norm, as determined by the linear regression on school Algebra I ECA passing rates and school free/reduced lunch rates in the state), the data were analyzed for each null hypothesis.

For the second research question, analysis of implementation levels of Marzano et al.'s (2001) research-based instructional strategies and McREL's (Waters & Grubb, 2004) leadership responsibilities was completed by descriptive statistical analyses. The descriptive statistics consisted of frequencies, percentages, means, and standard deviations.

Independent sample *t* tests were conducted for the second and fourth null hypotheses to determine if there were significant differences in the implementation of Marzano et al.'s (2001) nine instructional strategies between teachers at high-performing schools and teachers at low-performing schools or in prioritizing McREL's (Waters & Grubb, 2004) 21 leadership responsibilities between secondary level principals in low-performing schools and secondary level principals in high-performing schools. Separate tests were run using the composite scores from the survey results on Question 6 on the teacher survey and Question 7 on the principal survey. The independent samples *t* test was applied since, in both the second and fourth null

hypotheses, the dependent variable (i.e., composite score for teachers for the first null hypothesis and composite score for principals for the third hypothesis) was compared to the independent variable (school performance type) with two levels (i.e., below and above predicted expectations).

To address the third and fifth null hypotheses, stepwise multiple regression was used. Stepwise multiple regression addressed whether any predictor variables (i.e., teacher or principal characteristics) explained a significant amount of variance in the criterion variable (i.e., residual score) to allow them to act as predictors of the criterion variable. The stepwise multiple regression determined the best combination of predictor variables (i.e., teacher characteristics for the third null hypothesis and principal characteristics for the fifth null hypothesis), to predict the criterion score (i.e., residual score). The statistical analysis completed in SPSS provided both unstandardized and standardized relationships. The unstandardized partial regression coefficients identified the predicted amount of change in the criterion variable (i.e., residual score) with a one unit increase in a significant predictor variable while holding all other variables constant. The standardized partial regression coefficient used *z* scores, or beta-weights, to allow for comparison of the predicted impact on the criterion variable for each significant predictor. This allowed us to compare the impact of two or more significant predictors in order to rank order their impact, while having them on the same metric (*z* scores).

Significance of the Study

This study will enhance the field of education by providing educators with further research into Marzano et al.'s (2001) instructional strategies and McREL's (Waters & Grubb, 2004) research-based leadership responsibilities, specifically in relation to Algebra I classrooms. As Marzano et al. (2001) stated, "The field of education is at a turning point in its history—a

point at which schooling and teaching are beginning to become more of a science than an art" (p. 156). Marzano et al. (2001) also concluded that "research on instruction and schooling must be synthesized and made readily available to educators" (p. 156), which this study addressed. They encourage schools and districts to focus high-quality staff development on research-based effective practices. This study leads to a better understanding of the instructional strategies and leadership responsibilities that should be the focus of professional development.

Summary

With high standards related to student achievement in mathematics and much research on the impact of teachers, instruction, and leadership on student achievement, this study accounts for the research-based impact of poverty on student achievement and provides qualitative data in those areas. The study examined differences in the prioritization of Marzano et al.'s (2001) research-based instructional strategies and McREL's leadership responsibilities (Waters & Grubb, 2004), assisting teachers and leaders as they focus on school reform and increasing student achievement.

CHAPTER 4

ANALYSIS OF DATA

The study sought to better understand the instructional strategies of Algebra I teachers and leadership characteristics of administrators among secondary public schools with high and low performance on Algebra I ECAs. Marzano et al.'s (2001) nine instructional strategies are research-based, with strong effects on student achievement. McREL's *Balanced Leadership Framework* found a significant correlation between principal leadership and student achievement (Waters & Grubb, 2004). Poverty was considered in the statistical analysis due to the significant amount of research, as included in Chapter 2 of this study, supporting the existence of an inverse relationship between poverty and student achievement.

The Teacher Survey (Appendix A) and Principal Survey (Appendix B) were emailed to the database of public high school Algebra 1 teacher and principal email addresses provided by the IDOE. Participants in the teacher survey were asked both personal and school demographic questions and to rate their level of implementation of Marzano et al.'s (2001) nine instructional strategies. Principals who participated in the principal survey were asked both personal and school demographic questions and to rate the prioritization of McREL's (Waters & Grubb, 2004) 21 leadership responsibilities. The survey results were analyzed following linear regression calculated to classify schools as high- or low-performing on the Algebra 1 ECA, with the prediction equation being derived from the data base of public high school Algebra 1 ECA

passing rates for first-time test takers and free and reduced lunch rates in 2012-2013, provided by the IDOE. The survey results were then analyzed for both high- and low-performing schools on each demographic area and Marzano et al.'s (2001) instructional strategies (teachers) or McREL's (Waters & Grubb, 2004) leadership responsibilities (principals). Participants' responses for both Marzano et al.'s (2001) instructional strategies and McREL's (Waters & Grubb, 2004) leadership responsibilities were combined, with the sums being composite scores to serve as dependent variables within some of the inferential tests. The composite scores for each survey were reliable, both having Cronbach's alpha numbers that were above .7 (0.763 for instructional strategies composite score and 0.882 for leadership responsibilities composite score).

This chapter contains null hypotheses, descriptive and inferential analysis of the data for the whole samples (teacher and principals) and the samples broken down by demographics for high- and low-performing schools, and a summary of the findings. The analyses of data first presents teacher survey data, followed by principal data.

Classification of Schools

$H_0$1 stated, A school's free and reduced lunch percentage does not serve as a significant predictor for ECA passing rate percentage. In order to determine whether each school included in the study had a low- or high-ECA pass rate, a linear regression was conducted with the first-time test takers' Algebra I ECA passing rates and free/reduced lunch rates for each public high school in Indiana for 2012-2013 (data provided by the IDOE) to create a prediction equation. The actual Algebra I ECA passing rates for first-time test takers of individual schools participating in the study were then compared to the predicted rates from the linear regression, which predicted the ECA passing rate based on the free/reduced lunch rate of each school. The

Algebra I residual score for each school was then calculated as the difference between their actual and predicted passing rates. The residual scores were then converted to *z*-scores to create the groups (high- or low-performers). Schools were considered low performers when their ECA passing rates were below the predicted rate by more than .3 standard deviations and high performers when their ECA passing rates were more than .3 standard deviations above the norm.

All assumptions were met for the linear regression. The Durbin-Watson test was run, with a value near 2, which satisfied independence of residuals. A scatter plot of the ECA passing rates and free and reduced lunch rates modeled a linear relationship, satisfying the assumption of linearity. The assumption of homogeneity of variance was met, meaning "the distribution of Y for a particular value of X have a constant variance for all values of X" (Lomax & Hahs-Vaughn, 2012, p. 339). The assumption of fixed X was met, since "x is a fixed variable rather than a random variable" (Lomax & Hahs-Vaughn, 2012, p. 342). Because "all values of X, the scores on Y or the prediction errors are normally distributed," normality of residuals was met (Lomax & Hahs-Vaugh, 2012, p. 339).

There was a significant, negative relationship between free and reduced lunch rate and first-time test taker Algebra 1 ECA score, $F(1,332) = 37.09$, $p<.001$. The linear regression equation was $Y' = -.424X + 70.65$, which explains that a school with a 0.0% free and reduced lunch rate is expected to have a passing rate of 70.65% with first-time test takers on the Algebra 1 ECA. For every 1% increase in free and reduced lunch rate, it is expected that the first-time test taker ECA pass rate would decrease by .424%. Breaking the schools into high-, typical-, and low-achieving categories using the prediction equation, resulted in 18 (26.5%) as high-achieving, 13 (19.1%) as typical-achieving, and 37 (54.4%) as low-achieving.

Whole Group Demographics (Teachers)

The teacher surveys were emailed to 1,418 Indiana public high school Algebra 1 teachers, whose email addresses were provided by the IDOE. The number of teacher respondents was 68, within which there were 24 men (35.3%) and 44 women (64.7%). When asked the highest degree earned, 26 (38.2%) of the teachers had earned Bachelor's degrees and 42 (61.8%) had earned a Master's degree. For school locale, 15 (22.1%) of the teachers reported that their schools were in an urban area, 15 (22.1%) reported their schools were in a suburban area, and the remaining 38 (55.9%) reported being in a rural area.

Table 3 shows the means and standard deviations for the Algebra teachers' years of teaching Algebra 1, schools' free and reduced lunch rates, residual scores, and composite scores on their level of agreement for the importance of each of the nine instructional strategies.

Table 3

Teacher Survey Participants (Whole Sample)

Descriptive Statistics	*M*	*SD*
Number of years teaching Algebra 1	11.29	8.39
School Free/Reduced Lunch Rate for 2012-2013	50.59	10.18
Residual Score	-.17	0.95
Marzano Composite Score	44.28	4.65

Teacher participants were asked to rate their level of agreement with the statement "To be a highly effective Algebra 1 teacher, you must utilize this instructional strategy" for each of Marzano et al.'s (2001) nine instructional strategies. Those strategies are identifying similarities

and differences; summarizing and note-taking; reinforcing effort and providing recognition; homework and practice; nonlinguistic representations; cooperative learning; setting objectives and providing feedback; generating and testing hypothesis; cues, questions, and advance organizers (Marzano et al., 2001). The participants rated their level of agreement for each strategy as 1 = *strongly disagree*, 2 = d*isagree*, 3 = *somewhat disagree*, 4 = *somewhat agree*, 5 = *agree*, or 6 = *strongly agree*. Table 4 displays the results from all teacher respondents.

Table 4

Marzano et al.'s Instructional Strategies Ratings (Whole Sample)

Marzano et al.'s Instructional Strategy	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Identifying similarities and differences	0.0.0%	1.5%	7.4%	27.9%	47.1%	16.2%
Summarizing and note-taking	0.0.0%	2.9%	2.9%	22.1%	47.1%	25.0.0%
Reinforcing effort and providing recognition	0.0.0%	2.9%	0.0.0%	17.6%	41.2%	38.2%
Homework and practice	0.0.0%	0.0.0%	4.4%	10.3%	38.2%	47.1%
Nonlinguistic representations	1.5%	0.0.0%	4.4%	25.0.0%	39.7%	29.4%
Cooperative learning	1.5%	0.0.0%	4.4%	36.8%	41.2%	16.2%
Setting objectives and providing feedback	0.0.0%	1.5%	2.9%	19.1%	52.9%	23.5%

Table 4 (continued)

Marzano et al.'s Instructional Strategy	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Generating and testing hypothesis	0.0.0%	1.5%	7.4%	36.8%	41.2%	13.2%
Cues, questions, and advance organizers	0.0.0%	0.0.0%	2.9%	10.3%	45.6%	41.2%

Descriptive Statistics for High-Achieving Schools (Teachers)

Following the application of the prediction equation from the first research question, 18 teacher participants' schools fell into the high-achieving schools group. This consisted of five (27.8%) men and 13 (72.2%) women. Among those 18 Algebra 1 teachers, 7 (38.9%) reported Bachelor's degrees as their highest degrees and 11 (61.1%) reported Master's degrees as their highest degrees earned. Among those in high-achieving schools, two (11.1%) listed their school locale as urban, six (33.3%) listed suburban, and 10 (55.6%) reported rural locales.

For teacher participants from the high-achieving schools group, Table 5 shows the means and standard deviations for the Algebra 1 teachers' years of teaching Algebra 1, schools' free and reduced lunch rates, residual scores, and composite scores on their level of agreement for the importance of each of the nine instructional strategies.

Table 5

Teacher Survey Participants (High-Achieving Schools)

Descriptive Statistics	*M*	*SD*
Number of years teaching Algebra 1	11.61	9.51
School Free/Reduced Lunch Rate for 2012-2013	36.73	6.76
Residual Score	1.12	0.63
Marzano Composite Score	43.72	4.69

When comparing the data in Table 5 for teachers in high-achieving schools to the data in Table 4 for all teacher participants in the study, the mean free and reduced lunch rate percentage for teachers in high-achieving schools was 36.73%, lower than that of the whole group of teacher participants, with their mean free and reduced lunch rate being 50.59%. The instructional strategy composite score of high-achieving teachers was slightly lower (M = 43.72) than that of the whole group (M = 44.28).

The composite scores for Algebra 1 teacher participants were calculated by adding together their ratings for Marzano et al.'s (2001) nine instructional strategies and their importance for being a highly effective Algebra 1 teacher. Table 6 displays the percentage of teacher respondents from high-achieving schools rating each level for the nine instructional strategies, in response to the statement "To be a highly effective Algebra 1 teacher, you must utilize this instructional strategy."

Table 6

Marzano et al's. Instructional Strategies Ratings (Teachers in High-Achieving Schools)

Marzano et al.'s Instructional Strategy	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Identifying similarities and differences	0.0%	0.0.0%	5.6%	38.9%	44.4%	11.1%
Summarizing and note-taking	0.0%	5.6%	0.0.0%	27.8%	33.3%	33.3%
Reinforcing effort and Providing recognition	0.0%	11.1%	0.0.0%	11.1%	44.4%	33.3%
Homework and practice	0.0%	0.0.0%	0.0.0%	5.6%	61.1%	33.3%
Nonlinguistic representations	0.0%	0.0.0%	5.6%	33.3%	44.4%	16.7%
Cooperative learning	0.0%	0.0.0%	0.0.0%	44.4%	33.3%	22.2%
Setting objectives and providing feedback	0.0%	0.0.0%	0.0.0%	22.2%	61.1%	16.7%
Generating and testing hypothesis	0.0%	5.6%	5.6%	38.9%	33.3%	16.7%
Cues, questions, and advance organizers	0.0%	0.0.0%	0.0.0%	16.7%	55.6%	27.8%

When comparing the rating percentages of Algebra 1 teachers in the high-achieving schools to those of the whole group of participants, there was a noticeable difference between the percentages of participants who chose *agree* for the statement and the instructional strategy homework and practice. For the whole group of participants (teachers in high-, typical-, and low-achieving schools, combined), 38.2% agreed that homework and practice must be utilized to be highly effective. Among the participants in the high-achieving schools, that percentage was much higher at 61.1% in agreement. Another difference between the ratings of participants in high-achieving schools and the whole group of teacher participants was in their ratings of

strongly agree with the statement in regards to the instructional strategy nonlinguistic representations. A number (16.7%) of teacher participants in high-achieving schools rated nonlinguistic representations with *strongly agree*, whereas 29.4% of the whole group of teacher participants rated it at that level.

Descriptive Statistics for Low-Achieving Schools (Teachers)

Following the application of the prediction equation from the first research question, 37 participants' schools fell into the low-achieving schools group. This consisted of 14 (37.8%) men and 23 (62.2%) women. Among those 37 Algebra 1 teachers, 13 (35.1%) reported Bachelor's degrees as their highest degrees and 24 (64.9%) reported Master's degrees as their highest degrees earned. Among those in low-achieving schools, 12 (32.4%) listed their school locales as urban, six (16.2%) listed suburban, and 19 (51.4%) reported rural locales.

For teacher participants from the low-achieving schools group, Table 7 shows the means and standard deviations for the Algebra 1 teachers' years of teaching Algebra 1, schools' free and reduced lunch rates, residual scores, and composite scores on their level of agreement for the importance of each of the nine instructional strategies (Marzano et al., 2001).

Table 7

Teacher Survey Participants (Low-Achieving Schools)

Descriptive Statistics	*M*	*SD*
Number of years teaching Algebra 1	9.96	7.39
School Free/Reduced Lunch Rate for 2012-2013	57.94	4.17
Residual Score	-0.86	0.39
Marzano Composite Score	44.59	4.78

When comparing the data in Table 7 for teachers in low-achieving schools to the data in Table 3 for all teacher participants in the study, the mean years of experience teaching Algebra 1 for teachers in low-achieving schools (M = 9.96) was 1.33 years lower than that of the whole group of teacher participants (M = 11.29). The free and reduced lunch rate for low-achieving schools was higher (M = 57.94) than that of the whole group of teacher participants (M = 50.59). The Marzano composite score was slightly higher for low-achieving teachers (M = 44.59) than for the whole group (M = 44.28).

Table 8 displays the percentage of teacher respondents from low-achieving schools rating each level for the nine instructional strategies, in response to the statement "To be a highly effective Algebra 1 teacher, you must utilize this instructional strategy."

Table 8

Marzano et al.'s Instructional Strategies Ratings (Teachers in Low-Achieving Schools)

Marzano et al.'s Instructional Strategy	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Identifying similarities and differences	0.0%	2.7%	8.1%	18.9%	54.1%	16.2%
Summarizing and note-taking	0.0%	2.7%	2.7%	21.6%	54.1%	18.9%
Reinforcing effort and providing recognition	0.0%	0.0.0%	0.0.0%	21.6%	37.8%	40.5%
Homework and practice	0.0%	0.0.0%	8.1%	8.1%	32.4%	51.4%
Nonlinguistic representations	0.0%	0.0.0%	2.7%	24.3%	37.8%	35.1%

Table 8 (continued)

Marzano et al.'s Instructional Strategy	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Cooperative learning	0.0%	0.0.0%	2.7%	37.8%	40.5%	18.9%
Setting objectives and providing feedback	0.0%	2.7%	5.4%	16.2%	45.9%	29.7%
Generating and testing hypothesis	0.0%	0.0.0%	8.1%	35.1%	43.2%	13.5%
Cues, questions, and Advance organizers	0.0%	0.0.0%	5.4%	10.8%	43.2%	40.5%

When comparing the ratings of the teachers in low-achieving schools to those in the whole group of teacher participants, the ratings at each level for each strategy were similar. For the instructional strategy of identifying similarities and differences, 18.9% of teachers from low-achieving schools chose *somewhat agree* and 54.1% chose *agree*. For the same instructional strategy, 27.9% of the whole group of teacher participants chose *somewhat agree* and 47.1% chose *agree*.

Descriptive Statistics for Urban Locale (Teachers)

The number of teacher respondents reporting that their schools were located in urban areas was a total of 15 teachers, consisting of seven (46.7%) men and eight (53.3%) women. Among those 15 Algebra 1 teachers, five (33.3%) reported Bachelor's degrees as their highest degrees and 10 (66.7%) reported Master's degrees as their highest degree earned. Among the

urban schools, two (13.3%) were in the high-achieving category, one (6.7%) was in the typical-achieving category, and the remaining 12 (80.0%) were in the low-achieving category.

For teacher participants from the urban schools, Table 9 shows the means and standard deviations for the Algebra 1 teachers' years of teaching Algebra 1, schools' free and reduced lunch rates, residual scores, and composite scores on their level of agreement for the importance of each of the nine instructional strategies

Table 9

Teacher Survey Participants (Urban Schools)

Descriptive Statistics	*M*	*SD*
Number of years teaching Algebra 1	10.17	6.34
School Free/Reduced Lunch Rate for 2012-2013	55.54	8.03
Residual Score	-0.63	0.75
Marzano Composite Score	44.40	5.05

When comparing the data in Table 9 for teachers in urban schools to the data in Table 3 for all teacher participants in the study, the mean number of years of experience teaching Algebra 1 for those in urban schools (M = 10.17) was 1.12 years less than those in the whole sample (M = 11.29). The mean free and reduced lunch rate was 4.95% higher in urban schools (M = 55.54) than that of the whole sample (M = 50.59). The instructional strategy composite scores were similar in the urban school group (M=44.4) and the whole group (M=44.28).

Table 10 displays the percentage of teacher respondents from urban schools rating each level for the nine instructional strategies, in response to the statement "To be a highly effective Algebra 1 teacher, you must utilize this instructional strategy."

Table 10

Marzano et al.'s Instructional Strategies Ratings (Teachers in Urban Schools)

Marzano et al.'s Instructional Strategy	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Identifying similarities and differences	0.0%	0.0.0%	0.0.0%	46.7%	40.0.0%	13.3%
Summarizing and note-taking	0.0%	6.7%	6.7%	0.0.0%	66.7%	20.0.0%
Reinforcing effort and providing recognition	0.0%	0.0.0%	0.0.0%	13.3%	40.0.0%	46.7%
Homework and practice	0.0%	0.0.0%	6.7%	20.0%	40.0.0%	33.3%
Nonlinguistic representations	0.0%	0.0.0%	6.7%	0.0.0%	53.3%	40.0.0%
Cooperative learning	0.0%	0.0.0%	6.7%	20.0.0%	53.3%	20.0.0%
Setting objectives and providing feedback	0.0%	6.7%	6.7%	6.7%	53.3%	26.7%
Generating and testing hypothesis	0.0%	0.0.0%	6.7%	60.0.0%	26.7%	6.7%
Cues, questions, and advance organizers	0.0%	0.0.0%	6.7%	0.0.0%	60.0.0%	33.3%

When comparing the ratings of the teachers in urban schools to those in the whole group of teacher participants, 66.7% of teachers in urban schools chose the *agree* rating for the summarizing and note-taking strategy and 47.1% of the whole group chose the *agree* rating. For the nonlinguistic representations strategy, teachers from the urban schools rated the strategy higher for *strongly agree* (40.0% versus the whole group percentage of 29.4%). Participants from urban schools rated generating and testing hypothesis as *somewhat agree* at 60.0% and *agree* at 26.7%, whereas the whole group rated them as 36.8% and 41.2% respectively. Urban participants and all participants had similar combined rankings for *agree* and *strongly agree* for cues, questions, and advance organizers, with urban participants ranking the strategy as 93.3% in those two categories and the whole group ranking those two categories at 86.8%. The urban participants, however, had 60.0% *agree* rankings and 33% *strongly agree*, and the whole group had a closer to even split at 45.6% *agree* and 41.2% *strongly agree*.

Descriptive Statistics for Suburban Locale (Teachers)

The number of teacher respondents reporting that their schools were located in suburban areas was a total of 15 teachers, consisting of 10 (66.7%) men and 5 (33.3%) women. Among those 15 Algebra 1 teachers, six (40.0%) reported Bachelor's degrees as their highest degrees and nine (60.0%) reported Master's degrees as their highest degree earned. Among the suburban schools, six (40.0%) were in the high-achieving category, three (20.0%) were in the typical-achieving category, and the remaining six (40.0%) were in the low-achieving category.

For teacher participants from the suburban schools, Table 11 shows the means and standard deviations for the Algebra 1 teachers' years of teaching Algebra 1, schools' free and reduced lunch rates, residual scores, and composite scores on their level of agreement for the importance of each of the nine instructional strategies (Marzano et al., 2001).

Table 11

Teacher Survey Participants (Suburban Schools)

Descriptive Statistics	*M*	*SD*
Number of years teaching Algebra 1	9.36	7.57
School Free/Reduced Lunch Rate for 2012-2013	49.54	9.19
Residual Score	-0.07	0.86
Marzano Composite Score	42.13	4.93

When comparing the data in Table 11 for teachers in suburban schools to the data in Table 3 for all teacher participants in the study, the mean number of years of experience teaching Algebra 1 for those in suburban schools ($M = 9.36$) was 1.93 years less than those in the whole sample ($M = 11.29$). The free and reduced lunch rate for suburban schools ($M = 49.54$) was similar to that of the whole group ($M = 50.59$). The instructional strategies composite score for suburban schools was lower ($M = 42.13$) than for the whole group ($M = 44.28$).

Table 12 displays the percentage of teacher respondents from suburban schools rating each level for the nine instructional strategies, in response to the statement “To be a highly effective Algebra 1 teacher, you must utilize this instructional strategy.”

Table 12

Marzano et al.'s Instructional Strategies Ratings (Teachers in Suburban Schools)

Marzano et al.'s Instructional Strategy	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Identifying similarities and differences	0.0.0%	0.0.0%	13.3%	20.0.0%	60.0.0%	6.7%
Summarizing and note-taking	0.0.0%	6.7%	6.7%	20.0.0%	53.3%	13.3%
Reinforcing effort and providing recognition	0.0.0%	13.3%	0.0.0%	20.0.0%	33.3%	33.3%
Homework and practice	0.0.0%	0.0.0%	0.0.0%	20.0.0%	46.7%	33.3%
Nonlinguistic representations	6.7%	0.0.0%	13.3%	33.3%	33.3%	13.3%
Cooperative learning	6.7%	0.0.0%	0.0.0%	26.7%	60.0.0%	6.7%
Setting objectives and providing feedback	0.0.0%	0.0.0%	0.0.0%	26.7%	53.3%	20.0.0%
Generating and testing hypothesis	0.0.0%	6.7%	6.7%	40.0.0%	40.0.0%	6.7%
Cues, questions, and advance organizers	0.0.0%	0.0.0%	0.0.0%	26.7%	46.7%	26.7%

When comparing the ratings of the teachers in suburban schools to those in the whole group of teacher participants, the ratings for the teachers in suburban schools for homework and practice had a combined total of 100.0% for *somewhat agree, agree*, and *strongly agree*. The whole group had a combined total for those same ratings of 95.6%. The breakdown for each ranking differed, with suburban teachers ranking *somewhat agree* at 20.0.0%, *agree* at 46.7% and *strongly agree* at 33.3%. In the whole group, *somewhat agree* was 10.3%, *agree* was 38.2% and *strongly agree* was 47.1%. Nonlinguistic representations was ranked as *strongly agree* by 13.3% of teachers from the suburban locale group and by 29.4% of the whole group of teacher participants. Among teachers from suburban schools, 60.0% ranked cooperative learning as *agree*, whereas 41.2% of the whole group gave that rating. Cues, questions, and advance organizers were ranked as *somewhat agree* by 26.7% of suburban teachers, but 10.3% of the whole group. The same strategy was ranked as *strongly agree* by 26.7% of suburban teachers, but 41.2% of the whole group.

Descriptive Statistics for Rural Locale (Teachers)

The number of teacher respondents reporting that their schools were located in rural areas was a total of 38 teachers, consisting of seven (18.4%) men and 31 (81.6%) women. Among those Algebra 1 teachers, 15 (39.5%) reported Bachelor's degrees as their highest degrees and 23 (60.5%) reported Master's degrees as their highest degree earned. Among the rural schools, 10 (26.3%) were in the high-achieving category, nine (23.7%) were in the typical-achieving category, and the remaining 19 (50.0%) were in the low-achieving category.

For teacher participants from the rural schools, Table 13 shows the means and standard deviations for the Algebra 1 teachers' years of teaching Algebra 1, schools' free and reduced

lunch rates, residual scores, and composite scores on their level of agreement for the importance of each of the nine instructional strategies

Table 13

Teacher Survey Participants (Rural Schools)

Descriptive Statistics	*M*	*SD*
Number of years teaching Algebra 1	12.45	9.33
School Free/Reduced Lunch Rate for 2012-2013	49.05	10.88
Residual Score	-0.03	1.02
Marzano Composite Score	45.08	4.21

When comparing the data in Table 13 for teachers in rural schools to the data in Table 3 for all teacher participants in the study, the mean number of years of experience teaching Algebra 1 for those in rural schools (M = 12.45) was 1.16 years higher than those in the whole sample (M = 11.29). The free and reduced lunch rate for the group reporting rural schools (M = 49.05) was similar to that of the whole group (M = 50.59). The instructional strategies composite score was slightly higher for the rural schools (M = 45.08) than it was for the whole group (M = 44.28).

Table 14 displays the percentage of teacher respondents from rural schools rating each level for the nine instructional strategies, in response to the statement “To be a highly effective Algebra 1 teacher, you must utilize this instructional strategy.”

Table 14

Marzano et al.'s Instructional Strategies Ratings (Teachers in Rural Schools)

Marzano et al.'s Instructional Strategy	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Identifying similarities and differences	0.0%	2.6%	7.9%	23.7%	44.7%	21.1%
Summarizing and Note-taking	0.0%	0.0.0%	0.0.0%	31.6%	36.8%	31.6%
Reinforcing effort and Providing recognition	0.0%	0.0.0%	0.0.0%	18.4%	44.7%	36.8%
Homework and Practice	0.0%	0.0.0%	5.3%	2.6%	34.2%	57.9%
Nonlinguistic representations	0.0%	0.0.0%	0.0.0%	31.6%	36.8%	31.6%
Cooperative learning	0.0%	0.0.0%	5.3%	47.4%	28.9%	18.4%
Setting objectives and Providing feedback	0.0%	0.0.0%	2.6%	21.1%	52.6%	23.7%
Generating and testing hypothesis	0.0%	0.0.0%	7.9%	26.3%	47.4%	18.4%
Cues, Questions, and Advance Organizers	0.0%	0.0.0%	2.6%	7.9%	39.5%	50.0.0%

Ratings for the instructional strategy summarizing and note-taking resulted in 31.6% of teachers from the rural group rating it as *somewhat agree*, 36.8% rating it as *agree*, and 31.6% rating it as *strongly agree*. This differs from the whole group, where ratings were 22.1% *somewhat agree*, 47.1% *agree*, and 25% *strongly agree*. Teachers in the rural group chose the *somewhat agree* rating for homework and practice at 2.6%, versus 10.3% for the whole group, but increased the *strongly agree* rating at 57.9%, versus 47.1% of the whole group. For cooperative learning, 47.4% of rural teachers chose *somewhat agree* and 28.9% chose *agree*, whereas 36.8% of the whole group chose *somewhat agree* and 41.2% chose *agree*. Teacher respondents from schools with rural locale rated generating and testing hypothesis at 26.3% *somewhat agree* and 47.4% *agree*. Among the whole group of respondents, for that instructional strategy, 36.8% chose *somewhat agree* and 41.2% chose *agree*. Area of noticeable differences were the *agree* and *strongly agree* ratings for cues, questions, and advance organizers. For that strategy, 39.5% of rural teachers rated it as *agree* and 50.0% as *strongly agree*. The whole group rated *agree* at 45.6% and *strongly agree* at 41.2%.

Differences in Instructional Strategies Based on School Performance

$H_0$2. There is no significant difference on Marzano et al.'s (2001) research-based instructional strategies composite score based on school performance type. The composite scores from respondents' ratings of Marzano et al.'s (2001) instructional strategies were analyzed for high- and low-performing schools. Table 15 displays the group statistics.

Table 15

Marzano et al.'s Ratings Composite Scores by School Performance Type

School Type	*M*	*SD*
High-Achieving	43.72	4.69
Low-Achieving	44.59	4.78

An independent samples *t* test was run on the data for high- and low-achieving schools to determine whether there was a significant difference in instructional strategies rating composite score based on school performance. The assumptions of independent observations, normality, and homogeneity of variance were met. A random sample was used, meeting the assumption of independent observations. The data were normally distributed, with a symmetrical distribution of scores, meeting the assumption of normality (Gravetter & Wallnau, 2013). Levene's test was run on the data, with a value of .893. Since it was greater than 0.05, the assumption of homogeneity of variance was met. There was no significant difference between high-achieving schools (M = 43.72, SD = 4.69) and low-achieving schools (M = 44.59, SD = 4.78) on reported use of Marzano et al.'s instructional strategies, $t(53) = -.639$, $p = .525$, two-tailed.

$H_0$3. The teacher characteristics of gender, educational degree attainment, years of experience, and locale do not serve as significant predictors of Algebra I ECA residual score. A multiple regression was run to test whether gender, educational degree attainment, years of experience teaching Algebra 1, and locale serve as significant predictors of Algebra 1 ECA residual scores. The residual scores were calculated as the difference between their actual and predicted first-time test taker Algebra 1 ECA passing rates, using the prediction equation

calculated by linear regression of 2012-2013 first-time test taker Algebra 1 ECA data and free and reduced lunch rates for Indiana public high schools.

All assumptions of independence of residuals, linearity, homoscedasticity, multicollinearity, fixed X, and normality of residuals were met. The Durbin-Watson test was run for independence of residuals, with a value of approximately 2, which satisfied the assumption of independence of residuals. "There is a linear relationship between the observed scores on the dependent variable Y and the values of the independent variables" (Lomax & Hahs-Vaughn, 2012, p. 382), which met the assumption of linearity. Since the plot of standardized and unstandardized residuals did not have an increasing or decreasing spread as the predictor value increased, homoscedasticity was not violated. The assumption of multicollinearity was met, with tolerance levels for the predictor variables above .2. "The independent variables are fixed variables rather than random variables" (Lomax & Hahs-Vaughn, 2012, p 384), satisfying the assumption of fixed X. The normality of residuals assumption was met since the residuals were normally distributed along a diagonal line. Table 16 displays the model summary for the predictors, followed by an interpretation.

Table 16

Model Summary of Predictor Variables for $H_0 3$

Model	*R*	R^2	Adjusted R^2	*SE* of the Estimate
Value	.254	.065	.004	.953

The multiple correlation coefficient, *R* had a value of .254. "A correlation measures the degree of relationship between two variables on a scale from 0 to 1.00" (Gravetter & Wallnau, 2013, p. 523). With a value of .254, it was relatively low, meaning it was relatively weak. The

multiple coefficient of determination, R^2, "describes the proportion of the total variability of the Y scores that is accounted for by the regression equation" (Gravetter & Wallnau, 2013, p. 576). Here, it was 6.5%, meaning 6.5% of the variance for the Y scores were be predicted by the regression equation. The adjusted R^2, .4%, took into consideration sample size, which was relatively small in this study, and the number of predictors, for a more conservative estimate. The shrinkage of the model (i.e. the difference between R^2 and adjusted R^2) was 6.1%. This meant 6.1% of the explained variance was lost with the adjustment for sample size and number of predictors. The standard error of the estimate, .953, was "the standard distance between the predicted Y values (from the regression equation) and the actual Y values (in the data)" (Gravetter & Wallnau, 2013, p. 578).

The predictor variables of gender, educational degree attainment, years of experience teaching Algebra 1, and school locale were not found to be significant predictors of the first-time test taker Algebra 1 ECA residual scores, which was greater than .05, meaning a greater than 5% chance of a type 1 error, $F(4,62) = 1.073$, $p = .377$.

Whole Group Demographics (Principals)

The principal surveys were emailed to 421 Indiana public high school principals, whose email addresses were provided by the IDOE. The number of principal respondents was 32, which included 23 (71.9%) men, and nine (28.1%) were women. Of the respondents, nine (28.1%) reported having Master's degrees and 23 (71.9%) reported having degrees beyond Master's degrees. For school locale, six (18.8%) reported that their schools were in an urban areas, nine (28.1%) reported being located in a suburban area, and 17 (53.1%) reported being located in a rural area.

Table 17 displays the means and standard deviations for the principals' years of experiencing as an administrator in their current buildings, years of experience as a teacher prior to becoming an administrator, schools' free and reduced lunch rates, residual scores, and composite scores on their level of agreement for the prioritization of each of McREL's (Waters & Grubb, 2004) leadership responsibilities.

Table 17

Principal Survey Participants (Whole Sample)

Descriptive Statistics	*M*	*SD*
Number of years as an administrator in current building	7.91	5.85
Number of years as a teacher prior to administrator	11.13	6.11
School Free/Reduced Lunch Rate for 2012-2013	47.59	9.77
Residual Score	.11	.91
McREL Composite Score	92.88	7.42

Principal participants were asked to rate their level of agreement with the statement "To be a highly effective leader, you must make this responsibility a priority" for each of the 21 leadership responsibilities. Those responsibilities are affirmation; communication; contingent rewards; culture; curriculum, instruction, and assessment; discipline; flexibility; focus; ideals/beliefs; change agent; input; intellectual stimulation; knowledge of curriculum, instruction, and assessment; monitors/evaluates; optimizer; order; outreach; relationship; resources; situational awareness; and visibility (Waters & Grubb, 2004). The participants rated their level of agreement for each strategy as 1 = *strongly disagree*, 2 = *disagree*, 3 = s*omewhat*

disagree, 4 = *somewhat agree*, 5 = *agree*, or 6 = *strongly agree*. Table 18 displays the results from all principal respondents.

Table 18

McREL's Leadership Responsibilities Ratings (Whole Sample)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Affirmation	0.0%	0.0.0%	0.0.0%	3.1%	50.0.0%	46.9%
Communication	0.0%	0.0.0%	0.0.0%	0.0.0%	25.0.0%	75.0.0%
Contingent rewards	0.0%	0.0.0%	3.1%	21.9%	53.1%	21.9%
Culture	0.0%	0.0.0%	0.0.0%	0.0.0%	46.9%	53.1%
Curriculum, instruction, assessment	0.0%	3.1%	0.0.0%	18.8%	31.3%	46.9%
Discipline	0.0%	0.0.0%	0.0.0%	9.4%	50.0.0%	40.6%
Flexibility	0.0%	0.0.0%	0.0.0%	0.0.0%	37.5%	62.5%
Focus	0.0%	0.0.0%	0.0.0%	3.1%	31.3%	65.6%
Ideals/Beliefs	0.0%	0.0.0%	3.1%	9.4%	25.0.0%	62.5%
Change agent	0.0%	0.0.0%	0.0.0%	3.1%	31.3%	65.6%
Input	0.0%	0.0.0%	0.0.0%	6.3%	46.9%	46.9%
Intellectual stimulation	0.0%	0.0.0%	0.0.0%	12.5%	56.3%	31.3%
Knowledge of curriculum, instruction, assessment	0.0%	0.0.0%	0.0.0%	15.6%	50.0.0%	34.4%
Monitors/Evaluates	0.0%	0.0.0%	0.0.0%	3.1%	28.1%	68.8%
Optimizer	0.0%	0.0.0%	0.0.0%	21.9%	40.6%	37.5%

Table 18 (continued)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Order	0.0%	0.0.0%	3.1%	6.3%	56.3%	34.4%
Outreach	0.0%	0.0.0%	3.1%	9.4%	46.9%	40.6%
Relationship	0.0%	0.0.0%	0.0.0%	6.3%	40.6%	53.1%
Resources	0.0%	0.0.0%	3.1%	3.1%	43.8%	50.0.0%
Situational awareness	0.0%	0.0.0%	0.0.0%	3.1%	31.3%	65.6%
Visibility	0.0%	0.0.0%	0.0.0%	3.1%	31.3%	65.6%

Descriptive Statistics for High-Achieving Schools (Principals)

Following the application of the prediction equation from the first research questions, 10 (31.3%) principal participants' schools fell into the high-achieving schools group. This consisted of seven (70.0%) men and three (30.0%) women. Among those principals, one (10.0%) reported a Master's degree as highest degree earned, and nine (90.0%) reported degrees beyond Master's degrees. Among those in high-achieving schools, none listed their school locale as urban, four (40.0%) listed suburban, and six (60.0%) reported rural locales.

For principal participants from the high-achieving schools group, Table 19 shows the means and standard deviations for the principals' years as an administrator in their current buildings, years of teaching experience prior to becoming administrators, schools' free and reduced lunch rates, residual scores, and composite scores on their level of prioritization of McREL's (Waters & Grubb, 2004) 21 leadership responsibilities.

Table 19

Principal Survey Participants (High-Achieving Schools)

Descriptive Statistics	*M*	*SD*
Number of years as administrator in current building	10.65	7.80
Number of years as a teacher prior to administration	9.40	5.10
School Free/Reduced Lunch Rate for 2012-2013	36.50	5.13
Residual Score	1.14	.48
McREL Composite Score	95.7	6.48

When comparing the data in Table 19 for principals in high-achieving schools to the data in Table 17 for all principal participants in the study, the mean number of years as administrators in their current buildings was 2.74 years higher for those in the high-achieving schools (M = 10.65) than it was for the whole group (M = 7.91). The mean number of years of teaching prior to administration was 1.73 years lower for respondents in high-achieving schools (M = 9.4) than the whole group (11.13 years). The free and reduced lunch rate for those in high-achieving schools (M = 36.5) was lower than the whole group (M = 47.59) by 11.09. The residual scores were higher for the high-achieving group (M = 1.14) than for the whole group (M = 0.11). The leadership responsibilities composite scores for the high-achieving group (M = 95.7) were higher than for the whole group (M = 92.88).

The composite score for principal participants was calculated by adding together their ratings for McREL's (Waters & Grubb, 2004) 21 leadership responsibilities and their level of priority for being a highly effective leader. Table 20 displays the percentage of principal respondents from high-achieving schools rating each level for the 21 leadership responsibilities,

in response to the statement “To be a highly effective leader, you must make this responsibility a priority.”

Table 20

McREL’s Leadership Responsibility Ratings (Principals in High-Achieving Schools)

McREL’s Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Affirmation	0.0%	0.0%	0.0%	0.0%	20.0%	80.0%
Communication	0.0%	0.0%	0.0%	0.0%	30.0%	70.0%
Contingent rewards	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%
Culture	0.0%	0.0%	0.0%	0.0%	40.0%	60.0%
Curriculum, instruction, assessment	0.0%	0.0%	0.0%	10.0%	30.0%	60.0%
Discipline	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%
Flexibility	0.0%	0.0%	0.0%	0.0%	40.0%	60.0%
Focus	0.0%	0.0%	0.0%	0.0%	30.0%	70.0%
Ideals/Beliefs	0.0%	0.0%	0.0%	10.0%	20.0%	70.0%
Change agent	0.0%	0.0%	0.0%	0.0%	20.0%	80.0%
Input	0.0%	0.0%	0.0%	0.0%	60.0%	40.0%
Intellectual stimulation	0.0%	0.0%	0.0%	10.0%	60.0%	30.0%
Knowledge of curriculum, instruction, assessment	0.0%	0.0%	0.0%	10.0%	50.0%	40.0%
Monitors/Evaluates	0.0%	0.0%	0.0%	0.0%	20.0%	80.0%
Optimizer	0.0%	0.0%	0.0%	10.0%	40.0%	50.0%
Order	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%
Outreach	0.0%	0.0%	0.0%	10.0%	40.0%	50.0%

Table 20 (continued)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Relationship	0.0%	0.0%	0.0%	0.0%	20.0%	80.0%
Resources	0.0%	0.0%	0.0%	0.0%	40.0%	50.0%
Situational awareness	0.0%	0.0%	0.0%	0.0%	40.0%	60.0%
Visibility	0.0%	0.0%	0.0%	0.0%	30.0%	70.0%

When comparing the rating percentages of principals in the high-achieving schools to those of the whole group of participants, there was a noticeable difference between the percentages of participants who chose *agree* and *strongly agree* for the statement and the leadership responsibility affirmation. For the whole group of participants (principals in high-, typical-, and low-achieving schools, combined), 50.0% agreed and 46.9% strongly agreed. For the high-achieving group, 20.0% agreed and 80.0% strongly agreed. For the leadership responsibility contingent rewards, in the whole group of participants, 21.9% somewhat agreed and 21.9% strongly agreed, whereas 0.0% somewhat agreed and 50.0% strongly agreed among the principals in high-achieving schools. The ratings for *strongly agree* for the whole group on leadership responsibility optimizer was lower (37.5%) than for those in the high-achieving group (50.0%). Only 34.4% of those in the whole group rated order as *strongly agree*, whereas 50.0% of those in the high-achieving gave that rating. Both *agree* and *strongly agree* ratings were quite different for the leadership responsibility relationship for the whole group (*agree* = 40.6%, *strongly agree* = 53.1%) and the high-achieving group (*agree* = 20.0%, *strongly agree* = 80.0%).

Descriptive Statistics for Low-Achieving Schools (Principals)

Following the application of the prediction equation from the first research question, 10 (31.3%) principal participants' schools fell into the low-achieving schools group. This consisted of seven (70.0%) men and three (30.0%) women. Among those principals, four (40.0%) reported Master's degrees as their highest degrees, and six (60.0%) reported degrees beyond a Master's degrees. Among those in low-achieving schools, five (50.0%) listed their school locales as urban, two (20.0%) listed suburban, and three (30.0%) reported rural locales.

For principal participants from the low-achieving schools group, Table 21 shows the means and standard deviations for the principals' years as an administrator in their current buildings, years of teaching experience prior to becoming administrators, schools' free and reduced lunch rates, residual scores, and composite scores on their level of prioritization of the 21 leadership responsibilities.

Table 21

Principal Survey Participants (Low-Achieving Schools)

Descriptive Statistics	*M*	*SD*
Number of years as administrator in current building	5.55	3.72
Number of years as a teacher prior to administration	10.40	4.35
School Free/Reduced Lunch Rate for 2012-2013	57.69	2.66
Residual Score	-0.84	0.25
McREL Composite Score	90.80	8.63

When comparing the data in Table 21 for principals in low-achieving schools to the data in Table 17 for all principal participants in the study, the mean number of years as administrators

in their current buildings was 2.36 years lower (*M* = 5.55) for those in the low-achieving schools than it was for the whole group (*M* = 7.91). The free and reduced lunch rate for those in low-achieving schools (*M* = 57.69) was higher than the whole group (*M* = 47.59) by 10.0%. The residual scores were lower for the low-achieving group (*M* = -0.84) than for the whole group (*M* = 0.11). The leadership responsibilities composite scores for the low-achieving group (*M* = 90.8) were lower than for the whole group (*M* = 92.88).

The composite score for principal participants was calculated by adding together their ratings for McREL's (Waters & Grubb, 2004) 21 leadership responsibilities and their level of priority for being a highly effective leader. Table 22 displays the percentage of principal respondents from low-achieving schools rating each level for the leadership responsibilities, in response to the statement "To be a highly effective leader, you must make this responsibility a priority."

Table 22

McREL's Leadership Responsibilities Ratings (Principals in Low-Achieving Schools)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Affirmation	0.0%	0.0%	0.0%	10.0%	50.0%	40.0%
Communication	0.0%	0.0%	0.0%	0.0%	10.0%	90.0%
Contingent Rewards	0.0%	0.0%	10.0%	30.0%	50.0%	10.0%
Culture	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%
Curriculum, instruction, assessment	0.0%	0.0%	0.0%	30.0%	50.0%	20.0%
Discipline	0.0%	0.0%	0.0%	20.0%	50.0%	30.0%
Flexibility	0.0%	0.0%	0.0%	0.0%	30.0%	70.0%

Table 22 (continued)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Focus	0.0%	0.0%	0.0%	0.0%	40.0%	60.0%
Ideals/Beliefs	0.0%	0.0%	10.0%	0.0%	30.0%	60.0%
Change Agent	0.0%	0.0%	0.0%	10.0%	40.0%	50.0%
Input	0.0%	0.0%	0.0%	10.0%	50.0%	40.0%
Intellectual stimulation	0.0%	0.0%	0.0%	20.0%	40.0%	40.0%
Knowledge of curriculum, instruction, assessment	0.0%	0.0%	0.0%	20.0%	50.0%	30.0%
Monitors/Evaluates	0.0%	0.0%	0.0%	0.0%	40.0%	60.0%
Optimizer	0.0%	0.0%	0.0%	30.0%	40.0%	30.0%
Order	0.0%	0.0%	10.0%	10.0%	50.0%	30.0%
Outreach	0.0%	0.0%	0.0%	20.0%	40.0%	40.0%
Relationship	0.0%	0.0%	0.0%	10.0%	40.0%	50.0%
Resources	0.0%	0.0%	0.0%	10.0%	40.0%	50.0%
Situational awareness	0.0%	0.0%	0.0%	0.0%	30.0%	70.0%
Visibility	0.0%	0.0%	0.0%	10.0%	30.0%	60.0%

When comparing the rating percentages of principals in the low-achieving schools to those of the whole group of participants on ratings for the leadership responsibility of communication, 10.0% of those in the low-achieving group agreed and 90.0% strongly agreed, whereas the whole group had 25% who responded with *agree* and 75% with *strongly agree*.

Among principals in low-achieving schools, 20.0% rated intellectual stimulation as *somewhat agree*, 40.0% rated it as *agree*, and 40.0% rated it as *strongly agree*. Among the whole group of principal respondents, 12.5% rated intellectual stimulation as *somewhat agree*, 56.3% rated it as *agree*, and 31.3% rated it as *strongly agree*. For the leadership responsibility knowledge of curriculum, instruction, and assessment, 30.0% of the low-achieving group rated it as *somewhat agree*, 50.0% as *agree*, and 20.0% as *strongly agree*. The whole group rated *somewhat agree* at 18.8%, *agree* at 31.3%, and *strongly agree* at 46.9%. The instructional strategy of monitors/evaluates had differing ratings, as well. For the principals in the low-achieving schools group, 40.0% rated the strategy as *agree* and 60.0% rated it as *strongly agree*. Principals in the whole group rated it as 28.1% *agree* and 68.8% *strongly agree*.

Descriptive Statistics for Urban Locale (Principals)

The number of principal respondents reporting that their schools were located in urban areas was a total of six principals, consisting of three men (50.0%) and three women (50.0%). Among those principals, one (16.7%) reported a Master's degree as his orher highest degree and five (83.3%) reported a degrees beyond Master's degrees as the highest degree earned. Among the urban schools, none were in the high-achieving category, one (16.7%) was in the typical-achieving category, and the remaining five (83.3%) were in the low-achieving category.

For principal participants from the urban schools group, Table 23 shows the means and standard deviations for the principals' years as an administrator in their current buildings, years of teaching experience prior to becoming administrators, schools' free and reduced lunch rates, residual scores, and composite scores on their level of prioritization of McREL's (Waters & Grubb, 2004) 21 leadership responsibilities.

Table 23

Principal Survey Participants (Urban Schools)

Descriptive Statistics	*M*	*SD*
Number of years as administrator in current building	5.33	4.13
Number of years as a teacher prior to administration	10.67	4.18
School Free/Reduced Lunch Rate for 2012-2013	55.26	3.87
Residual Score	-0.61	0.36
McREL Composite Score	93.17	8.98

When comparing the data in Table 23 for principals in urban schools to the data in Table 17 for all principal participants in the study, the mean number of years as administrators in their current buildings was 2.58 years lower for those in the urban schools ($M = 5.33$) than it was for the whole group ($M = 7.91$). The free and reduced lunch rate for those in urban schools ($M = 55.26$) was higher than the whole group ($M = 47.59$) by 7.67%. The residual scores were lower for the urban group ($M = -0.61$) than for the whole group ($M = 0.11$). The leadership responsibilities composite scores for the urban group ($M = 93.17$) were higher than for the whole group ($M = 92.88$).

The composite score for principal participants was calculated by adding together their ratings for McREL's (Waters & Grubb, 2004) 21 leadership responsibilities and their level of priority for being a highly effective leader. Table 24 displays the percentage of principal respondents from urban schools rating each level for the 21 leadership responsibilities, in response to the statement "To be a highly effective leader, you must make this responsibility a priority."

Table 24

McREL's Leadership Responsibilities Ratings (Principals in Urban Schools)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Affirmation	0.0%	0.0%	0.0%	16.7%	50.0%	33.3%
Communication	0.0%	0.0%	0.0%	0.0%	16.7%	83.3%
Contingent rewards	0.0%	0.0%	16.7%	16.7%	50.0%	16.7%
Culture	0.0%	0.0%	0.0%	0.0%	33.3%	66.7%
Curriculum, instruction, assessment	0.0%	0.0%	0.0%	16.7%	33.3%	50.0%
Discipline	0.0%	0.0%	0.0%	33.3%	16.7%	50.0%
Flexibility	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%
Focus	0.0%	0.0%	0.0%	0.0%	33.3%	66.7%
Ideals/Beliefs	0.0%	0.0%	0.0%	0.0%	16.7%	83.3%
Change agent	0.0%	0.0%	0.0%	16.7%	16.7%	66.7%
Input	0.0%	0.0%	0.0%	16.7%	33.3%	50.0%
Intellectual Stimulation	0.0%	0.0%	0.0%	0.0%	66.7%	33.3%
Knowledge of curriculum, instruction, assessment	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%
Monitors/Evaluates	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Optimizer	0.0%	0.0%	0.0%	16.7%	66.7%	16.7%
Order	0.0%	0.0%	16.7%	0.0%	33.3%	50.0%
Outreach	0.0%	0.0%	0.0%	16.7%	50.0%	33.3%
Relationship	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%

Table 24 (continued)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Resources	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%
Situational awareness	0.0%	0.0%	0.0%	16.7%	16.7%	66.7%
Visibility	0.0%	0.0%	0.0%	0.0%	16.7%	83.3%

When comparing the rating percentages of principals in the urban schools to those in the whole group, for the leadership responsibility of discipline, 33.3% of the urban group rated the responsibility as *somewhat agree* and 16.7% as *agree*. In the whole group, 9.4% rated discipline as *somewhat agree* and 50.0% rated it as *agree*. Among principals in the urban group, 16.7% rated ideals/beliefs as *agree* and 83.3% rated the responsibility as *strongly agree*, whereas, for the whole group, 25% rated it as *agree* and 62.5% rated it as *strongly agree*. For monitors/evaluates, among the urban group, *strongly agree* was rated 100.0%, though in the whole group it was rated at 68.8%. Participants in the urban group rated optimizer with 66.7% agreeing and 16.7% agreeing strongly. Participants in the whole group rated optimizer with 40.6% agreeing and 37.5% agreeing strongly. In the urban group, 33.3% rated order as *agree* and 50.0% rated it as *strongly agree*. This differs from the whole group which rated *agree* at 56.3% and *strongly agree* at 34.4%. The leadership responsibility visibility was rated 16.7% *agree* and 83.3% *strongly agree* among principals from the urban schools, but as 31.3% *agree* and 65.6% *strongly agree* by the whole group of principal participants.

Descriptive Statistics for Suburban Locale (Principals)

The number of principal respondents who reported that their schools were located in suburban areas was a total of nine principals, consisting of six (66.7%) men and three (33.3%) women. Among those principals, one (11.1%) reported a Master's degree as his or her highest degree earned and eight (88.9%) reported degrees beyond Master's degrees. Among the urban schools, four (44.4%) were in the high-achieving category, one (11.1%) was in the typical-achieving category, two (22.2%) were in the low-achieving category and two (22.2%) did not report their school (data included in descriptive analysis but not inferential analysis).

For principal participants from the suburban schools group, Table 25 shows the means and standard deviations for the principals' years as an administrator in their current buildings, years of teaching experience prior to becoming administrators, schools' free and reduced lunch rates, residual scores, and composite scores on their level of prioritization of the 21 leadership responsibilities.

Table 25

Principal Survey Participants (Suburban Schools)

Descriptive Statistics	*M*	*SD*
Number of years as administrator in current building	9.44	7.45
Number of years as a teacher prior to administration	10.56	7.50
School Free/Reduced Lunch Rate for 2012-2013	44.75	9.19
Residual Score	0.37	0.86
McREL Composite Score	92.11	7.08

When comparing the data in Table 25 for principals in suburban schools to the data in Table 17 for all principal participants in the study, the mean number of years as administrators in their current buildings was 1.53 years higher for those in the suburban schools (M = 9.44) than it was for the whole group (M = 7.91). The free and reduced lunch rate for those in suburban schools (M = 44.75) was lower than the whole group (M = 47.59) by 2.84%. The residual scores were higher for the suburban group (M = 0.37) than for the whole group (M = 0.11). The leadership responsibilities composite sores for the suburban group (M = 92.11) were slightly lower than for the whole group (M = 92.88).

The composite score for principal participants was calculated by adding together their ratings for McREL's (Waters & Grubb, 2004) 21 leadership responsibilities and their level of priority for being a highly effective leader. Table 26 displays the percentage of principal respondents from suburban schools rating each level for the 21 leadership responsibilities, in response to the statement "To be a highly effective leader, you must make this responsibility a priority."

Table 26

McREL's Leadership Responsibilities Ratings (Principals in Suburban Schools)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Affirmation	0.0%	0.0%	0.0%	0.0%	55.6%	44.4%
Communication	0.0%	0.0%	0.0%	0.0%	33.3%	66.7%
Contingent rewards	0.0%	0.0%	0.0%	0.0%	77.8%	22.2%
Culture	0.0%	0.0%	0.0%	0.0%	66.7%	33.3%
Curriculum, instruction, assessment	0.0%	0.0%	0.0%	22.2%	33.3%	44.4%

Table 26 (continued)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Discipline	0.0%	0.0%	0.0%	0.0%	77.8%	22.2%
Flexibility	0.0%	0.0%	0.0%	0.0%	44.4%	55.6%
Focus	0.0%	0.0%	0.0%	0.0%	44.4%	55.6%
Ideals/Beliefs	0.0%	0.0%	0.0%	0.0%	33.3%	66.7%
Change agent	0.0%	0.0%	0.0%	0.0%	44.4%	55.6%
Input	0.0%	0.0%	0.0%	0.0%	66.7%	33.3%
Intellectual stimulation	0.0%	0.0%	0.0%	22.2%	55.6%	22.2%
Knowledge of curriculum, instruction, assessment	0.0%	0.0%	0.0%	11.1%	77.8%	11.1%
Monitors/Evaluates	0.0%	0.0%	0.0%	0.0%	44.4%	55.6%
Optimizer	0.0%	0.0%	0.0%	22.2%	44.4%	33.3%
Order	0.0%	0.0%	0.0%	0.0%	55.6%	44.4%
Outreach	0.0%	0.0%	11.1%	0.0%	44.4%	44.4%
Relationship	0.0%	0.0%	0.0%	11.1%	33.3%	55.6%
Resources	0.0%	0.0%	0.0%	0.0%	44.4%	55.6%
Situational awareness	0.0%	0.0%	0.0%	0.0%	55.6%	44.4%
Visibility	0.0%	0.0%	0.0%	0.0%	44.4%	55.6%

When comparing the rating percentages of principals in the suburban schools to those in the whole group, for the leadership responsibility of contingent rewards, 21.9% chose *somewhat*

agree and 53.1% chose *agree* from the whole group, whereas 0.0% chose *somewhat agree* and 77.8% chose *agree* among principals from the suburban group. For the leadership responsibility of culture, 66.7% of participants from the suburban schools chose *agree* and 33.3% chose *strongly agree*. For the whole group ratings for culture, 46.9% chose *agree* and 53.1% chose *strongly agree*. Although both of these *agree* and *strongly agree* category sums are approximately 99%, their distribution among the two rankings varies. For the discipline responsibility, 77.8% of suburban participants agreed with the statement and 22.2% strongly agreed. In the whole group, 50.0% agreed and 40.6% strongly agreed. Principals from suburban locales ranked the input responsibility as 66.7% *agree* and 33.3% *strongly agree*. The whole group of participants ranked input as 46.9% *agree* and 46.9% *strongly agree*. Responding in regard to the area of knowledge of curriculum, instruction, and assessment, 77.8% of suburban principals ranked it as *agree* and 11.1% ranked it as *strongly agree*. Within the whole group of participants, 50.0% ranked it as *agree* and 34.4% ranked it as *strongly agree*. Among the principals from suburban schools, 55.6% ranked situational awareness as *agree* and 44.4% ranked it as *strongly agree*. Among all principal participants, 31.3% ranked situational awareness as *agree* and 65.6% ranked it as *strongly agree*.

Descriptive Statistics for Rural Locale (Principals)

The number of principal respondents reporting that their schools were located in rural areas was a total of 17 principals, consisting of 14 (82.4%) men and three (17.6%) women. Among those principals, seven (41.2%) reported Master's degrees as their highest degrees and 10 (58.8%) reported degrees beyond Master's degrees as their highest degree earned. Among the rural schools, six (35.3%) were in the high-achieving category, six (35.3%) were in the typical-

achieving category, three (17.6%) were in the low-achieving category, and two (11.8%) did not report their schools (included in descriptive analysis, but not inferential analysis).

For principal participants from the rural schools group, Table 27 shows the means and standard deviations for the principals' years as an administrator in their current buildings, years of teaching experience prior to becoming administrators, schools' free and reduced lunch rates, residual scores, and composite scores on their level of prioritization of the 21 leadership responsibilities.

Table 27

Principal Survey Participants (Rural Schools)

Descriptive Statistics	*M*	*SD*
Number of years as administrator in current building	8.00	5.41
Number of years as a teacher prior to administration	11.59	6.18
School Free/Reduced Lunch Rate for 2012-2013	45.84	10.49
Residual Score	0.27	0.98
McREL Composite Score	93.18	7.49

When comparing the data in Table 27 for principals in rural schools to the data in Table 17 for all principal participants in the study, the means were relatively similar for each demographic. The free and reduced lunch rate for rural schools (M = 45.84) was lower than the rate for the whole group (M = 47.59). The residual score for participants from rural schools (M = 0.27) was higher than that of the whole group (M = 0.11). The leadership responsibilities composite score for the suburban group was slightly higher (M = 93.18) than the composite score for the whole group (M = 92.88).

The composite score for principal participants was calculated by adding together their ratings for McREL's (Waters & Grubb, 2004) 21 leadership responsibilities and their level of priority for being a highly effective leader. Table 28 displays the percentage of principal respondents from urban schools rating each level for the 21 leadership responsibilities, in response to the statement "To be a highly effective leader, you must make this responsibility a priority."

Table 28

McREL's Leadership Responsibilities Ratings (Principals in Rural Schools)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Affirmation	0.0%	0.0%	0.0%	0.0%	47.1%	52.9%
Communication	0.0%	0.0%	0.0%	0.0%	23.5%	76.5%
Contingent rewards	0.0%	0.0%	0.0%	35.3%	41.2%	23.5%
Culture	0.0%	0.0%	0.0%	0.0%	41.2%	58.8%
Curriculum, instruction, assessment	0.0%	5.9%	0.0%	17.6%	29.4%	47.1%
Discipline	0.0%	0.0%	0.0%	5.9%	47.1%	47.1%
Flexibility	0.0%	0.0%	0.0%	0.0%	29.4%	70.6%
Focus	0.0%	0.0%	0.0%	5.9%	23.5%	70.6%
Ideals/Beliefs	0.0%	0.0%	5.9%	17.6%	23.5%	52.9%
Change agent	0.0%	0.0%	0.0%	0.0%	29.4%	70.6%
Input	0.0%	0.0%	0.0%	5.9%	41.2%	52.9%
Intellectual stimulation	0.0%	0.0%	0.0%	11.8%	52.9%	35.3%

Table 28 (continued)

McREL's Leadership Responsibility	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Knowledge of curriculum, instruction, assessment	0.0%	0.0%	0.0%	23.5%	35.3%	41.2%
Monitors/Evaluates	0.0%	0.0%	0.0%	5.9%	29.4%	64.7%
Optimizer	0.0%	0.0%	0.0%	23.5%	29.4%	47.1%
Order	0.0%	0.0%	0.0%	11.8%	64.7%	23.5%
Outreach	0.0%	0.0%	0.0%	11.8%	47.1%	41.2%
Relationship	0.0%	0.0%	0.0%	5.9%	41.2%	52.9%
Resources	0.0%	0.0%	5.9%	5.9%	41.2%	47.1%
Situational awareness	0.0%	0.0%	0.0%	0.0%	23.5%	76.5%
Visibility	0.0%	0.0%	0.0%	5.9%	29.4%	64.7%

When comparing the rating percentages of principals in the rural schools to those in the whole group, all rankings were relatively similar for each of the 21 leadership responsibilities and six rankings. For the leadership responsibility knowledge of curriculum, instruction, and assessment, 35.3% of participants chose *agree*, whereas 50.0% of the whole group of participants chose *agree*.

$H_0$4. There is no significant difference on McREL's (Waters & Grubb, 2004) research-based leadership responsibilities composite score based on school performance type. The composite scores from respondents' ratings of McREL's (Waters & Grubb, 2004) 21 leadership

responsibilities were analyzed for high- and low-performing schools. Table 29 displays the group statistics.

Table 29

McREL Ratings Composite Scores by School Performance Type

School Type	*M*	*SD*
High-Achieving	95.70	6.48
Low-Achieving	90.80	8.63

An independent samples *t* test was run on the data for high- and low-achieving schools to determine whether there was a significant difference in leadership responsibilities rating composite score based on school performance. The assumptions of independent observations, normality, and homogeneity of variance were met. A random sample was used, meeting the assumption of independent observations. The data was normally distributed, with a symmetrical distribution of scores, meeting the assumption of normality (Gravetter & Wallnau, 2013). Levene's test was run on the data, with a value of .115. Since it was greater than 0.05, the assumption of homogeneity of variance was met. There was no significant difference between high-achieving schools (M = 95.70, SD = 6.48) and low-achieving schools (M = 90.80, SD = 8.63) on reported use of the leadership responsibilities, $t(18) = 1.44$, $p = .168$, two-tailed.

$H_0$5. The principal characteristics of gender, educational degree attainment, years of experience, and locale do not serve as significant predictors of Algebra I ECA residual score. A multiple regression was run to test whether gender, educational degree attainment, years of experience as an administrator in his or her current building, and locale served as significant predictors of Algebra 1 ECA residual scores. The residual scores were calculated as the

difference between their actual and predicted first-time test taker Algebra 1 ECA passing rates, using the prediction equation calculated by linear regression of 2012-2013 first-time test taker Algebra 1 ECA data and free and reduced lunch rates for Indiana public high schools.

All assumptions of independence of residuals, linearity, homoscedasticity, multicollinearity, fixed X, and normality of residuals were met. The Durbin-Watson test was run for independence of residuals, with a value of approximately 2, which satisfied the assumption of independence of residuals. "There is a linear relationship between the observed scores on the dependent variable Y and the values of the independent variables," (Lomax & Hahs-Vaughn, 2012, p. 382) which meets the assumption of linearity. Since the plot of standardized and unstandardized residuals did not have an increasing or decreasing spread as the predictor value increased, homoscedasticity was not violated. The assumption of multicollinearity was met, with tolerance levels for the predictor variables above .2. "The independent variables are fixed variables rather than random variables," (Lomax & Hahs-Vaughn, 2012, p. 384) satisfying the assumption of fixed X. The normality of residuals assumption was met since the residuals were normally distributed along a diagonal line. Table 30 displays the model summary for the predictors, followed by an interpretation.

Table 30

Model Summary of Predictor Variables for $H_0$5

Model	*R*	R^2	Adjusted R^2	*SD* of the Estimate
	.577	.333	.216	.807

With a multiple correlation coefficient, *R*, of .58, it was moderate relative to the range of 0 to 1. The multiple coefficient of determination, R^2, was 33.3%, meaning 33.3% of the variance

for the Y scores could be predicted by the regression equation. The adjusted R^2, 21.6%, took into consideration sample size, which was relatively small in this study, and the number of predictors, for a more conservative estimate. The shrinkage of the model was .117. This meant 11.7% of the explained variance was lost with the adjustment for sample size and number of predictors. The standard error of the estimate is .807.

At least one of the predictor variables of gender, educational degree attainment, years of experience as an administrator in his or hercurrent building, and locale were found to be significant predictors of the first-time test taker Algebra 1 ECA residual scores. This was evident with the values of the multiple regression test, $F(4,23) = 2.865$, $p = .046$. To determine which of the predictor variables were significant, an examination of the coefficients output was necessary.

Among the principal participants, highest educational degree earned served as a significant predictor of Algebra 1 ECA residual scores for first-time test takers, $t = 2.31$, $p = .030$. Locale was also a significant predictor, $t = 2.30$, $p = .031$. With an unstandardized coefficient of .814 for educational degree earned, the residual score was predicted to increase .814, while holding all other predictors constant, when principals moved from Master's degrees to degrees beyond Master's degrees. With an unstandardized coefficient of .466 for school locale, the residual score was predicted to increase by .466 for a change from urban to rural or rural to suburban. The β weight "values represent the change in the criterion (in standard deviations) associated with a change of one standard deviation on a predictor [holding constant the value(s) on the other predictor(s)]" (Lane, n.d.). The β weights for degree and locale were .411 and .419 respectively, with locale being a slightly stronger predictor than educational degree level.

Summary

This chapter provided an analysis of the data, both descriptive and inferential. Teacher and principal survey data were reported to analyze each of the research questions in the study. The information was presented by tables of data, as well as comparisons between each group and the whole samples.

The first research question, does a school's free and reduced lunch percentage serve as a significant predictor for ECA pass rate percentage, was tested by running a linear regression with 2012-2013 data for Indiana public high schools' first-time test takers' Algebra 1 ECA passing rates and the schools' free and reduced lunch rates. There was a significant, negative relationship between the two variables. This allowed for the calculation of a prediction equation, which was used to determine schools' performance levels by comparing their actual ECA passing rates to the predicted rates (residual scores), based on poverty levels.

The second research question, what is the current implementation level of Marzano et al.'s (2001) research-based instructional strategies in Algebra 1 classrooms and McREL's (Waters et al., 2003) leadership responsibilities among high school principals in Indiana public high schools, was investigated through descriptive statistics. The data were presented for all teacher participants, all principal participants, and each of those samples broken down by school performance type and school locale. Differences between the descriptive statistics for each group were compared to the whole group of teacher or principal participants.

The third research question, is there a significant difference on Marzano et al.'s (2001) research-based instructional strategies composite score based on school performance type, was tested by running an independent samples *t* test on the composite scores for high- and low-performing schools. No significant difference was found between high- and low-achieving

schools on reported use of Marzano et al.'s (2001) instructional strategies, $t(53) = -.639$, $p = .525$, two-tailed.

For the fourth research question, do teacher characteristics of gender, educational degree attainment, years of experience, and locale serve as significant predictors of Algebra 1 ECA residual score, a multiple regression was run. Those demographics were not found to be significant predictors of the first-time test taker Algebra 1 ECA residual scores, $F(4,62) = 1.073$, $p = .377$.

The fifth research question, is there a significant difference on McREL's (Waters et al., 2003) research-based leadership responsibilities composite score based on school performance type, was tested with an independent samples *t* test. No significant difference was found between high- and low-achieving schools on reported use of McREL's (Waters et al., 2003) leadership responsibilities, $t(18) = 1.44$, $p = .168$, two-tailed.

For the sixth research question, do the principal characteristics of gender, educational degree attainment, years of experience, and locale serve as significant predictors of Algebra 1 ECA residual score, a multiple regression was run. For principal respondents, those demographics were found to be significant predictors of the first-time test taker Algebra 1 ECA residual scores, $F(4,23) = 2.865$, $p = .046$. Educational degree attainment served as a significant predictor of Algebra 1 ECA residual score, $t = 2.31$, $p = .030$, B = .814. School locale was also a significant predictor of Algebra 1 ECA residual score, $t = 2.30$, $p = .031$, B = .466. The β weight for educational degree attainment was .411 and, for locale, it was .419. Thus, locale was a slightly stronger predictor than educational degree attainment.

Chapter 4 described the participants in the study. For each set of participants (teachers and principals), descriptive and inferential statistics were analyzed, with discussion of the

findings, comparing each group to the whole group of participants. Further discussion is presented in Chapter 5.

CHAPTER 5

DISCUSSION OF THE FINDINGS, RECOMMENDATIONS FOR FURTHER STUDY

This chapter contains four sections. The first section provides a general introduction to the chapter. The second section, discussion of the findings, includes a rich description of the findings for each of the null hypotheses that were presented in Chapter 4. Discussion will also ensue regarding the descriptive data analysis. For each finding, there is also discussion of related literature, possible explanations for the findings, and implications for educators. The third section is a listing of limitations for the study. Finally, recommendations for further study are suggested.

Discussion of the Findings

$H_0$1. A school's free and reduced lunch percentage does not serve as a significant predictor for ECA passing rate percentage. Running a linear regression on the 2012-2013 first-time test taker Algebra 1 ECA passing rates and free and reduced lunch rates found the existence of a significant, negative relationship between the two variables, $F(1,332) = 37.09$, $p < .001$. The regression equation was $Y' = -.424X + 70.65$. This finding is supported by Blazer and Romanik (2009) who reviewed studies on the relationship between poverty (i.e. individual and school concentration) and student achievement. A summary of their conclusions is that lower levels of academic achievement tend to be reached by low-income students and the number of disadvantaged students in a school affects the achievement of all students (Blazer & Romanik,

2009). "Researchers have found that income level is one of the most powerful predictors of students' academic performance" (Blazer & Romanik, 2009, p. 1). A possible reason for this negative relationship could be higher rates of mobility among students in poverty, which may lead to lack of foundation skills. Other reasons, some of which are discussed in Chapter 2, could be the educational level of parents, hidden social class rules, and teacher quality in high-poverty schools.

Implications for this finding include the importance of educators' attention to student demographics and understanding of additional supports that may assist in them being well-prepared for academic achievement. Tied to results such as these, Rose (2013) noted,

> If we're serious about helping more students succeed in school, then we'll have to provide the kind of ongoing support for low-income students that will give them at least a prayer of a chance of competing on the modestly level playing field we as a nation claim we value. (p. 14)

School and district leaders must pay attention to resources and supports for students. The resources and supports may not be the same among all groups of students, taking into account demographics and academic history for each student. Vertical alignment and collaboration is also important, with educators at all levels attending to students' needs, both social and educational. Although vertical alignment often refers to curriculum, it can also involve attention to interventions and supports that are provided at each level of education, and whether those are continued or terminated for students as they move through the grades.

Research Question 2. What is the current implementation level of Marazano et al.'s (2001) research-based instructional strategies in Algebra 1 classrooms and McREL's (Waters & Grubb, 2004) leadership responsibilities among high school principals in Indiana public high

schools? This research question was analyzed descriptive statistics covering the mean and standard deviation values for participants' responses to the survey questions on instructional strategies composite scores (teachers) and leadership responsibilities composite scores (principals), as well as their responses to the ratings of the individual instructional strategies (teachers) and leadership responsibilities (principals). For teachers, all of the instructional strategies were rated at *agree* or *strongly agree* at over 50.0%, with only cooperative learning and generating and testing hypothesis having a combined *agree* and *strongly agree* total less than 60.0%. The top two strategies for a combined *agree* and *strongly agree* total were homework and practice (85.3%) and cues, questions, and advance organizers (86.8%). For principals, all of the leadership responsibilities were rated at *agree* or *strongly agree* at 70.0% or higher. Fourteen of the responsibilities had a combined *agree* and *strongly agree* total of over 90.0%. Communication, culture, and flexibility each had combined totals of 100.0% *agree* and *strongly agree*.

The findings on high ratings of homework and practice are supported by the U.S. Department of Education, when they stated that "student achievement rises significantly when teachers regularly assign homework and students conscientiously do it" (as cited in Heitzmann, 2007, p. 42). A significant amount of practice is beneficial to math students, especially those who are struggling. The homework should be focused on understanding, in addition to skills (Burns, 2007).

The high ratings on cues, questions, and advance organizers are supported by Gurlitt, Dummel, Schuster, and Nuckles (2012), whose "results showed strong beneficial effects of well-structured advance organizers on near and far transfer tasks" (p. 1). Teachers should consider the research on these instructional strategies when planning lessons and assessing student

learning. This includes the details on what type of homework to assign and the design of cues, questions, and advance organizers.

The findings on high ratings of communication, culture, and flexibility are supported by McTighe (2008), who discussed the need for principals to lead teachers in determining what it is that students should learn, how student learning will be assessed, and in collaborating to address areas in need of improvement. Principals must create collaborative cultures where knowledge is shared, discussed, and acted upon by teachers. The high ratings among all 21 of the responsibilities point out the importance of each responsibility and principals self-assessing their prioritization, as well as gathering input from other stakeholders to gauge their views.

$H_0$2. There is no significant difference on Marzano et al.'s (2001) research-based instructional strategies composite score based on school performance type. Running an independent samples *t* test on the data for high- and low-performing schools to determine whether there was a significant difference in the instructional strategies rating composite score based on school performance found no significant difference between high- and low-performing schools on reported use of Marzano et al.'s (2001) instructional strategies, $t(53) = -.639$, $p = .525$, two-tailed. This could be due to what Haynie and Kellogg (2008) explained in their study of the use of Marzano et al.'s (2001) strategies to identify practices of effective instruction, which was that reporting the use of these strategies does not ensure that they are implemented as defined by Marzano et al.. Teachers may have been trained in the effectiveness of the instructional strategies or even evaluated based on those instructional strategies, therefore rating them as important, but not actually implemented them as defined by Marzano et al. (2001). It could also mean that, as mentioned in *Classroom Instruction That Works* (Marzano et al., 2001), the impact of the nine instructional strategies has not been researched for differences in impact

among various subject areas. It is possible that the strategies are not as significant in mathematics courses as in others, such as language arts. Further discussion of subject-area impact differences occurred in *Reviewing the Evidence on How Teacher Professional Development Affects Student Achievement* (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). In a review of several studies, it was reported that "the sole negative effect . . . was in mathematics (fractions computation), where traditional instruction showed more positive effects on student achievement than a reform model" (p. 8).

Educators must move from knowledge of various instructional strategies to implementation of the strategies. Through professional development opportunities, collaboration with colleagues, and leadership support and feedback, implementation success should increase. If the results were due to a lesser impact of the strategies in mathematics courses than in others, it is important for educators to address the different needs of various courses, possibly providing professional development on a diverse set of strategies, not just one set. An example of a possible set of additional strategies is that presented by Gersten and Clarke (2007) in an effective strategies brief by the NCTM over strategies for teaching students with difficulties in mathematics. Six evidence-based strategies, supported by multiple studies, are reviewed on their effect sizes for special education and for low-performing students.

$H_0$3. The teacher characteristics of gender, educational degree attainment, years of experience, and locale do not serve as significant predictors of Algebra I ECA residual score. A multiple regression was run to test whether gender, educational degree attainment, years of experience, and locale served as significant predictors of Algebra 1 ECA residual scores. They were not found to be significant predictors of the first-time test taker Algebra 1 ECA residual scores, $F(4,62) = 1.073$, $p = .377$.

This finding is supported by the literature review, including the statement that "the majority of studies conclude that teacher education and experience are not strong predictors of teacher effectiveness, as measured by student achievement gains" (Prince et al., 2006, p. 1). "The preponderance of evidence suggests that teachers who have completed graduate degrees are not significantly more effective at increasing student learning than those with no more than a bachelor's degree" (Prince et al., 2006, p. 1). Possible reasons that they are not significant predictors may be that these demographics do not overcome the out-of-school factors that impact students' achievement. In regards to educational degree attainment and years of experience, it may be that neither the education programs nor professional development offered by the schools increase teachers' understanding of the application of Marzano et al.'s (2001) instructional strategies. Another issue may be that, once in the classroom, all teachers in a school are receiving the same professional development training, focusing on the same student learning outcomes, and being evaluated on the same indicators, therefore they are similar in their teaching methods and outcomes.

$H_0$4. There is no significant difference on McREL's (Waters & Grubb, 2004) research-based leadership responsibilities composite score based on school performance type. An independent samples *t* test was run on the data for high- and low-performing schools to determine whether there was a difference in the leadership responsibilities rating composite score based on school performance. No significant difference was found between high- and low-performing schools on reported use of McREL's (Waters & Grubb, 2004) leadership responsibilities, $t(18) = 1.44$, $p = .168$, two-tailed. This could support further work from McREL in the area of leadership that recognizes "simply knowing what to do is often not enough to transform schools and classrooms" (Waters & Cameron, 2007, p. 1). It is possible that the

principals have been trained on what responsibilities are important and impact student achievement, but they are not trained on how to implement those responsibilities. It may be that principals believe they have prioritized the responsibilities one way, but they are not accurately assessing how others view their priorities. It could also be the case that the principal respondents have building-level leaders, such as lead teachers or department chairs, that assist in instructional leadership responsibilities and that they have a significant impact on student achievement based on their leadership responsibilities. In best principals espouse(Newsleader, 2011), "a national study examining the characteristics of effective school principals has found that high student achievement is directly linked to 'collective leadership'-the shared influence of educators, parents, stakeholders, and community members" (p. 1).

In terms of overall implications for principals, the importance of an evaluation system that assists them in determining what priorities they exhibit on a daily basis should be considered. Thinking or talking about a responsibility that is deemed important is much different than consistently and actively making decisions and acting in ways that support that responsibility. Empowering building-level leaders as instructional leaders should also be a priority, as they may have as much or more of an impact in staff collaboration than others throughout a school district and, in turn, student achievement. Research evidences that the single most influential person in a school is the building principal (Marzano et al., 2005; Waters et al., 2003).

$H_0$5. The principal characteristics of gender, educational degree attainment, years of experience, and locale do not serve as significant predictors of Algebra I ECA residual score. A multiple regression was run to test whether gender, educational degree attainment, years of experience, and locale served as significant predictors of Algebra 1 ECA residual scores. Two of

the principal characteristics were found to be significant predictors of first-time test taker Algebra 1 ECA residual scores, $F(4,23) = 2.865$, $p = .046$. One of the significant predictors was highest educational degree earned, $t = 2.31$, $p = .030$. The other was locale, $t = 2.30$, $p = .031$.

The significance of educational degree attainment may be due to the principals having gone through higher-level coursework on analyzing and conducting research, thereby increasing their ability to apply the available research. They may also be more knowledgeable on a larger variety of instructional strategies and leadership responsibilities. Finally, they may have higher levels of training in school culture, providing for increased collaboration and positive impacts on student achievement.

The significance of locale was supported by the article entitled Education and the Inequalities of Place (Roscigno, Tomaskovic-Devey, & Crowley, 2006), which stated that "students living in inner city and rural areas of the United States exhibit lower educational achievement and a higher likelihood of dropping out of high school than do their suburban counterparts" (p. 2121). It is possible that the sizes of the schools varied among the different locales, and Howley and Bickel (2000) found that the "correlation between poverty and low achievement is much stronger in larger schools than in smaller schools" (p. 10). The significance of locale could also be due to reasons similar to those discussed by Payne (1996) in relation to poverty. Similar to what Payne noted regarding the impact of poverty, it is possible that school locale impacts students' lives including hidden rules of the community and statewide tests using formal register which may be understood better by students from certain communities. Schools in the various locales may vary in mobility rates and foundational skills.

Limitations

Several limitations are noted for this study.

1. This study relied on principals and teachers self-assessing the importance they placed on instructional strategies and prioritizing of responsibilities.
2. Some respondents may not have received their letters of invitation to participate in this study because they were filtered or blocked. Some of the e-mail addresses provided by the IDOE were also no longer valid.
3. Students who took Algebra 1 in middle school may have taken the ECA multiple times, meaning it is not their first-time pass rate.
4. Many variables could have an impact on student achievement on the ECA. Their impact was not considered in this study.

Recommendations for Further Study

This study involved surveying Indiana public high school Algebra 1 teachers on demographics and the importance of Marzano et al.'s (2001) nine research-based instructional strategies on teacher effectiveness. Indiana public high school principals were also surveyed on select demographics, as well as on the prioritization of McREL's (Waters & Grubb, 2004) 21 leadership responsibilities and leadership effectiveness. The responses to the survey questions were used to check for significant relationships with first-time test taker Algebra 1 ECA results. The following are recommendations for further research in these areas.

Collect data from other stakeholders. Teachers could rate their perceptions of principals' prioritization of the leadership responsibilities. Students could rate their perceptions of the importance teachers place on the instructional strategies or the frequency with which they are used. Building-level leaders, such as department chairs, could be included for leadership data, in addition to the principals. As discussed in Chapter 2, Haynie and Kellogg (2008) provided recommendations for building-level leaders to foster student success in Algebra 1.

Collect data over multiple years for students' and teachers' effectiveness ratings. Ravitch's (2010) research included the work of Hanushek and Rivkin of Stanford University, concluding "that having five years of good teachers in a row could overcome the average seventh-grade mathematics achievement gap between lower-income kids and those from higher-income families" (p. 181). The importance of teacher impact on student success is also supported by NCLB's requirement "that all students will be taught by a *highly qualified teacher*" (Haynie & Kellogg, 2008, p. 2).

Expand the study to gather information from a larger group of teachers and principals, regionally or nationally. The expansion could also include the surveying of middle school respondents, given that Algebra 1 is also taught at the middle school level. A larger group of participants may positively impact the statistical analysis of the study. Including middle school data addresses the third limitation in this study, listed previously, that students whose passing rates were included in this study may have taken the test before, making their scores not first-time test taker data.

Include questions to determine the level of professional development on Marzano et al.'s (2001) instructional strategies for teachers. This could also be done for principals, determining the level of professional development they have had on McREL's (Waters & Grubb, 2004) leadership responsibilities. One option would be to include assessment of professional development with the set of five criteria for professional development to be considered high quality by No Child Left Behind (Yoon et al., 2007).

Conduct a qualitative study. With this method of study, principals, teachers, or additional stakeholders could be interviewed about their use of and training regarding the instructional strategies or leadership responsibilities. This could provide a much richer and deeper

understanding of the complex issues related to this dissertation (Creswell, 2009). As Clandinin (2007) noted, "[q]ualitative research forms around assumptions about interpretations and human action. Qualitative researchers are interested not in prediction and control, but in understanding" (p. 4). This may allow for a more accurate response to implementation of the strategies and responsibilities, rather than how important they believe them to be. The interviews may give more information to the researcher as to areas that impacted or are impacted by the implementation of the strategies and responsibilities.

Collect data on teacher effectiveness levels and the use of instructional strategies. This study did not take into account teacher effectiveness levels, therefore, it could be that the participants in the study were not a representative sample of the various levels of teacher effectiveness. This idea was supported by Marzano et al. (2001), with their statement "If we can identify what those highly effective teachers do, then even more of the differences in student achievement can be accounted for" (p. 3). The use of instructional strategies could include a variety of instructional strategies, with much research being present on various sets of strategies and mathematics teaching on the NCTM website, http://www.nctm.org/.

Include data on school size. The studies summarized by Howley and Bickel (2000) implied that policies supporting research on poverty and reform, such as their data about poverty and school size, should be used if narrowing the achievement gap between children from high and low SES is a goal. Their summary of studies found that the "correlation between poverty and low achievement is much stronger in larger schools than in smaller schools" (p. 10).

Summary

This chapter provided main points from the analysis of data presented in Chapter 4. For each finding, related literature, possible explanations, and implications for educators were listed.

This was done for each of the five null hypotheses for the study. The survey design, participants, and related literature were also reviewed to make suggestions for further research.

There are currently many policies related to Algebra for graduation requirements. Although adjustments continue to be made to state exams, those adjustments do not include removing Algebra 1 assessment pieces, only editing them. Educators must analyze instructional strategies, teacher and principal characteristics, and administrative instructional leadership capacity to ensure best-practice teaching and leadership and high levels of student achievement. The information can be used to guide building-level, district-level, and state-level decisions.

As the literature review related to this study explained, success in Algebra should be important to all stakeholders. Algebra success is important to students and educators, impacting graduation rates and student success as they move beyond Algebra and beyond high school. It is also important to the community, as STEM-related jobs are unfilled due to an inadequate number of skilled people for the field. Gathering data and making research-based decisions on best practice for optimal student achievement in Algebra should be a priority.

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APPENDIX A: ALGEBRA 1 TEACHER SURVEY

Teacher Characteristics and Implementation of Marzano et al.'s (2001) Nine Instructional Strategies

I am a doctoral student at Indiana State University conducting this study for my dissertation. The purpose of this study is to better understand the instructional strategies of Algebra I teachers and leadership responsibilities of principals among secondary public schools with high and low performance on Algebra I End-of-Course Assessments (ECA's). Through your participation, the hope is to gain and share knowledge related to instruction, leadership, and Algebra achievement.

This survey should take less than 10 minutes to complete.

An item in the survey requests that participants provide their schools' names and cities. This is for the researcher to pull school data (Algebra 1 End-of-Course Assessment passing rate and free/reduced lunch rates from 2012-2013) from public records via the Indiana Department of Education. To maintain confidentiality across all sections and all documents, after the data is pulled, the school names will be deleted from the data file.

If you choose to participate, click "continue, I agree to participate" in the survey below. Making this choice will indicate consent. Participation in the survey is completely voluntary. You have the right to withdraw from the study at any time, by closing the window and not submitting your responses. Your responses will be kept confidential via the Internet-based survey program, Qualtrics, and the security provided by that software. Completion of all items will facilitate scoring.

If you have any questions or concerns about participating in this study, please contact me at (812) 989-3527 or mginkins@sycamores.indstate.edu . You may also contact my faculty sponsor, Dr. Bradley Balch, at (812) 237-2802 or at brad.balch@indstate.edu. If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by e-mail at irb@indstate.edu.

Thank you, in advance, for your participation in this study. Without those like you willing to take the time to respond, research into the best practices for increased student achievement would not be possible.

Sincerely,
Michelle Ginkins
Michelle Ginkins

Section I: Demographic Information

1. Gender__ ____ Male _____Female

2. What is the highest degree you have earned?

   _____Bachelor's _____Master's

3. For how many years, including this year, have you taught Algebra 1? _____

4. What is the complete name of your high school and school district?

   *School Name: _____
   School District: _____
   *These will be used to determine the 2012-2013 Algebra 1 End-of-Course Assessment (ECA) passing rate and percent of students who received free or reduced lunch during the 2012-2013 school year

5. Which of the following best describes your school?

   _____Urban _____Suburban _____Rural

Section II: Instructional Strategies

6. Rate your level of agreement with the statement "To be a highly effective Algebra 1 teacher, you must utilize this instructional strategy" for each of Marzano's instructional strategies listed in the table. Rate your level of agreement as 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, or 6=strongly agree, in the third column of the following table.

Marzano's Instructional Strategy	**Description of the responsibility**	**Rating**
Identifying similarities and differences	Comparing, classifying, creating metaphors, creating analogies	
Summarizing and Note-taking	Summarizing by deleting, substituting, and keeping some information after analyzing the information	
Reinforcing effort and Providing recognition	Explicitly teaching and exemplifying the connection between effort and achievement, students tracking effort and its relationship to achievement	
Homework and Practice	Communicating a homework policy, homework assignments clearly articulating the purpose and outcome	
Nonlinguistic representations	Creating graphic representations, making physical models, mental pictures, drawings, kinesthetic activity	

Cooperative learning	Informal pair-share; formal tasks designed to include positive interdependence, group processing, social skills, face-to-face interaction, individual and group accountability; long-term groups for ongoing support	
Setting objectives and Providing feedback	Criterion-referenced feedback on knowledge and skills, student-led feedback	
Generating and testing hypothesis	Deductive and inductive reasoning in the application of knowledge, including systems analysis, problem solving, historical investigation, invention, decision making, experimental inquiry	
Cues, Questions, and Advance Organizers	Activating prior knowledge	

APPENDIX B: PRINCIPAL SURVEY

Identification of Key Leadership Responsibilities among High School Principals

I am a doctoral student at Indiana State University conducting this study for my dissertation. The purpose of this study is to better understand the instructional strategies of Algebra I teachers and leadership responsibilities of principals among secondary public schools with high and low performance on Algebra I End-of-Course Assessments (ECA's). Through your participation, the hope is to gain and share knowledge related to instruction, leadership, and Algebra achievement.

This survey should take less than 10 minutes to complete.

An item in the survey requests that participants provide their schools' names and cities. This is for the researcher to pull school data (Algebra 1 End-of-Course Assessment passing rate and free/reduced lunch rates from 2012-2013) from public records via the Indiana Department of Education. To maintain confidentiality across all sections and all documents, after the data is pulled, the school names will be deleted from the data file.

If you choose to participate, click "continue, I agree to participate" in the survey below. Making this choice will indicate consent. Participation in the survey is completely voluntary. You have the right to withdraw from the study at any time, by closing the window and not submitting your responses. Your responses will be kept confidential via the Internet-based survey program, Qualtrics, and the security provided by that software. Completion of all items will facilitate scoring.

If you have any questions or concerns about participating in this study, please contact me at (812) 989-3527 or mginkins@sycamores.indstate.edu. You may also contact my faculty sponsor, Dr. Bradley Balch, at (812) 237-2802 or at brad.balch@indstate.edu. If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by e-mail at irb@indstate.edu.

Thank you, in advance, for your participation in this study. Without those like you willing to take the time to respond, research into the best practices for increased student achievement would not be possible.

Sincerely,
Michelle Ginkins
Michelle Ginkins

Section I: Demographic Information

1. Gender___ _____ Male _____Female
2. What is the highest degree you have earned?

   _____Bachelor's _____Master's _____Beyond Master's
3. For how many years, including this year, have you been an administrator in your current building? _____
4. For how many years were you a teacher, prior to becoming an administrator?

   _____
5. What is the complete name of your high school and school district?

   *School Name: _____

   School District: _____

   *These will be used to determine the 2012-2013 Algebra 1 End-of-Course Assessment (ECA) passing rate and percent of students who received free or reduced lunch during the 2012-2013 school year
6. Which of the following best describes your school community?

   _____Urban _____Suburban _____Rural

Section II: Instructional Leadership

7. Rate your level of agreement with the statement "To be a highly effective leader, you must make this responsibility a priority" for each of the leadership responsibilities listed in the table. Rate your level of agreement as 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, or 6=strongly agree, in the third column of the following table.

Responsibility	**Description of the responsibility**	**Rating**
Affirmation	recognizes & celebrates school accomplishments& acknowledges failures	
Change agent	is willing to & actively challenges the status quo	
Communication	establishes strong lines of communication with teachers & among students	
Contingent rewards	recognizes & rewards individual accomplishments	
Culture	fosters shared beliefs & a sense of community & cooperation	
Curriculum, instruction, assessment	is directly involved in the design & implementation of curriculum, instruction & assessment practices	
Discipline	protects teachers from issues & influences that would detract from their teaching time or focus	
Flexibility	adapts leadership behavior to the needs of the current situation & is comfortable with dissent	
Focus	establishes clear goals & keeps those goals in the forefront of the school's attention	
Ideals/beliefs	communicates & operates from strong ideals & beliefs about schooling	
Input	involves teachers in the design & implementation of important decisions & policies	
Intellectual stimulation	ensures that faculty & staff are aware of the most current theories & practices & makes the discussion of these a regular aspect of the school's culture	

Knowledge of curriculum, instruction assessment	is knowledgeable about current curriculum, instruction & assessment practices	
Monitors/evaluates	monitors the effectiveness of school practices & their impact on student learning	
Optimizer	inspires & leads new & challenging innovations	
Order	establishes a set of standard operating procedures & routines	
Outreach	is an advocate & spokesperson for the school to all stakeholders	
Relationship	demonstrates an awareness of the personal aspects of teachers & staff	
Resources	provides teachers with materials & professional development necessary for the successful execution of their jobs	
Situational awareness	is aware of the details & undercurrents in the running of the school & uses this information to address current & potential problems	
Visibility	has quality contact & interactions with teachers & students	

APPENDIX C: COVER LETTER TO ALGEBRA 1 TEACHERS AND PRINCIPALS

September 17, 2014

Dear Respondent,

I am a doctoral student at Indiana State University conducting this study for my dissertation. The purpose of this study is to better understand the instructional strategies of Algebra I teachers and leadership responsibilities of principals among secondary public schools with high and low performance on Algebra I End-of-Course Assessments (ECA's). Through your participation, the hope is to gain and share knowledge related to instruction, leadership, and Algebra achievement.

As a participant in the study, you will be asked to complete an online survey consisting of five demographic questions and rating nine instructional strategies, if you are a teacher. If you are a principal, you will be asked six demographic questions and to rate 21 leadership responsibilities. Both principals and teachers will be asked to provide the names and districts of their schools, to obtain information from public data sources (free/reduced lunch rates and Algebra 1 End-of-Course Assessment (ECA) passing rates). To maintain confidentiality across all sections and all documents, after the data is pulled, the school names will be deleted from the data file. Either survey should take less than 10 minutes to complete.

If you choose to participate, click "continue, I agree to participate" in the survey below. Making this choice will indicate consent. Participation in the survey is completely voluntary. You have the right to withdraw from the study at any time, by closing the window and not submitting your responses. Your responses will be kept confidential via the Internet-based survey program, Qualtrics, and the security provided by that software.

If you have any questions or concerns about participating in this study, please contact me at (812) 989-3527 or mginkins@sycamores.indstate.edu . You may also contact my faculty sponsor, Dr. Bradley Balch, at (812) 237-2802 or at brad.balch@indstate.edu. If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by e-mail at irb@indstate.edu.Thank you, in advance, for your participation in this study. Without those like you willing to take the time to respond, research into the best practices for increased student achievement would not be possible.

To access the appropriate survey, please click the appropriate link below, or cut and paste the URL into your Internet browser:

For principals- https://indstate.qualtrics.com/SE/?SID=SV_9BLLvluqWZR98WN

For teachers- https://indstate.qualtrics.com/SE/?SID=SV_4JIcvm6TcPmXMIB

Sincerely,
Michelle Ginkins
Michelle Ginkins

APPENDIX D: FOLLOW-UP LETTER TO ALGEBRA 1 TEACHERS AND PRINCIPALS

I am a doctoral student at Indiana State University conducting this study for my dissertation. I previously e-mailed a similar letter, inviting you to participate in this study. The purpose of this study is to better understand the instructional strategies of Algebra I teachers and leadership responsibilities of principals among secondary public schools with high and low performance on Algebra I End-of-Course Assessments (ECA's). Through your participation, the hope is to gain and share knowledge related to instruction, leadership, and Algebra achievement.

As a participant in the study, you will be asked to complete an online survey consisting of 5five demographic questions and rating nine instructional strategies, if you are a teacher. If you are a principal, you will be asked six demographic questions and to rate 21 leadership responsibilities. Both principals and teachers will be asked to provide the names and districts of their schools, to obtain information from public data sources (free/reduced lunch rates and Algebra 1 End-of-Course Assessment (ECA) passing rates). To maintain confidentiality across all sections and all documents, after the data is pulled, the school and district names will be deleted from the data file.

Either survey should take less than 10 minutes to complete.

If you choose to participate, click "continue, I agree to participate" in the appropriate survey below. Making this choice will indicate consent. Participation in the survey is completely voluntary. You have the right to withdraw from the study at any time, by closing the window and not submitting your responses. Your responses will be kept confidential via the Internet-based survey program, Qualtrics, and the security provided by that software.

If you have any questions or concerns about participating in this study, please contact me at (812) 989-3527 or mginkins@sycamores.indstate.edu . You may also contact my faculty sponsor, Dr. Bradley Balch, at (812) 237-2802 or at brad.balch@indstate.edu. If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by e-mail at irb@indstate.edu.Thank you, in advance, for your participation in this study. Without those like you willing to take the time to respond, research into the best practices for increased student achievement would not be possible.

To access the appropriate survey, please click the appropriate link below, or cut and paste the URL into your Internet browser:

For principals- https://indstate.qualtrics.com/SE/?SID=SV_9BLLvluqWZR98WN

For teachers- https://indstate.qualtrics.com/SE/?SID=SV_4JIcvm6TcPmXMIB

Sincerely,
Michelle Ginkins
Michelle Ginkins