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Looping Mathematics Instruction at the High School Level: An Examination of Success Indicators

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by

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Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work here at Lindenwood University and that I have not submitted it for any other college or university course or degree here or elsewhere.

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Abstract

Success in high school and high school mathematics has long-term implications for students' college and career readiness and achievement. As the United States and many other nations examine ways to enhance the high school experience for young people and increase student achievement in mathematics every aspect of instruction needs close examination to determine best practices. This study helped determine the outcomes of looped instruction for high school students in the content area of mathematics and a comprehensive examination of success indicators for students in high school mathematics including standardized test scores, grades, common assessment scores, and attendance, discipline, as well as student and teacher perceptions.

Results of looped instruction participants compared to semi-looped participants and non-participants determined differences in outcomes based on instructional model. Results indicate no differences in standardized test scores, grades, common assessments or attendance. Although looped instruction did not increase student achievement indicators or attendance, there were no decreases in outcomes. However, results indicated differences in the area of student discipline, with students in looped instruction receiving fewer office discipline referrals than semi-participants and non-participants. The study suggests that looped instruction at the high school level in the area of mathematics is a viable instructional model to positively impact student learning.

Focus group data, gathered from eight students and four teachers who participated in looped instruction, determined that both students and teachers perceived benefits and drawbacks of looped instruction. Ultimately, students who have participated in looped instruction claim they would recommend it to a friend, "If it was a good teacher."

This study examined results from Algebra I to Geometry in the sequence of mathematics instruction that typically occurs at the ninth and 10th grade levels. The sample size included data collected from the 2008, 2009, and 2010 school years, with sample sizes of 157, 147, and 157 respectively. Samples from each year consisted of students from three categories, looped, semi-looped, and non-looped participants for comparative purposes.

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Key to Abbreviations

ACT – American College Test

APT - Annual Proficiency Target

ANOVA – analysis of variance

AYP – Annual Yearly Progress

CV – critical value

ESL – English as a second language

DESE – Department of Elementary and Secondary Education

DF – degrees of freedom

EOC – end of course exam

GLE(s) – grade-level expectations

MAP – Missouri Assessment Plan

MO DESE – Missouri Department of Elementary and Secondary Education

NCLB – No Child Left Behind

PLC – Professional Learning Community

PI – Pearson index

SEM - semester

NGA – National Governors' Association

Chapter One: Overview of the Study

As the United States attempts to prepare young people for an ever changing and global economy, student success in math has become essential (Bellanca & Brandt, 2010; Jacobs, 2009; Zhao, 2009). Preparation for 21st century job skills where competition for the most highly skilled workers extends across international lines is a major concern for educators and policy makers in the United States (Zhao, 2009). Furthermore, American high school students continue to struggle in mathematics when ranked against other nations, while the lack of mathematics success is the number one factor limiting students' options for work place readiness and completion of advanced degrees (Bellanca & Brandt, 2010; Zhao, 2009). Educators continue to seek instructional practices that raise the achievement levels of high school students, reduce the dropout rate by increasing student success, and connect students to the educational system through positive, productive relationships between students and teachers (Bellanca & Brandt, 2010; Jacobs, 2009; Zhao, 2009).

Background of the Study

International competition in the area of mathematics increased with such historical events as World War II, space exploration and the Cold War (Bethal, 2005; Garelick, 2005; Rouse & Kemple, 2009; Zhao, 2009). In more recent time, American educators have continued to look for more effective ways to instruct students in the area of mathematics, prepare them for careers in fields that ensure national security, and continue innovation in science, technology, engineering and mathematics (STEM) fields (Bethal, 2005; Bracey, 2005; Rouse & Kemple, 2009; Witzel, 2008-2009).

Official recognition of the practice of looping, a multiyear placement for both the students and the teacher, as an instructional model began in the early 1900's (Franklin & Holm, 2007; Gaustad, 1998; Ullman, 2005). Looping addresses issues of effective use of time, relationship and community building, and staff development (Elliot & Capp, 2003; Nichols & Nichols, 2002; Thompson, Franz, & Miller, 2009). Although much research cites the positive effects of looping at the elementary and middle school levels, limited research investigates the impacts of looping at secondary levels. The researcher's experience has shown although high school students are older, adolescents have similar relational needs as younger students and need the consistent guidance from the teachers in their lives.

The application of looping, or looped instruction, to high school mathematics is undocumented in the current body of research. The researcher believes that a study that investigates the impact of looping at the high school level in the area of mathematics would have implications for effective program development and instructional practice for high school mathematics programs across the nation.

Statement of Problem

Improving outcomes for high school students in the area of mathematics is a concern for educators throughout the United States (Trusty & Niles, 2003). Student success in high school mathematics has implications for American progress in engineering, medical science, and economics (VanLeuvan, 2004). For students, success in mathematics is vital for high school completion and particularly important for students continuing their education after high school (Morge, 2005; Trusty, 2002). A lack of success in high school mathematics limits post-secondary opportunities for students and contributes to high school dropout rates (Morge, 2005; Trusty & Niles, 2003; VanLeuvan, 2004).

Purpose of Study

The purpose of this study was to measure the impact of looped instruction delivered at the high school setting in the content area of mathematics. The study design was quasi-experimental, students were randomly assigned to teachers in year one, but intentional assigned to the looping teacher in year two (Bluman, 2008). Teacher participants volunteered for looped instruction from 2008 to 2010 and included four teachers of the 13-teacher mathematics department. Of the 14 members of the math department, five teachers taught Algebra I and five teachers taught Geometry; each year based on the course enrollment needs. All looping teachers taught Algebra I in year one followed by Geometry in year two.

Table 1

Looping Compared to Non-Looping Teachers

	2007 to 2008 School Year	2008 to 2009 School Year	2009 to 2010 School Year
Number of Looping Teachers	2	1	1
Number of Non-Looping Teachers	3	4	4

Note. School years indicate the two-year looping cycle from Algebra I to Geometry

This study will determine to what degree if any, it benefits or hurts students to have the same math instructor over the course of two years, consisting of Algebra I and Geometry, typically for ninth and 10th graders respectively. For this study, state mathematics achievement scores, course and exam grades, attendance rates, discipline rates, qualitative data for student and teacher perceptions gathered from focus groups, measure benefits and drawbacks for students. To the extent possible, the study will also investigate the benefits and concerns of a two-year teaching assignment for math teachers who participate in a looping program at the high school level. This researcher intended to examine these success indicators and establish documented results of looping practices at the high school level as it pertains to mathematics.

Research Questions

This study addressed the following questions:

1. Do students perceive a better sense of connectedness and community at school due to participating in looping?
2. Do students perceive a better relationship with their math teacher and greater trust in their math teacher because of participating in looping?
3. Does student and teacher perception support the thought that looped instruction increases teacher capacity to meet student needs and an increased understanding of the content curriculum?

Hypotheses

Null Hypothesis 1. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by Missouri Assessment Plan scores in Mathematics, when compared to non-participants and semi-participants.

Null Hypothesis 2. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain year-to-year in scores, as measured by Missouri Assessment Plan in Mathematics, when compared to non-participants and semi-participants.

Null Hypothesis 3. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by course grades in Mathematics, when compared to non-participants and semi-participants.

Null Hypothesis 4. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by common assessment scores in Mathematics, when compared to non-participants and semi-participants.

Null Hypothesis 5. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by attendance rates, when compared to non-participants and semi-participants.

Null Hypothesis 6. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by decreased discipline referrals, when compared to non-participants and semi-participants.

Alternate Hypothesis 1. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show a change in student success as measured by Missouri Assessment Plan scores in Mathematics, when compared to non-participants and semi-participants.

Alternate Hypothesis 2. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show a gain year-to-year in scores, as measured by Missouri Assessment Plan in Mathematics, when compared to non-participants and semi-participants.

Alternate Hypothesis 3. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show a gain in student success as measured by course grades in Mathematics, when compared to non-participants and semi-participants.

Alternate Hypothesis 4. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show a gain in student success as measured by common assessment scores in Mathematics, when compared to non-participants and semi-participants.

Alternate Hypothesis 5. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show a gain in student success as measured by attendance rates, when compared to non-participants and semi-participants.

Alternate Hypothesis 6. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show a gain in student success as measured by decreased discipline referrals, when compared to non-participants and semi-participants.

Definition of Terms

- **Common Assessment:** For the purpose of this study, the practice of providing students from multiple instructors with the same assessment at regularly scheduled intervals as a means of assessing instructional effectiveness and student progress toward a predetermined set of standards or learning targets (Carr & Harris, n.d.)
- **Constructed Response Item:** An assessment item that does not provide multiple-choice responses, instead students write the response, typically requiring the application of specific content knowledge and skills (MO DESE, 2008).

- **End of Course Exam:** A portion of Missouri's Assessment Plan aimed at assessing the students at the high school level, taken after the completion on specific course content (MO DESE, 2008).
- **Grade-Level Expectations:** Content standards and skills delineated by grade-level and described in Missouri's Assessment Plan and state Curriculum standards (MO DESE, 2008).
- **Looping/ looped instruction:** Looping is an instructional model where a teacher stays with the same class for more than one year, a multiyear placement for both the students and the teacher (Franklin & Holm, 2007; Gaustad, 1998; Ullman, 2005).
- **Looping students/ looped students:** For the purpose of this study, this term is defined as students who received instruction from the same teacher for two school years looping participants.
- **Non-looping, non-looped students:** For the purpose of this study, this term is defined as students who did not receive instruction from the same teacher for two years. These students did not receive instruction from a looping teacher in year one or year two.
- **Multi-age classrooms:** For the purpose of this study, multi-age classrooms stem from the one room classroom in which a single teacher in a classroom teaches students of many ages and curriculums (Kolstad & McFadden, 1998). Multi-age classrooms differ from looping in that students are generally in the same grade or level and progress to the next grade with the same teachers who are teaching all

the students the curriculum specifically aligned to each level during that particular year (Kolstad & McFadden, 1998).

- **Missouri Assessment Plan:** The state of Missouri standardized assessment program designed to measure student achievement beginning at grade three and continuing through the high school level (MO DESE, 2008). Student achievement is measured in the content areas of math, communication arts, and science in response to the No Child left Behind Act (MO DESE, 2008).
- **Performance Event:** The PE (Performance Event) is a mathematical scenario in which the student is required to respond to several constructed response items. (MO DESE, 2008, p. 26)
- **Persisting groups, rotational teaching, teacher rotation, looping, looped instruction, family style learning, two–cycle teaching, student teacher progression, and multiyear instruction:** An educational practice in which a teacher stays with the same class for more than one year; it is a multiyear placement for both the students and the teacher (Franklin & Holm, 2007; Ullman, 2005; Rappa, 1993; Gaustad, 1998). The researcher has chosen to use the term looping for the purpose of consistency in this study.
- **Semi-looped/ semi-looping:** For the purpose of this study, defined by the researcher as students who were randomly placed in year two by the school computer program during enrollment and received instruction from the looping teacher in year two, but were not with the teacher in year one.
- **School year:** For the purpose of this study, as defined by the researcher, a school year is the year in which the school year ends. For example, a school year

beginning in 2008 and ending in 2009 is described as the 2009 school year. This study consists of data gathered from the 2008, 2009, and 2010 school years.

Limitations

The conclusions drawn from this study are limited by the specific setting in which the study took place, also the manner in which looping was implemented within the school. Both the context and implementation were unique and considered as a limitation. Furthermore, implications of the study only pertain to the mathematics course offering available at the high school level. The extent of effect related to impacts on state assessments are limited to the specific assessment program employed by the state of Missouri. The scope of the research is also a limitation. Analysis included a measure of the statistical differences in achievement at the high school setting in the content area of mathematics among students who participated in a two-year looped instruction program, students who received instruction from the looping teacher in year two but were not with the teacher in year one, and those students who did not participate in looped instruction. The scope of this study excluded data from students who participated in year one instruction with the looping teacher, but not in year two. Qualitative data examined determined perceived benefits and drawbacks of looped instruction from the students and teachers' perspectives. The self-reporting nature of focus groups, and the many potential influences on participants' opinions such as tone of voice, their level of interest, and participants' interpretation of questions, all pose limitations (Bluman, 2008).

This study accounted for variables that normally interfere with instructional comparisons such as varying instructional activities, assessments, and curricular materials. For this study, all teachers teaching the same course planned instructional activities together and used the same curriculum materials, as well as implemented common assessments and common scoring guides. This helped to minimize variables such as varying curriculum materials, instructional activities, assessments, activities, and scoring methods. Comparable groups will consist of sample sets of students who participated in looped instruction, nonparticipants, and semi-participants.

Independent Variables

Independent variables pertaining to this study include the placements of students to teachers for course work, and the assignment of coursework taught by teachers. In this study, students were intentionally assigned, rather than randomly, to the same teacher for two years for two courses in a sequence of mathematics offered at the high school level, Algebra during year one and Geometry during year two. Similarly, teachers in this study taught a sequence of courses over two years with the same students intentionally as opposed to the assignment of teaching the same course with different students each year.

Dependent Variables

The dependent variables in this study include the following:

1. Student Scores on the Missouri Assessment Plan (2008) and the EOC Exam (2009, 2010)
2. Student course grades (second semester final grade)
3. Student scores on first semester exams (teacher made common assessment)
4. Student absence rates (attendance)
5. Student discipline referral rates

6. Other dependent variables examined by this study are the perceived benefits to instruction, school, students themselves and teachers by student and teacher participants.

Summary

At the heart of looped instruction is the idea that prolonging the time that a learner and teacher spend together increases learning when compared to a typical one-year student and teacher learning arrangement (Franklin & Holm, 2007; Ullman, 2005). To the extent possible, this study attempts to measure the outcome of looped instruction in high school mathematics in both a qualitative and quantitative manner. Although studying looped instruction in one setting offers a unique set of circumstances, the researcher is hopeful that the results of this study will clarify further the nature of student teacher relationships over two years and the resulting outcomes for students and teachers. As educators across the United States look to employ instructional structures that benefit students, this study can provide guidance and potentially lead to further questions in the pursuit of sound practices that impact student mathematics learning in the most efficient way possible.

Chapter Two: Review of Literature

Introduction

This literature review investigated the research related to the practice of looping as a means of positively affecting the academic results of high school students within the mathematics classroom. To the extent possible, as it relates to the benefits of looping, this study also includes the literature findings of student peer relationships, student and teacher relationships, the implications of achieving in the area of mathematics for students at the high school level and providing instructional frameworks that fit with the 21st century needs of students.

Teachers can address academic issues more quickly when teachers begin the school year with an established positive, productive relationship with their students. The United States Department of Education officially recognized this benefit to students as early as 1913 when “teacher rotation” was endorsed (Ullman, 2005). Franklin and Holm (2007) referred to the practice teacher rotation as looping, a practice in which a teacher stays with the same class for more than one year. Beginning in 1840, the accepted model of educating America’s youth was placing students in a classroom for one year at a time, with a different teacher for each year. As the United States entered the industrial revolution, educational approaches followed the business assembly line model and teachers began to specialize in one grade-level resulting in one teacher per year for students (Forster, Grant, & Richardson, 1999).

Some educators recognized that students performed better when their teacher had an additional year with students and adapted instructional models to include multi-aged instruction, which is reminiscent of one-room schoolhouses in which students of various ages learn together from a single teacher who covers various curriculums within the classroom (Kolstad & McFadden, 1998). Gaustad (1998) found that terms used synonymously with looping over the years include family style learning, two-cycle teaching, student teacher progression, and multi-year instruction.

Historically, improving the educational system has been a constant effort in the United States for various reasons: from competition with other countries in space exploration, scientific innovations, domestic economic needs of the work force and as a means of substantiating public funds directed to education (Bethal, 2005; Garelick, 2005; Rouse & Kemple, 2009). Major school reform efforts have come and gone at various times throughout our country's history (Zhao, 2009); each focused on improving student success rates at school and advancing students toward higher levels of education as typical desired outcomes. Furthermore, in the spirit of global competition, countries around the world routinely compare the test scores and high school success rates of students in various industrialized countries. Often, American students rank below average in relation to math and science scores and high school graduation rates, which is surprising to United Sates educators and policy makers (Bethal, 2005; Bracey, 2005; Rouse & Kemple, 2009; Witzel, 2008-2009).

In fact several of the countries cited above, that have better high school success rates and perform better in mathematics than the United States, have implementation of looping at the elementary and secondary levels for hundreds of years (Nichols & Nichols, 2002). Thompson et al. (2009) have documented that several countries such as Japan, Germany, and Italy, have experienced success using the concept of looping. Japanese philosophy believes the teacher's relationship with a student is more important in placing students than the curricular expertise of the teacher. Considerable time and effort is spent in Japan matching students to a teacher of best fit (Nichols & Nichols, 2002). Furthermore, Germany, Japan and Italy, all use looping as a means of creating a community of learners (Nichols & Nichols, 2002). The researcher believes that these countries recognize the importance of a student's connection with the learning environment and teacher and intentionally create learning that capitalizes on the improved relationships looping helps to create.

Rouse and Kemple (2009) suggested that investments in school reform must build upon a platform of small schools and accountability, tackling the instructional core of high school as well as supplemental academic and social support services, guidance, and teacher quality. Implementing looped instruction at the high school level potentially has the ability to increase student success levels at the course level, increase student performance on state standardized exams, increase student attendance, increase student connectedness to school, and trust in their teacher, as well as decrease disruptive behavior (Nichols & Nichols, 2002; Thompson et al., 2009). Likewise, teachers can benefit from the looping concepts as well at the high school level. Looped instruction can provide teachers with the time needed to assess their student needs and intervene over the course of multiple school years (Elliot & Capp, 2003). It also can provide teachers an increased understanding of the scope and sequence for math course work, in settings where teachers typically teach one mathematics course, and increase their capacity to see math development of skills and concepts over two years (Elliot & Capp, 2003). Furthermore, looping provided teachers ownership of more variables such as scope, sequence, and instructional methods in the previous year, than provided for in the traditional method of high school math delivery where the teacher gets a new group of students every year, and the student gets a different math teacher every year or in some settings every semester (Forster et al., 1999).

Looping Creates Community

The National Governor's Association's (NGA) fifth national summit on education, held in 2004, was the first devoted to high schools (Rouse & Kemple, 2009). The federal government has invested millions of dollars in enhancing and scaling up the use of comprehensive school reform models for high schools and in supporting the creation of smaller learning communities in low performing high schools (Rouse & Kemple, 2009). Recent efforts to help high school students become more connected with their school include fostering better quality relationships with teachers and minimizing the size of the student population to reduce the possibility of "being lost in the crowd." Although looping does not physically change the structural size of a building or make the student population smaller, it does help eliminate the feeling of anonymity and helps to develop small communities of learners within the larger setting of the school (Forster et al., 1999).

The students' perception of the learning environment is most important and positively impacted by looping. As with any organization, the members must feel that they belong and benefit from being a part of the organization (Forster et al., 1999). In this case, students are the primary member of the organization of school, and if educators can structure students' learning in a manner that makes them feel connected and personalizes the experience for each student, then this will create the feel of a smaller school (Akhtar, 2007). Burke (1997) suggested that students and parents become more involved with smaller and more personalized educational environments.

Schools across the nation have implemented looping to help create a smaller school for learners who attend schools with large student populations (Franklin & Holm, 2007). Students and parents believed that they receive personal attention when participating in looping (Nichols & Nichols, 2002). The Waldorf School System, a nationally recognized private school system employs looping from first through eighth grade and is founded on the research of Rudolph Steiner who realized that personalized approach that looping creates has a profound impact on the students sense of connection with their education (Nichols & Nichols, 2002). The Waldorf School System actually takes looping to the extreme by having students grouped with the same teacher from first through eighth grade, thus creating a sense of family with the students and teacher (Nichols & Nichols, 2002). The Bill and Melinda Gates Foundation, as a primary method for improving high schools in the United States, recognized creating smaller schools as a method of reform (Rouse & Kemple, 2009).

As the majority of students going to high school transition from another building, the sense of connection becomes of particular importance. Both the beginning of the year and the end of the year can be extremely stressful for students as they anticipate the demands of creating new social networks and navigating the expectations of new teachers (Ullman, 2005). As today's adolescents experience a vast array of stressors not felt by previous generations, due to the instability of life outside of school, looping offers benefits particularly for students who struggle with adapting to the demands of a rigorous high school curriculum and preparation for college, now seen as the primary purpose of high school (Simel, 1998). As looping helps create personalized instruction for students in general, it also has the potential of serving the specific needs of student groups that so often do not realize their potential in high school settings, particularly in the area of mathematics (Nichols & Nichols, 2002).

In large schools with more than 500 students per grade level, establishing a sense of community is difficult (Alkandari & Alshallal, n.d). Students enroll for new courses and teachers every semester. Alkandari & Alshallal (n.d.) described school communities as the dynamics of social relationships that affects the student's feelings toward the institution. In institutions where students felt that they belonged to a community and had the support of peers, student grade point averages were noticeably higher (Alkandari & Alshallal, n.d). Jenkins (2009) and Bemak, Chi-Ying Chung, and Siroskey-Sabda (2005) found that that African American male students benefited from small school communities and Van Leuvan (2004) cited the benefits of a small school community for female students in the area of mathematics. Likewise, Kortering, deBettencourt, and Braziel (2005) and Nevin, Cramer, Voigt, and Salazar (2008) cited the benefits for students with learning disabilities when learning in a small school community. The research of Yamauchi (2003) depicted the benefits for students at-risk of failure and drop out when placed in a smaller school community. McAteer (2001) found that looped students were happier in the fall of the second year of school than their non-looped peers because of the familiarity of peers. Also associated with the benefits of peer support related to looping, Cistone and Shneyderman (2004), reported higher rates of attendance and reduced number of behavioral incidents.

Looping helps create the feel of smaller school settings, which lend themselves to increased peer cooperation and collaboration (Cistone & Shneyderman, 2004). The community of peers provides the sense of belonging for students, creates a family atmosphere, and ultimately improves student participation and achievement (Black, 2000; Simel, 1998; Raywid, 1999). Looping increases the opportunities for students to build academic relationships among each other that support both academic and social growth. Looping more often fosters an atmosphere of peer collaboration and support among students (Black, 2000; Simel, 1998; Raywid, 1999). It is true that a teacher can loop with their students and maintain a competitive non-collaborative environment, but it is less likely to occur in a two-year cycle because the inherent problems that would arise for student learning would become evident and the administration would be more likely to deal with the teacher regarding that issue (Elliot & Capp, 2003).

Looping Improves Relationships between Students and Teachers. "Thought is not born of other thoughts; thought has its origins in the motivating sphere of consciousness, a sphere that includes our inclinations and needs, our interests and impulses, and our affect and emotions" (Vygotsky, 1987, p.282).

With only about 75% of American ninth graders graduating in four years, it is apparent that the transition to high school and adapting to the high school structure poses a particular problem for students (Rouse & Kemple, 2009). One-third of all dropouts occur in the ninth grade because students were never able to acquire the credits necessary for the 10th grade (Rouse & Kemple, 2009). Rouse and Kemple (2009) cited the research of Ruth Curran Neild, of Johns Hopkins University, that concluded transitioning to high school causes so many students difficulties because high school years coincide with developmental changes, declining parent support, and increasing peer influence. Eighty percent of high school students in the United States must also transition to a new school building and many students feel inadequately prepared (Rouse & Kemple, 2009). Lastly, Rouse and Kemple (2009) argued that high school is structured with students attending multiple classes in a day and teachers identifying more with their content taught than the students they are teaching which contribute to a lack of connection to school from high school students.

Further, Rouse and Kemple (2009) concluded that it is the inadequate preparation of students for high school and the organization of high schools in which no one takes a personal interest in students' academic difficulties as the primary reason students across America are struggling with the transition to high school and ultimately the completion of high school. Looped instruction provides a forum for a strong relationship to build between students and teachers (Elliot & Capp, 2003). Rouse and Kemple (2009) stated that the most successful high school programs are those that foster a close relationship among teachers and students as a means of mentoring and monitoring students. Beatty and Brew (2004) described teaching as an emotional practice, and one in which students learn by building upon previous knowledge and experiences.

As students and teachers work together for two years, a partnership develops based on the trust students develop in the teacher's ability to meet his or her needs (Gregory & Ripski, 2008). Billet, Ovens, Clemans, and Seddon (2006) described five sets of principles for establishing and maintaining highly functional partnerships in education. Perhaps the most important educational partnership is between students and the teachers who work with them to help them learn. The five principles are shared purpose and vision, relationships with partners, the capacity for partnership work, governance and leadership, and trust (Billet et al., 2006).

As students and teachers work together over an extended length of time, two years in the typical looping scenario, teachers and students establish Billet's five principles. The factor of time is perhaps most important for establishing trust (Billet et al., 2006). Further, looping demonstrates a teacher's commitment to students that leads to trust by both parents and students (Elliot & Capp, 2003).

During the high school years, adolescence, students are changing physically, emotionally, and socially. The attachment to adults is vital during this changing time for students, as they need guidance and security provided through the bond that only a long-term relationship provides (Billet et al., 2006). Looping provides students with a learning environment that fosters the development of meaningful relationships that are necessary to help adolescents navigate successfully the teen-age years while maintaining academic success (Hedge & Cassidy, 2004; Thompson et al., 2009).

Looping over two years, in core classes provides a significant adult in a child's life, one in which they feel they can always count on (Michaud, 1992). The long-term arrangement of looping prohibits teachers from disregarding student needs as ones that will go away at the end of the school year (Michaud, 1992). According to Nichols and Nichols (2002) looping increases a teachers influence on a student's academic and social growth similar to the impact families have due to the persistence and consistency it offers over time as opposed to a teacher who spends a single year with students. Further, Nichols and Nichols (2002) describe looping as a strategy that specifically increases student and teacher intimacy, which results in productive bonds between student and teacher leading to increased student success. As expected, tensions can occur in any relationship and it is vital for children to learn to work through the stress that can be found in relationships. Wynne and Waldberg (1994) argued, persistent groups, (looping) in schools help students make such adaptations.

According to Nichols and Nichols (2002), the most beneficial aspect of looping is the knowledge the teacher gains of the learner and the confidence the learner has in the teacher. This is a positive, productive relationship, and a two-year cycle of instruction allows this accomplishment. As the relationship between student and teacher grow, so does the relationship among parents and the teacher. No amount of record keeping can substitute for this relationship as students move from one level to the next (Nichols & Nichols, 2002). This relationship is particularly beneficial as the number of homeless students, and students living in poverty in America steadily increase, as does the number of students returning from school to empty homes due to single parent households or both parents working (Forster et al; 1999). Ullman (2005) claimed the connections created by looping are a primal need in action and “people are hard wired for long term relationships, and emotional growth isn’t optimally possible without a permanent, supportive presence” (p. 3).

Research in the field of English as a Second Language (ESL) has recognized trust as the overriding theme that determines whether students and parents will support the program (Roessingh, 2006). Consequently, ESL teachers work with groups of students and families over many years as an accepted and established practice (Roessingh, 2006). Furthermore, the work of Roessingh (2006) establishes that trust, particularly among diverse cultures, is not established merely by someone’s title or role, and must be gained through first hand experiences that only extended time can provide. When a teacher builds trust among her students and their parents, the class is a secondary family (Forster et al.,1999; Roessingh, 2006; Ullman, 2005).

Relationships and Trust Impact Classroom Management and Learning. The research of Gregory and Ripski (2008) correlates student level of trust in their teacher to be a determining factor related to the number of discipline referrals written by high school teachers. Teachers with a lack of trust by students have more classroom management issues than teachers who are described as trustworthy by students. Gregory and Ripski (2008) determined that the teacher who had the greatest success in gaining student trust were those who had a “relational approach” to classroom management. The relational approach is one where the teacher builds strong relationships with students and demonstrates care and attention to students’ individual needs (Forster et al., 1999; Roessingh, 2006; Ullman, 2005). As teachers build relationships with students, the students trust in the teacher’s authority increases. Students begin to describe themselves as being more cooperative and confident in their abilities in class. This research held true particularly for students who had a history of disciplinary infractions (Gregory & Ripski, 2008).

To create this trust teachers and students must have emotional connections among students and teachers over a long period (Forster et al., 1999; Roessingh, 2006; Ullman, 2005). Likewise, overcoming personality conflicts adds to trust building as students and teachers handle emotional conflict and challenges by dealing with it productively rather than avoiding it (Gregory & Ripski, 2008). Looping encourages this emotional problem solving (Franklin & Holm, 2007). Over time a teacher with a relational approach becomes more aware of students' zone of proximal development, and the important emotional and social interaction components of learning (Beatty & Brew, 2004; Gregory & Ripski, 2008).

Leading research for impacting America's youth in crisis calls for building trust and relationships among teachers and students (Larson, 2005, DeSalvatore, Millspaugh, & Long, 2009). DeSalvatore et al. (2009) cited the need for the most challenging students to satisfy the need to belong and the need for educators to build trust. "No significant learning can take place without a significant relationship, so building trust between staff and youth is essential" (DeSalvatore et al., 2009, p. 25). Franklin and Holm (2007) cite middle school research indicating students participating in looping may feel increased sense of self-esteem. Adolescents routinely identify the number one factor needed for success in life as having a positive connection with the adults working with them in academic settings (Larson, 2005). Kenny, Gallagher, Alvarez-Salvat, & Silsby (2002) cited the positive effects of adolescent relationships with a caring adult to include reduced life stress, decreased drug and alcohol usage, increased resiliency, and increased competency in learning. Akhtar (2007) and Silverman (1988) cited research supporting the notion that effectively managed learning environments yield increases in student motivation.

Looping Increases the Instructional Capacity of Teachers

Improving instructional content and practice is another call to action cited by Rouse and Kemple (2009). Current instructional practice limits the sustained contact with students that is necessary for adequate assessment as well as the ability to provide effective instructional interventions (Rouse & Kemple, 2009).

> Teachers and administrators will need to use more 'adaptive' instructional approaches that respond continually to student progress and needs. In today's standards-based policy environment, improving instruction is critical to achieving the dual goals of increasing academic rigor while also raising the achievement standards for all students. (Rouse & Kemple, 2009, p. 2)

According to Elliot and Capp (2003), looping provides no room for ineffective instruction and provides a heightened need to administrators to address ineffective teaching practices. Otherwise, the negative impact to students may occur over two years. Wynne and Waldberg (1991) also suggested that looping can be a form of quality control in which the looping relationship exposes inadequate teachers. Looping creates an increased need to address inadequacy. Obviously, teachers and administrators have the ability to respond to instructional weaknesses positively through professional development and improved lesson planning (Elliot & Capp, 2003). Denault (1999) found that teachers reported feeling like pioneers when implementing looping and felt increased pride from student accomplishments over the two years. Teachers attributed the success of looping to the additional time and ability to adapt to the learning styles of at risk students (Denault, 1999). Nichols and Nichols (2002) argued that teachers benefit from the stimulation of looping and grow professionally through the continuous relationship with students. In addition, teachers reported increased confidence, higher expectations, and greater productivity in the students who looped with them (Nichols & Nichols, 2002).

"It is an established fact that a better understanding of students' perceptions about studying and learning helps educators in designing effective and relevant instructional practices that address the needs of a diverse student population" (Akhtar, 2007, p. 268).

Looping Increases Instructional Time Available to Teachers. A factor continually considered by school reformers, administrators, and teachers is the issue of time, specifically how teachers can capitalize on the time available to meet the academic and social needs of students. Reformers have called for longer school days and longer school years as a means of covering more curricular material (Bellanca & Brandt, 2010). Effective education requires time for teachers to assess student strengths and weaknesses, re-teach curriculum when needed, and time to get to know students on a personal level in order to anticipate their needs and interactions with peers (Jacobs, 2009). Students attending traditional k-12 public education are accustomed to the beginning of the school year to review. This review often encompasses the first month of school or even longer (Bellanca & Brandt, 2010). The National Mathematics Advisory Panel (2008) and the National Council of Teachers of Mathematics (2006) argue that teachers should avoid the need to revisit essentially the same material over several years. The teacher wastes time on review and revisiting material because he or she is not aware of their students' specific learning needs and/or previous concepts mastered (Ullman, 2005). No amount of record keeping, standardized assessment, and anecdotal notes passed up to the next level by the teacher can bridge the gap in knowledge that a teacher gains in spending a year with a student (Ullman, 2005).

Continuing the time that the teacher and student spend together captures valuable learning and instruction that might otherwise be wasted. Franklin and Holm (2007) described looping as a way to “hit the ground running” because at the beginning of the second year teachers do not have to assess student differences or develop classroom norms and routines. Students gain additional time when classroom norms and routines were previously established during year one (Franklin & Holm, 2007). Students are more likely to function as a productive group, reducing the need for the teacher to revisit behavioral expectations as often as with a new classroom (Franklin & Holm, 2007). Thompson et al. (2009) argued that with looping there is no need for a “getting to know you” period at the beginning of the second year of instruction. The researcher has found through his administrative and teaching experience that the first day of school becomes similar to returning from a long vacation rather than starting over. Teachers can use the summer time to prepare for the specific needs of their students rather than thinking of curricular delivery with a hypothetical premise because the looping teacher knows their students (Thompson et al., 2009). Gaustad (1998) showed that teachers estimated that they gained a month of learning time at the start of the second year. Given this better use of time, the looping teacher gains more opportunity to assess student achievement and diagnose potential learning problems (Franklin & Holm, 2007; Gaustad, 1998; Thompson et al., 2009).

In traditional classroom arrangements, a considerable waste of time occurs at the end of the school year, particularly after the completion of standardized testing (Zhao, 2009). Teachers and students have naturally built up to peak performance for state testing, which occurs a month before the end of the school year in some states (Zhao, 2009). This lends itself to less rigorous instruction as students and teachers wind down to summer vacation (Franklin & Holm, 2007). This may be because the teacher already covered and assessed the essential objectives based on the testing schedule created at the state level (Gaustad, 1998). According to Franklin and Holm (2007), looping teachers tend to continue instruction through the end of the year instead of packing up and checking out, in essence this adds an extra four to six weeks of instructional time that is lost in traditional non-looping classrooms. This allows looping classrooms to end on an academically productive note. Some teacher can even capitalize on the summer break by assigning work between the loop (Franklin & Holm, 2007).

Elliot and Capp (2003) described the additional, more purposeful time created by looping as a "gift". Teachers no longer aim to complete as much of a text as possible in a given school year (Elliot & Capp, 2003). Today, teachers are responsible for teaching specific standards based on curriculum content established at the state and national level (Jacobs, 2009). Teachers and students participating in looping can utilize the two-year span to master standards, not mastered during year one (Elliot & Capp, 2003).

Teachers found success with looping in regards to student learning that looping increased due to parent demand for the program. Elliot and Capp (2003) cited a prime example of increased demand for looping in the Rocklin Unified School District. Looping was an intentional design of the school for Rocklin Elementary and increased to offerings at every grade level from kindergarten through sixth grade because of parent demand (Elliot & Capp, 2003). Parents rated looped instruction as a 5.783 on a 1-6 scale, six being most effective instructional approach for their children when compared to traditional learning models (Elliot & Capp, 2003). The school district then built another elementary school in 2001 with the specific goal of implementing the looping model (Elliot & Capp, 2003). The Rocklin School District's results showed that looping proved to be specifically beneficial in advancing students in the area of math and language arts when comparing the development and performance of non-looped students with looped students (Elliot & Capp, 2003). The district attributes this success to the additional time looping allows the teacher in identifying struggling learners' needs early and working with them over two years to meet those needs (Elliot and Capp, 2003).

Effective teaching models should increase the teacher's ability to extend the curriculum and teach in conjunction with students' varying level of development and capacity (Mulcahy, n.d.). The two-year period of looping increases the teacher's ability to respond to the diverse needs and developmental differences within the classroom (Elliot & Capp, 2003). Even at a secondary level student's achievement, ability, and background knowledge vary widely (Trusty & Niles, 2003). This also occurs in secondary mathematics where the level of mastery of previously covered skills varies widely among students (Garelick, 2005). Forster, Grant, and Richardson (1997) claims that the benefit of additional time for correcting learning problems results in a lower rate of special education referrals for students who participate in looping. Burke (1997) found that, when compared to non-looping students, looping students performed better on standardized reading and math tests, "even when both were taught by the same teacher" (p. 2).

Looping provides a refreshing approach for teachers who sometimes stagnate after teaching the same content year after year to new groups of students (Gaustad, 1998). Looping motivates teachers to find long-term solutions to student learning problems that might otherwise be overlooked or "ridden out" for one year (Gaustad, 1998). Furthermore, teacher elementary education programs often do not prepare teachers with the exact content skills and knowledge needed to teach math (Garelick, 2005; Little & Dacus, 1999; Witzel, 2008-2009). Teachers often enter the field with varied degrees of understanding of teaching practices (Cooter, 2003). Looping offers teachers a wider view of the content and enhances their ability to help students grasp that wider view through more developmentally appropriate practice; looping also helps teachers learn varied instructional strategies and differentiated instructional practices (Little & Dacus, 1999; Witzel, 2008-2009). Cooter (2003) argued that teachers learn in the same way that students do, from varied experiences in a constructivist manner. Through looping, teachers build knowledge upon previous experiences and as they adapt to new learning material they can in turn better help their students do the same. Riley and Roach (2006), referred to this model of teacher learning as “emergent curriculum” and cite the need for trusting relationships as another prerequisite for effective teacher development.

Cooter (2003) argued professional development for teachers, described as teacher “capacity building” is the most important improvement efforts for today’s schools (p. 1). Teacher capacity has a bigger impact on student learning than teacher years of experience or class size (Cooter, 2003). In a school setting where there are multiple teachers teaching at each level, teachers who loop can receive coaching from fellow teachers during the second year as a means of assisting the teacher with the transition to new curriculum (Reilly, 1999). The looping teacher can also inform the teacher instructing at the lower level of the essential concepts discovered in year two and the vital interactions students have with the curriculum related to the developmental needs of students (Cooter, 2003; Reilly, 1999). Looping encourages teachers to be learner centered and increase their ability to meet the individual needs of students (Reilly, 1999).

The Importance of Increasing Student Achievement in High School Mathematics

Looping has the potential to have a great impact on student learning and achievement within the math curriculum at the high school level (Cooter, 2003; Reilly, 1999). Research has established that female students lose interest in math during the high school years and report having more confidence and higher aspirations in middle school than they do in high school (Morge, 2005). This reduced interest and confidence in math has been associated with social pressures during the formative years of high school that steer female students toward liberal arts fields of study and those that are a better fit for working mothers (Morge, 2005). Success in high school mathematics is vital for all students in preparing them to attend and be successful in college (Trusty, 2002). This is particularly true for female, African American, and Hispanic students who have lagged behind in high school mathematics (Morge, 2005; Trusty, 2002). This is partially due to students' inability to identify their math teacher as being similar to them and having characteristics similar to their own because students believe their math teachers' ability and understanding of math concepts came naturally to the teacher without any struggle (Morge, 2005; Trusty, 2002). Looping provides a forum for students to build a better relationship with math teachers, find common characteristics, build confidence, and find encouragement to continue math education (Forster et al., 1997). Math course work in high school is the gateway to college success particularly courses taken beyond the second year of algebra (Trusty & Niles, 2003; Van Leuvan, 2004). Trusty and Niles (2003), found that students who finished one course in Algebra II or beyond more than doubled the likelihood that students would finish college. In fact, the effects of high school course taking was a stronger determinant factor than test scores, grade point average, class rank and background variables including socioeconomic status, race and ethnicity (Trusty & Niles, 2003). Trusty (2002) showed that students who took more coursework in mathematics in high school scored higher on the ACT assessment. Further, students' math course work in high school had the greatest impact on the choice of major of students particularly for women. Trusty (2002) attributed student confidence building in math to taking challenging course work particularly in courses such as trigonometry and pre-calculus. Morge (2005) substantiates earlier findings and attributes student confidence in their math abilities as a primary determinant in course selection at the high school level and choice of major in college. Perhaps most important, research shows that the score students receive in high school math courses is not as important as the courses taken when predicting college success (Morge, 2005; Trusty 2002; Trusty & Niles, 2003,). If students can be encouraged to take a fourth year of math because of a positive relationship with a math teacher, established through looping, they will be more successful in college (Morge, 2005; Trusty, 2002; Trusty & Niles, 2003).

Addressing 21st Century Educational Concerns

The objective of the American school system is to educate every student to his or her highest potential (Bellanca & Brandt, 2010; Jacobs, 2009; Zhao, 2009). District, school, and individual student results are increasingly measured and tracked in an effort to improve outcomes for students (Zhao, 2009). Zhao (2009) argued that schools need to increase their results, not by the current focus on standards based accountability, but by focusing efforts on the quality of services provided to learners. "An input-oriented accountability system measures the quality of schools by looking at the quality of educational resources and opportunities they provide to each student" (Zhao, 2009, p.

184). Many of our current educational structures hinder the learning and development of students rather than promote it (Jacobs, 2009; Zhao, 2009). Such structures as age cohorts, classes, time frames, instructional organization, curriculum and content frameworks need to be reconsidered (Bellanca & Brandt, 2010; Jacobs, 2009; Zhao, 2009). Although the concept of keeping students with the same teacher for multiple school years, often referred to as "looping", is not a new approach in the American education system, it offers unique opportunities for learners that supports America's talent development and learning of 21st Century Skills (Thompson et al., 2009).

Contest Mobility in America. An educational accountability structure that focuses on standardized test results to group and categorize students and even schools is contrary to the foundational ideals of the United States (Zhao, 2009). Turner (1960) described the American educational system as a contest mobility model, one in which the system is structured in a manner that provided equal opportunities for everyone. Morgan (1990) recognized that America's contest mobility system comes at the "expense of clearly defined measures of quality" (para. 5). Since that time, the American educational system have moved from a wide range of standards across the country at the various levels to a more narrowly defined set of standards promoted at the national level (Zhao, 2009). Morgan (1990) stated that the English system of standardization in examinations and identifying those able to go on to post-secondary education is much more predictive and reliable than the system in the United States where standards vary and there are many opportunities for students to opt in and opt out of education. People in the United States can find educational opportunities beyond high school that fit their specific needs and interests (Morgan, 1990). There is finality in accomplishments for individuals when an exam predicts future opportunities (Zhao, 2009). The United States "keeps the opportunity of education open to more people and for a longer period" (Morgan, 1990, para. 2). There is a wide range of standards within the higher education system to provide some benefit of education to literally all who want it (Morgan, 1990).

As the United States puts more emphasis on standardized test scores of students as an accountability tool, the system moves further away from our contest mobility model (Zhao, 2009). Rosenbaum (1978), cited data that showed the United States was becoming more of a "tournament mobility" model than contest mobility model in that "when you win, you only win the right to go on to the next round, when you lose, you lose forever" (p. 252). The increased emphasis on college entrance exams to sort and define potential student opportunities is an example of the increasing tournament mobility model in the United States described by Resenbaum (1978). Looping avoids shifting the blame forward, and blaming the previous teacher for lack of growth, providing ownership to teachers (Franklin &Holm, 2007; Roessingh, 2006; Rouse & Kemple, 2009). The accountability and responsibility lies within the teacher and adults within the system (Bellanca & Brandt, 2010; Longo, 2010).

Looping allows for more opportunities for learning to occur for students by stretching out the learning period to multiple school years, thus increasing the student's opportunity through the teacher's knowledge of the learner over two years (Franklin & Holm, 2007). Zhao (2009) cited the benefits of contest mobility systems for learners where opportunities to participate are numerous and judgments regarding the learner's perceived ability are delayed. "In contest mobility systems, individual talents, as diverse as they may be, are tolerated and preserved until much later, when specialization is called for" (Zhao, 2009, p. 55). The contrasting model, sponsored mobility, is one in which educational decisions are made early based on identified potential. Access to programs is therefore limited or granted based on a met standard (Zhao, 2009). This is common in programs that emphasize tracks of study based on previous student achievements, such as a student's achievement in sixth grade math concepts predicting their ability to access specific courses at the seventh grade. The potential danger in this model is that valued talents or abilities may not be those most needed in the future, thus reducing the potential for future talent needs to be developed (Zhao, 2009). By keeping students and teachers together in an instructional loop for at least two years, the school organization sends a clear message to learners and the teacher that students learn at different rates, but all will learn and make progress (Franklin & Holm, 2007).

Talent and Creativity Development. American culture values late bloomers. "Late bloomers have contributed to all fields of human activity" (Zhao, 2009, p. 56). The current educational system allows students to investigate strengths and talents in high school and postpone career decisions until after graduation (Bellanca & Brandt, 2010; Zhao, 2009). Expecting all people to learn and develop talent at the same rate is not realistic or in line with human growth and development (Bellanca & Brandt, 2010; Zhao, 2009). Looping allows the teacher to work with students' development over an extended time rather than passing them off to the next teacher who will need to reassess academic skill levels and build a relationship (Franklin & Holm, 2007). Zhao (2009) described the words of his own son's teacher, exemplifying America's acceptance and value of a late bloomer by likening children to popcorn, "They all pop, some sooner and some later, but in the end they all pop" (p. 54). Looping extends the time a teacher works with students providing more time for the teacher to nurture and foster the development of student talents (Franklin & Holm, 2007).

The United States is not alone in its value and concern for talent and creativity (Bellanca & Brandt, 2010; Jacobs, 2009; Zhao, 2009). According to Gallagher (2008), "Each nation needs brilliant minds that can see alternative answers to pressing problems, and large societies like China and India are using early identification and additional educational resources to help develop the next generation of creative thinkers" (p.1). As America has increased its value of standardized test scores, it should not lose sight of the need to develop talent (Zhao, 2009). The American educational system needs specific structures that are able to maximize discovered talent and support the late bloomers (Zhao, 2009; Gallagher, 2008). Craft (2006) claims creativity is nothing without wisdom defined as "making thoughtful, well informed and appropriate judgments leading to sound courses of action with regard to the consequences" (p. 337). Craft (2006) reported that educators need to foster creativity with wisdom by teaching students to consider the global effects of solutions proposed to solve national and global issues. To achieve this, students must first feel connected to their learning and therefore the teacher and environment that the learning takes place (Craft, 2006). Zhao (2009) called for change in education that will personalize the experience for all learners, "a path to talent diversification" (p. 182). Students must feel connected to be successful (Bellanca & Brandt, 2010; Jacobs, 2009; Zhao, 2009). Looping increases a student's sense of connectedness (Thompson et al., 2009).

Coleman and Southern (2006) cited the need to provide more time and nonstandard methods for identifying potential academic talent because early identification systems often disqualified underserved student populations, primarily urban minority students of low socioeconomic backgrounds. In the spirit of contest mobility, Coleman and Southern (2006) recognized that talent develops with effective instruction and stated that one year may not be enough time for a teacher to nurture and develop student's unique strengths and talents. Looped instruction has the potential to create a student-teacher relationship that can counteract factors, Coleman and Southern (2006), claim are contributing to low achievement of students with low socioeconomic backgrounds (Thompson et al., 2009). These factors include limited options for learning, out of school environment is unsupportive of academic achievement, and achievement is not valued by peers and may be seen as a betrayal (Coleman & Southern, 2006; Thompson et al., 2009). Talent is also lost by the increase in drill and practice as teachers prepare for high stakes testing and a narrow view of learning measurement (Coleman & Southern, 2006). Marshall (2010) argued that experience and practice shape habits of mind and that knowledge is co-constructed, meaning social relationships play a pivotal role in nurturing science, technology, engineering and math talent.

MacNamara, Button, and Collins (2010) found that talent development in athletes closely correlates to family support. The three primary characteristics identified by excellent athletes and their parents were perseverance, self-motivation, and the belief that they could excel (MacNamara et al., 2010). Interestingly, researchers have found that focusing on one's weaknesses was not a critical factor for success (Jarvin & Subotnik, 2010; MacNamara et al., 2010). Their study of word class athletes also revealed that there was no strong genetic endowment for athletes (MacNamara et al., 2010). MacNamara et al. (2010) reported that most world-class athletes felt that they had developed their talent despite their weaknesses and felt their talent was not an innate ability. “Many successful athletes were not born with the physical attributes deemed of most value in their sport, but developed the talent and skill over time” (MacNamara et al., 2010, p. 63).

Consistent with the looping benefits, talent development requires realistic evaluation and useful assessment (Thompson et al., 2009; MacNamara et al., 2010). MacNamara et al. (2010) also identified a high correlation in the need to be part of a team where one can assess their growth as well as the growth/success of the team. Several researchers have identified the role of mentors in providing guidance to help to overcome stress and challenges associated with achievement (Coleman & Southern, 2006; MacNamara et al., 2010; Thompson et al., 2009). Athletes finding the greatest success were ones that worked with coaches and mentors for many seasons rather than jumping from coach to coach and team to team (MacNamara et al., 2010).

Jarvin and Subotnik (2010) found that different academic, performance, and personality variables become important at varying stages in an artist or scholar’s life. “Abilities can be developed into expertise and, beyond that, talent, and the weight of various factors shifts over time particularly variables associated with practical intelligence or social skills” (Jarvin & Subotnik, 2010, p.79). Developing student talents included factors such as quality of student-teacher experience, persistence in good and bad times, fostering intrinsic motivation, and self-awareness of weaknesses and strengths (Jarvin & Subotnik, 2010).

The development of math talent, particularly in female students, required a positive high school experience in the math classroom (Gavin, 1996). Female students benefited from a mentor/mentee relationship with their teacher (Gavin, 1996). Female students' grades directly affect their self-concept in math (Gavin, 1996). Female students often attribute their understanding of concepts to the teacher's ability to connect the material to real-world experiences (Gavin, 1996). The student – teacher relationship had the biggest impact on female students choosing to pursue mathematics in college (Gavin, 1996). Gavin's (1996) study exemplified the value of fostering positive student teacher relationships as it pertains to academic talent development. Fostering a long-term positive student teacher relationship is at the heart of the looped instruction model (Franklin & Holm, 2007).

Differences in transitions, both pre and post classroom and school environments, contribute to declining motivation of students (Watt, 2008). Furthermore, male students showed a higher intrinsic value for math although both boys and girls experienced a decline in student perceptions of their math talent and intrinsic value of math though secondary school (Watt, 2008). Female students believed they had lower math achievement than boys, even though they did not; this resulted in fewer females taking higher-level math courses (Watt, 2008). Watt's (2008) research demonstrated a loss in math talent, recapturing this talent is possible, particularly for female students who loop instruction at the high school level. Longo (2010) argued that the teacher has the greatest impact on student learning in today's educational climate as teachers attempt to balance the test driven educational system with the need to foster creativity. Outstanding teachers prepare students for state tests by the process standards that they teach along the way and the quality activities they provide (Longo, 2010). The educational system should support teacher control of instructional variables so teachers can balance state assessment needs as well as the developmental needs of their students (Longo, 2010). Looping provides teachers with the time necessary to control more variables and address the developmental needs of their students (Franklin & Holm, 2007).

Developing Skills for the 21st Century. Darling-Hammond (2010) recommended redesigning schools so they become supportive of in-depth teaching and learning.

> We continue to struggle with the factory model that we inherited one hundred years ago. The model neither values relationships between adults and children nor the time for in-depth study. to make the school factory model work, we adopted the age-grading system that sends elementary school students to a different teacher every year and middle and high school students to a different teacher every forty-five or fifty five minutes. (Hammond as cited by Bellanca & Brandt, 2010, p. 47)

Thomson et al. (2009) argued that looping allows improvement to occur in schools and in an economically responsible way. The educational focus of United States policy makers should be creating policies that support teacher development and learning for students that enable 21st century skill characterized by the following: global education; learning and innovation skills; information, technology and media literacy; life, career skills and considerations for the environment; assessment and instruction; and professional development to match (Bellanca & Brandt, 2010). Zhao (2009) agreed with Darling-Hammond (2010) in his argument that the future calls for providing educational structures that allow for in depth relationships and a sense of connectedness for the learner.

> For the global village to become a happy place for all its residents, everyone in the village must accept the facts that their well-being is interconnected and depends on others; they must understand and be willing to tackle common problems facing the village, they must treat each other as equals; and they must try to understand and appreciate each other's beliefs, values, behaviors, and customs. (Zhao, 2009, p. 175)

Looping provides a format for modeling with students the ability to establish lasting relationships with those they work with, and the ability to work together over extended periods of time (Thompson et al., 2009).

"Emotional intelligence – the ability and capacity to understand and manage emotions of self and others" – is vital for students' ability to acquire the knowledge and skills to help them be successful in a global, digital economy (Zhao, 2009, p. 151). This includes the ability to "interact with others, understand others, communicate with others, and manage one's own feelings" (Zhao, 2009, p.151). Malone (2009) advocates for creating educational structures that nurture student's interpersonal, collaborative, social responsibility, and self-direction skills. Emotional intelligence is developed over time through positive lasting relationships with others – looping provides the forum for this skill to be developed (Zhao, 2009; Roessingh, 2006).

According to Jacobs (2009), schools must adopt curriculum that matches the needs of the 21st century. "The notion that anyone can get deep, rigorous, high-quality learning in a system that treats students as assembly-line widgets is implausible" (Darling-Hammond, 2010, p. 47). To address curriculum needs in the 21st century effectively, educators should consider the schedule, the way we group learners, personnel configurations, and the use of space both physical and virtual (Jacobs, 2009). "Our quest requires that our most human, psychological, and spiritual aspects be considered as we look into the future," (Jacobs, 2009, p. 4). Establishing a positive relationship with the teacher is a basic human need for a learner (Jacobs, 2009; Nevin et al., 2008).

Jacobs (2009) recognizes that the manner in which schools structure their time has deep implications regarding the effectiveness of delivering 21st century skills. However, Jacobs (2009) advocated for strategic schedule planning based on the demand and nature of the task. For example, 20 to 30 minutes to edit a first draft, 15 to 20 minutes to review a draft with a peer (Jacobs, 2009). The danger of this logic is assuming all students learn at the same rate (Zhao, 2009). This is not the case in American classrooms today and exemplifies the same fundamental problem with No Child Left Behind and contrary to American contest mobility ideals (Zhao, 2009).

The teacher must be creative in making time work for learners in the most efficient and effective manner possible to meet the varied needs of the students (Bellanca & Brandt, 2010; Jacobs, 2009). Meeting the needs of diverse learners cannot be prescribed pre learning and often requires in- process flexibility that looping provides (Franklin & Holm, 2007).

As the debate continues among researchers regarding the optimal way to address 21st century skills, develop talent, and maintain American educational values, it is important to follow American ingenuity practices that often call for using methods that are already available, but in a new way (Zhao, 2009). Looped instruction at elementary and middle school levels of education demonstrated benefits for students contributing to preparation for globalization and the future (Franklin & Holm, 2007; Nevin et al., 2008).

Now is the time to strengthen our instructional approach and look for new ways of developing our students' strengths and talents through the positive, ongoing student-teacher relationship that looping creates (Rouse & Kemple, 2009).

Summary

The implementation level of looped instruction varies widely. Some elementary and middle schools offer looping at every grade level, while in some districts, looping only exists where two teachers have promoted it (Thompson et al., 2009). Looping occurs most often in elementary school and occasionally in middle schools, and is both public and private school settings (Franklin & Holm, 2007; Nevin et al., 2008; Thompson et al., 2009). Although popularity for looping has increased in the United States, many educators still considered it innovative (Franklin & Holm, 2007).

As reported by Ullman (2005) Barbara Schaefer, professor in charge of the undergraduate programs in school psychology and an associate professor of education at Pennsylvania State University, believes "looping has positive attributes but there's a difference between feeling something is valid and demonstrating its value" (p. 2). She encouraged districts to put evaluation practices in place for looping programs. There is limited research regarding the effectiveness of looped instruction at the secondary level particularly in the area of mathematics, although there is a history of findings documenting the benefits of looping at the elementary and middle school levels (Ullman, 2005). Psychologists and educators agree that enhanced learning occurs through long – term connections between teachers and pupils, yet students rarely have the same instructor for more than one school year particularly at the secondary level (Ullman, 2005).

Perhaps a primary benefit during times of fiscal limitations and accountability, Franklin and Holm (2007) described looping as requiring minimal funding and a relatively easy intervention to implement. "Additional curriculum and professional development is helpful, but most teachers are skilled enough to advance to the next grade" (Franklin & Holm, 2007, p. 2). Thomas et al. (2009) argued that looping has helped middle school students and teachers combat the same issues that are facing high school such as teacher capacity to address student learning needs, student connectedness to school, and positive relationship building between staff and students.

Chapter Three: Research Methods

Overview

There is limited research showing the benefits of looped instruction at the high school level. The research literature currently available documents the importance of trusting relationships for adolescent development and achievement. There is also research supporting the idea that success in high school mathematics is a vital predictor of later success in college. The high school setting of this study has employed looping as a strategic instructional practice aimed at increasing achievement outcomes for students from 2008 to 2010 specifically targeted at the algebra to geometry sequence of course work. Select groups of students have looped with their teacher from Algebra I to Geometry courses. Analysis of student achievement results, including grades, state test scores, and exam grades; indicators of school connectedness such as absenteeism rates and office discipline referral rates; as well as the perceptions of students and teachers involved in looped instruction was used to measure the effects looped instruction at the high school level in the content area of mathematics. The control group consisted of data gathered from non-looped student groups. A third group, semi-looped student data was also compared to analyze benefits for students who and receive instruction form a looping teacher and are in class with looping students.

Purpose of the Study

Quantitative data analysis includes a measure of the statistical differences in achievement between students who participate in a two-year looped instruction program, delivered at the high school setting in the content area of mathematics and those students who did not participate for two years in looped instruction. A third group used for comparison purposes consisted of students who experienced their second year of instruction from a looping teacher, but did not have the teacher for year one of instruction. This group is referred to as semi-participants. Comparable groups consisted of sample sets of students who participated in looped instruction, non-participants and semi-participants.

Qualitative data from focus groups examined perceived benefits and drawbacks of looped instruction from a representative group of students who participated in looping as well as perspectives from teacher participants.

This study will determine to what degree it benefits students to have the same math instructor over the course of two years. Statistical comparisons occurred in three domains to determine if significant difference exists among sub groups and to what extent participating teachers and students perceived benefits and drawbacks of looping. Domains examined in this study are as follows:

1. Student achievement as measured by student course grades, common assessment scores and scores on Missouri's EOC Exam.
2. School connectedness as measured by student attendance and discipline data.
3. Student and teachers' perceived benefit of looping as it relates to the student/teacher relationship, sense of community, trust in the teacher and effective delivery of instruction.

Study Hypotheses by Domain

Student Achievement. Null Hypothesis 1: Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by Missouri Assessment Plan scores in Mathematics, when compared to non-participants and semi-participants.

Null Hypothesis 2: Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change year-to-year in scores, as measured by Missouri Assessment Plan in Mathematics, when compared to non-participants and semi-participants

Null Hypothesis 3: Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by course grades in Mathematics, when compared to non-participants and semi-participants.

Null Hypothesis 4: Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by common assessment scores in Mathematics, when compared to non-participants and semi-participants.

School Connectedness. Null Hypothesis 5: Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by the number of absences when compared to non-participants and semi-participants.

Null Hypothesis # 6: Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by decreased discipline referrals, when compared to non-participants and semi-participants.

Student and Teachers' Perceived Benefits of Looping. Research Question(s):

1. Do students perceive a better sense of connectedness and community at school due to participating in looping?
2. Do students perceive a better relationship with their math teacher and greater trust in their math teacher because of participating in looping?
3. Does perception support the thought that looped instruction increases teacher capacity to meet student needs and an increased understanding of the content curriculum?

Process for Student Selection for Looped Instruction Participation

Students were randomly selected and placed in classrooms by computer system in year one. The looping teacher recommended looping students for year two based on two criteria. The first criteria was, the student must have successfully pass the year one math course with a 60% or higher. The second criterion was that in the teacher's opinion, the student would be likely to benefit from the looping program.

School personnel sought informal parent consent for student participation, although the implementation plan was a decision made by school administration. School counselors worked from lists of teacher recommendations to contact students and parents though phone contacts and scheduling conferences. Students and parents could opt out of looping or opt in if the teacher did not recommend the student's participation in looping, but student, and/or parents wanted to participate. Counselors also had the option of recommending students for looped instruction and discussing the option with students, teachers, and parents.

Looping teachers' class sizes were set consistently with other teachers teaching the same course, and looping students had first priority placement with the looping teacher. Average class size ranged from 25 to 32 students. Other students were also placed with the looping teacher during year two randomly by the computer scheduling system and by guidance counselor placement as naturally occurs in high school scheduling. Schedule changes occurred, if possible given the student's specific scheduling needs, when teacher, student, or parent felt a placement with another teacher would benefit the student.

Description of Teacher Participants

Looped instruction began at the study location in 2008 and continued through the end of this study timeframe in 2010. During this time, teachers participating in the looping model were on a volunteer basis. In some cases, the teachers' administrator suggested their participation as an option to the teachers; in other cases, the teachers requested participation. In the first year of implementation, 2008, two teachers participated of the five teachers teaching Algebra I classes. One teacher of the five algebra teachers looped up to Geometry in both 2009 and 2010. All teachers held high school mathematics certification. Professional development for looping teachers consisted of weekly meetings with other geometry teacher to align instruction and assessment practices throughout the year. Teacher experience ranged from five-20 years. Participants were comprised of both tenured and non-tenured staff. Teacher focus group participants consisted of one Caucasian male, two Caucasian females, and one African American female.

Study Sample Selection

For the purpose of this study, 30 to 60 students from each of the three randomly selected comparison groups, looped participants, non-looped participants, and semi-looped participants for each year that looped instruction was provided at the study location. This consisted of the 2008, 2009, and 2010 school years. The 2008 school year was the first year of a completed looping rotation, meaning it was the second year of instruction for the first group experiencing looped instruction at the study location. Data consisting of attendance rates, number of discipline referrals, course grades, first-semester exam grades, and Missouri Assessment Plan test scores and levels were collected for each of the comparison groups for each school year 2008, 2009, and 2010.

Study Setting

The setting of this study was a public high school located in North St. Louis County in the state of Missouri. As of November 2010, the high school's district was fully accredited. In 2010, the state of Missouri had 522 school districts; 510 of which were fully accredited, 10 provisionally accredited and two unaccredited (MO DESE, 2011). Enrollment in the study school district between 2006 and 2010 was an average of 1,967 students. During the years of this study, 2008 through 2010, the student average demographic makeup consisted of 2.06% Asian, 40.40% Black, 7.83% Hispanic, 0.53% Indian, and 49.16% White. See enrollment statistics in Table 2.

Table 2

Setting Demographic Enrollment Statistics by Year

	2006	2007	2008	2009	2010
Total Number	1,585	1,950	2,039	1,995	1,992
Asian	2.2%	2.4%	2.2%	1.9%	2.1%
Black	34.3%	37.2%	38.4%	41.9%	40.9%
Hispanic	4.5%	5.5%	6.8%	7.8%	8.9%
Indian	0.2%	0.4%	0.5%	0.5%	0.6%
White	58.8%	54.6%	52.1%	47.9%	47.5%

Note. Adapted from MO DESE

The average attendance rate during the years of this study was 91.3% and approximately 55.87% of the students qualified for the free and reduced lunch program. The graduation rate during the years of 2008, 2009, and 2010 ranged from 80.2% to 88.3%. The average dropout rate was 4.03% during that same time.

Table 3

Setting Demographic Statistics by Year

	2006	2007	2008	2009	2010
Attendance Rate	91.8	90.0	91.1	92.0	90.8
Free or Reduced Lunch Program Participant Rate	45.6%	50.2%	49.7%	57.4%	60.5%
Graduation Rate	87.2	85.9	88.3	80.2	86.1
Dropout Rate	1.8	1.6	4.9	4.6	2.6

Note. Adapted from MO DESE

After graduation, the Missouri Department of Elementary and Secondary Education show for the years 2008, 2009, and 2010 an average of 23.9% of graduates entered a four-year college or university. An average of 22.1% entered a two-year college, and an average of 4.0% entered a technical institute during the same years.

Table 4

Setting Postsecondary Statistics by Year

	2006	2007	2008	2009	2010
Entering a 4yr. College/University	29.1	29.3	23.8	21.5	26.5
Entering a 2yr. College	18.4	22.0	18.9	24.7	23.5
Entering a Postsecondary (Technical) Institution	9.9	7.3	4.0	3.7	4.3

Note. Adapted from MO DESE

The high school setting had a student to classroom teacher ration ranging from 23 to 26 during the 2008, 2009, 2010 school years (Missouri Dept. of Elementary and Secondary Education, 2011). Teachers had an average of 10.9 years of experience and 60.7% of the staff held an advanced degree during the years examined in this study. The average regular term teacher salary was $55,892 from 2008 to 2010 (Missouri Dept. of

Elementary and Secondary Education, 2011). All teachers participating in this study, including data gathered from the control group of non-participants, received instruction from certified math teachers considered highly qualified by the state of Missouri. Students in the looping program were enrolled in Algebra 1 for year one and Geometry for year two of the looping cycle.

Table 5

Setting Professional Staff Statistics

	2006	2007	2008	2009	2010
Students to Classroom Teachers Ration	25	25	26	23	25
Years of Experience of Professional Staff	10.6	10.7	11.0	10.8	11.0
Professional Staff with Advanced Degrees	71.9	74.6	68.9	54.5	58.8
Average Regular Term Salary	$51,100	$52,519	$53,443	$57,059	$57,173

Note. Adapted from MO DESE

Mathematics results on the Missouri's Standardized Assessment indicated that the school has not met annual proficiency targets during the period of this study, 2008, 2009, 2010, or during any year from 2002 to 2010. In 2007, the overall proficiency rate met the annual proficiency target (APT) but not all subgroup data did, resulting in a not met status (Missouri Dept. of Elementary and Secondary Education, 2011).

Table 6

Setting Annual Proficiency Data by Year

	2002	2003	2004	2005	2006	2007	2008	2009	2010
AYP Status		Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met	Not Met
A P T	8.3	9.3	10.3	17.5	26.6	35.8	45.0	54.1	63.3
Total Results	5	8.6	9	5.9	27.8	25.2	31.2	24.9	25.4

Note. Adapted from MO DESE

Data Gathering Methods

Quantitative Data. The study location used a software program, eSchool Plus, to manage and track student data. Data managed by eSchool Plus included, but is not limited to, student attendance, discipline referral data, and grade data. After student sample groups were established, the researcher totaled and recorded absences for the second year of instruction, geometry, for each representative student from each sample group. The researcher also recorded the total number of office discipline referrals for each sample group during the second year of instruction. Similarly, reports from the eSchool Plus program provided first semester exam grades (common assessments) and second semester final course grades for the sample group representatives.

Qualitative Data. Qualitative data used to examine the research questions posed in this study were collected from focus group discussions led by questions posed by the researcher (See Appendices A and B). The teacher focus group consisted of five teachers who participated in looped instruction at the study location in the area of mathematics from 2008 to 2010. These teachers were the total number of teachers who participated in looped instruction from 2008 to 2010 at the study location. The focus group discussion occurred in October of 2010. A student focus group discussion occurred in March of 2011 and included all students who volunteered and returned parent permission forms. The student focus group consisted of eight students, made up of one African American male, two Caucasian males, two African American females, two Caucasian females, and one Hispanic female.

Description of 2008 Missouri Assessment Program (MAP Test)

The 2008 Missouri Assessment Program (MAP) for mathematics included assessments at Grades 3 through 8 and Grade 10. Missouri began testing students at grade levels in 2006 in response to requirements of No Child Left Behind (MO DESE, 2008a). The MAP test of 2008 aligned with Missouri content standards, Process Standards, and Content Strands/Grade-Level Expectations (MO DESE, 2008a). The 2008 school year was the third year of grade level MAP testing in Missouri. The test administration occurred from March 31 to May 2, 2008 (MO DESE, 2008a). CTB McGraw-Hill LLC developed and published the MAP.

The Missouri Department of Elementary and Secondary Education (2008a) stated the following:

> The MAP was designed to measure how well students acquire the skills and knowledge described in Missouri's Grade –Level Expectations. The assessments yield information on academic achievement at the student, class, school, district, and state levels. This information is used to diagnose individual student strengths and weaknesses in relation to the instruction of the GLE's and to gauge the overall quality of education throughout Missouri. (p. 5).

Student performance on the 2008 MAP test includes scale scores and levels of achievement (MO DESE, 2008a). Scale scores indicate a student's total performance by quantifying the level of achievement (MO DESE, 2008a). Levels of achievement, based on scale scores and pre-established cut scores, included below basic, basic, proficient, and advanced (MO DESE, 2008).

Efforts to validate the MAP included the creation of a test blueprint specifying target scores for content standards and a test design for each grade-level (MO DESE, 2008a). Missouri educators, regional instructional facilitators, DESE staff, and CTB personnel created test items in February of 2005 (MO DESE, 2008a). Tests pilots and revisions ensured calibration and validity of measured items as well as content and bias review workshops (MO DESE, 2008a). District training by the Missouri Department of Elementary and Secondary Education ensured standardization of testing procedures. A range of *p*-values, 0.20 and 0.30 to 0.90, on item analysis for the MAP tests indicates items measure a range of skills at a given grade-level. Item analysis of omit rates also indicate adequate time for test taking. Chi-square tests identified items of poor fit for removal purpose, further increasing validity. The Cronbach's coefficient alpha indicates a reliability rating of over .90, whereas ratings over .80 generally indicate reliable measures (MO DESE, 2008a).

According to the Missouri Department of Elementary and Secondary Education (2008a), uses of the MAP scores include the following:

- identifying students' strengths and weaknesses on Missouri's Grade-Level Expectations
- communicating expectations for all students
- evaluating school, district, and/or state-level programs
- informing stakeholders (teachers, school administrators, district administrators, DESE staff, parents, and the public) on status of the progress toward meeting academic achievement standards of the state
- meeting the requirements to measure Adequate Yearly Progress by NCLB

- meeting the requirements of the state's accountability program, Missouri Improvement Program (MSIP). (p. 10)

Description of the 2009, 2010 Missouri End of Course Exam (EOC Exam)

The development and implementation of Missouri's EOC assessment occurred in response to the requirements of NO Child Left Behind (NCLB) legislation (MO DESE, 2008b). Developed by Riverside Publishing, "the Missouri EOC Exam is intended for the following purposes and uses:

- Measuring and reflecting students mastery toward post-secondary readiness
- Identifying student strengths and weaknesses
- Communicating expectations for all students
- Providing a basis for state and national accountability plans
- Evaluating programs. (MO DESE, 2008b, p. 189)

The assessment development process began in the spring of 2008 with extensive field- testing to establish universal design and refinement of testing items related to Missouri's course level expectations. Much of this process incorporated Missouri educators, trained by Riverside Publishing. A panel of expert judges consisting of staff from MO DESE, educators from around the state, regional instructional facilitators, and Riverside staff accounted for test item bias.

> Riverside publishing used classical item statistics, including *n*-counts, p-values, percentage choosing each response option, point-biserial correlations, and differential item functioning (DIF) analysis for the SR items. Additionally, the Rasch model was used for distractor analysis for the SR items and for differential item functioning (DIF) analysis for the PE/WP items. (MO DESE, 2008b p. 48)

"The Missouri EOC Assessment score describes the relationship of student performance to a defined level of achievement" (MO DESE, 2008b, p. 2). Student performance on the assessment determines the student's level of achievement. Missouri's four achievement levels include below basic, basic, proficient and advanced. Cut scores, established through expert panelists, differentiate between levels of achievement on the test. The assessment intends to measure across a broad range of difficulty and intends to be a power test, providing ample time for students to complete each portion of the test.

Standardized assessment procedures using detailed Test Examiner's Manual and Test Coordinator's Manuals ensures consistency in the distribution, administration, and collection of the EOC Assessment. "All standards related to test security, administration, and accommodations are adhered to throughout the process" (MO DESE, 2008b, p. 86).

The Algebra I and Geometry EOC Exams each consist of 35 multiple-choice items and one performance event. To account for inter-rater reliability and score validation, scoring team leaders automatically rescore one out every ten responses. When scores differ, the team leader's score becomes score of record. This overall 10% inter-rater reliability check allows for consistent review of scorer match and differences rates by item (MO DESE, 2008b). Test reliability ranges from .83 to .88 with conditional standard errors of measurements between 6 and 7 scale score points at the cut scores (MO DESE, 2008b, p. 194).

Upon completion of scoring, Riverside Publishing provides score and achievement level reports to the Missouri Department of Elementary and Secondary

Education, and then distributed to schools in the form of state, district, school, student group, and individual student data.

Purpose of Statistical Tests

Descriptive Statistics. Data sets for each hypothesis were sorted according to subgroup, looping, semi-looping and non-looping. Each subgroups data set was then ranked least to greatest and descriptive statistics calculated using Microsoft Excel data analysis program. This established the measures of central tendency as well as the measures of variation for each data set used in subsequent statistical analysis (Bluman, 2008).

Furthermore, descriptive statistics established the Pearson Index of Skewness identifying the normality of the data set's distribution. Randomly selected data, considered representative of the population, permits the use of significantly skewed data and the presence of outliers (Bluman, 2008). The Pearson Index (PI) value determined significant skewness and described the normality of each data set. Index values greater or equal to 1, or less than or equal to -1 indicate that the data are significantly skewed (Bluman, 2008).

Chi-Square Goodness of Fit Test. Hypothesis 1 includes data from 2008 and 2010 determining a gain in MAP scores when comparing looped participant data to non-looped and semi-looped. The 2008 and 2010 MAP scoring values used different scales not permitting score data comparisons of these two years directly.

The Chi-Square Goodness of Fit test compares outcomes to expected outcomes to determine the existence of any favorable outcome based on category, or in this case instructional type (Bluman, 2008). "Assumptions for the Chi-Square Goodness of Fit test are as follows: the data is obtained from a random sample, and the expected frequency for each category must be 5 or more" (Bluman, 2008, p. 566).

Chi-Square Test for Independence. The Chi-Square Test for Independence compared the mean values of each data set over the span of the study, 2008 to 2010 to examine the relatedness of results to the instructional type. This test examined the dependency of hypothesis data sets to the instruction type. If mean values of data sets were determined to be related to instructional type, looping, non-looping, semi-looping it is possible to accept or reject hypothesis claiming a gain for looped student groups (Bluman, 2008).

Analysis of Variance (ANOVA). An ANOVA test determined differences in means among the sample groups for each hypotheses data set. An ANOVA uses an F-test, comparing F values to F-critical values determining differences in variance. The P-value method compares the P-value with the alpha level of .05. Both the resulting F test comparison and the calculated P-value compared with the alpha level determine differences in means and the need for *z*-tests to examine differences in mean values among the data sets (Bluman, 2008).

***Z*-test for Difference in Means.** A *z*-test, used when the sample is larger than thirty, typically compares sample mean values to expected population mean values determining the existence of statistical differences (Bluman, 2008). In this study, *z*-tests compared means of sample data sets, determining statistical differences based on looped instruction. If a statistical difference exists between sample means, the larger sample mean is statistically larger than the smaller of the two means. By comparing data sets between looped groups with semi-looped groups, then looped groups with non-looped groups, and finally semi-looped groups with non-looped groups, statistical differences in means is established.

Pearson Product Moment Correlation. To examine the relationship of year-to-year data for hypothesis 2, a correlation establishes a relationship between year-one and year-two data for each sample cohort group. Correlation calculations determine relationships between algebra one scores and geometry scores year-to-year for the cohort data comparing looped sample data to semi-looped and non-looped sample data. Differences in the relationships among the cohort sample groups determine gains based on looped instruction. The *R* square value results of correlation tests indicate the percent of the variance in algebra scores related to the variance in the geometry scores (Bluman, 2008).

F Test. An F test examines the variance between two sets of data and allows the researcher to compare data where differences in means may not occur. It is possible for data to have no difference in mean, but for the variation among values within data sets to differ (Bluman, 2008).

Quantitative Data Analysis Procedures by Hypothesis

Null Hypothesis 1. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no gain in student success as measured by Missouri Assessment Plan scores in Mathematics, when compared to non-participants and semi-participants.

The researcher began by sorting 2010 scores, and levels from least to greatest for each category and ran descriptive statistics for each. This also yields Pearson Index values to determine skewness of the data. These statistics describe the normality of the data and provide mean and variance values for running other statistical tests.

A Chi-Square Test for Independence for 2008 and 2010 determines if a relationship exists between looping experience and Missouri Assessment Plan scores. This is essential if gains exist due to looping a relationship would exist between scores and instructional type. Likewise, with the ANOVA test, if gains exist, one would expect to find differences among the MAP scores based on instructional type. Difference in variance using the F-test and P-value indicator determine potential differences in mean values and the need to examine these identified differences with *z*-tests.

The researcher compared the Missouri Assessment Plan scores of the 2008 and 2010 year independently for each subgroup using a *z*-test for difference in means to determine significant differences among mean scores for each group. In 2008, the assessment aimed at measuring student proficiency in concepts learned by the end of tenth grade. In 2009 and 2010, the Missouri Department of Elementary and Secondary Education began using EOC exams. In 2009, the school studied only administered algebra EOC exams, not geometry, resulting in no year-two state assessment data for 2009 looped students. The *z*-tests determined differences in mean scores for each group in 2010.

Comparing the average of the end-of-course exam scores of the looped groups to the semi-participant groups, and non-participant students helps to determine if there is a significant difference because of having the same math teacher for two years. The Missouri EOC Exam is a standardized test taken by all students at the completion of course work for Algebra I, and optional for school districts for those completing

Geometry, and Algebra II. For this comparison, *z*-scores were calculated and used to determine the existence of a significant difference between participants, semi-participants, and non-participants.

Null Hypothesis 2. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change year-to-year in scores, as measured by Missouri Assessment Plan in Mathematics, when compared to non-participants and semi-participants.

In 2009, the State of Missouri changed its standardized test procedures at the high school level in mathematics to include an end-of-course exam for Algebra I, Geometry, and Algebra II, aligned with state course-level expectations. Before 2009, the Missouri Assessment Plan assessed students at the high school level in mathematics covering a variety of concepts that taught by the end of 10th grade, associated with grade-level expectations. The new end-of-course exam assesses students' knowledge of math concepts specific to each course. Consequently, the looping, non-looping, and semi-looping student groups for the 2010 school year had end-of-course score data available for Geometry and the previous year's Algebra I test. By comparing, the mean Algebra I score of 50 randomly selected students from each group a baseline can be established and significant differences among the groups' Algebra I scores can be determined using the Chi-Square Test for Independence and a *z*-test. When comparing the mean Algebra I score with the next year's mean Geometry score for each group comparable growth can be determined. Significant differences in the mean scores of the Geometry scores for each group can also be determined using a Chi-Square Test for Independence and by conducting a *z*-test.

Pearson Product Moment Correlation helps determine a relationship between Algebra EOC scores and Geometry EOC scores when comparing student-to-student in each of the classroom delivery modes of looped, semi-looped, and non-looped. By examining the results of the correlation, the researcher can determine how well a student scores in year one has as it relates to their score in year two regardless based on instructional type. Results can also help determine which instructional type has the strongest relationship based on cohort data. Furthermore, an F-test can determine differences in variance where differences in means may not exist, helping the researcher further examine potential changes in year -to-year differences among cohort groups based on instructional type, looping, semi-looping, and non-looping.

Null Hypothesis 3. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by course grades in Mathematics, when compared to non-participants and semi-participants.

All teachers who teach the same course, Algebra I or Geometry for example, planned instructional activities together and use the same curriculum materials, as well as implement common assessments and common scoring guides. Agreed upon weighting criteria, 75% of course grade based on assessment scores and 25% based on homework and other class assignments, determined students' course grades. This helped to minimize the impact of variables such as varying curriculum materials, instructional activities, assessments methods, and scoring methods when comparing achievement results.

To test this hypothesis, final course scores from randomly selected for students who participated in looped instruction, non-participants, and semi participants. A mean score was calculated by first assigning a numeric value to letter grades, A=4, B=3, C=2, D=1, F=0. Comparisons between the groups using a Chi-Square Test for Homogeneity and a *z*-test examined differences in mean values for of the three years comprised of the study, 2008, 2009, and 2010.

Comparing the grades of study participants to those of non-participants and semi-participants determines the effect of the instruction delivery model for students. A *z*-test was used to determine if the mean score (average grade) of the looped group was significantly larger than the mean score (average grade) of the non-looped group and semi- looped at the same level (Bluman, 2008). A mean score will also be calculated for a randomly selected student group of those who experience instruction from the looping teacher in year two, but did not have the teacher in year one. In this case a *z*-score will also be used to help determine if a significant difference is present when compared to non-looped and looped students. This comparison will help to determine the extent to which looping was a factor in students achieving higher grades. This data may also help determine to what extent the practice of looping benefits the teacher and has an impact on all students they teach. The Chi-Square for Independence test examined the relatedness of looping experience to course grade averages for the sample groups (Bluman, 2008).

Analysis of Variance using F-test and the P-value indicators determines differences in means for each the three years of comparable sample group grades. The researcher expects to find differences in mean and variance if changes exist on grades due to looping.

Null Hypothesis 4. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by common assessment scores in Mathematics, when compared to non-participants and semi-participants.

Measures of central tendency and measures of variance indicate the normality of the data and describe the sample sets of each group for each year. Teachers at the site of this study work in collaborative groups according to the course content taught. Teachers created common, lesson activities, projects, assessments and scoring guides. This includes semester exams for the course. The first semester exam grades gathered for the randomly selected sample groups for each year 2008, 2009, and 2010 serve as further indicators of the impact of looped instruction. The mean scores for each group for each year, 2008, 2009, 2010, were compared using a Chi-Square for Independence test and a *z*-test for means.

As is the case with other hypotheses of this study, Analysis of variance using F-tests and P-value indicators show differences in means, determining an effect on student performance on semester exams based on looped instruction.

Null Hypothesis 5. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no difference in student success as measured by attendance rates, when compared to non-participants and semi-participants.

Attendance is an indicator of a student's connectedness to the school environment and contributes to student success. Attendance records for the students randomly selected for each comparison group for the 2008, 2009, 2010 school years were analyzed by first calculating measures of central tendency and measures of skewness to describe the normality of each data set. The Chi-Square test for Independence examines the relatedness of number of days absent to instructional type for each school year within the study. The use of *z*-tests further examined the differences in mean values for each school year. These two tests allow for comparisons among the three groups and determine whether or not significant statistical differences exist between the three groups of students in terms of average number of absences for each school year.

Comparing the variance, through F-test and P-value indicators, of the three groups for each year provides further examination of potential differences in attendance due to looped instruction. Students with fewer absences tend to perform better at school and have a better connection the school environment. Attendance rates are indicators of student success at the high school level.

Null Hypothesis 6. Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by decreased discipline referrals, when compared to non-participants and semi-participants.

Using eSchool Plus, the number of office discipline referrals for each student represented in the sample groups were gathered. Measures of central tendency and a Pearson Index of skewness value for each group for each year determined the level of normality for each group. The Chi-Square test for Independent measures the relatedness of average number of office referral for each year dependent on instructional type. Comparisons of mean values, through *z*-tests, allow for further examinations of differences among the data sets of discipline referral numbers.

A second method of measuring the effects on student discipline compares the number of office referral written by looped teachers to the number of office referrals written by other teachers teaching mathematics at that grade level over the three years of the study, from 2008 to 2010. Data from the 2007 school year were also included in order to determine differences among rates of office referrals from year one to year two in the 2007 - 2008 looping cycle. Teacher referral data were summarized for five looping teacher participants consisting of school years 2007, 2008, 2009, 2010. This allows for comparisons of referral rates in mathematics classes where the student data includes office referral from all settings within the school.

Qualitative Data Analysis by Research Question

1. Do students perceive a better sense of connectedness and community at school due to participating in looping?
2. Do students perceive a better relationship with their math teacher and greater trust in their math teacher as a result of participating in looping?

A student focus group, consisting of eight students, determined the connectedness and perceived benefits of having the same math teacher for two years of instruction at the high school level. Membership in the student focus group was selected randomly from the available pool of students who participated in looped instruction from 2008 to 2010 and were still attending the school in the spring of 2011. See appendix A for student interview questions.

3. Does perception support the thought that looped instruction increases teacher capacity to meet student needs and an increased understanding of the content curriculum?

Beginning in 2008, four math teachers, at the study location, had participated in looping of various forms. The five teacher participants of the focus group met in October of 2010. Transcripts of the focus group conversation were analyzed for positive, neutral and negative remarks related to benefits of looping for students and benefits for teachers. Analyzed coded remarks determined themes related to student and teacher perceptions of looping in mathematics at the high school level. Members of the teacher focus group all participated in looped instruction with in the years evaluated in this study, 2008, 2009, and 2010.

Interviews of the teacher participants in the form of a focus group helped to determine perceived increase in teacher capacity to meet the needs of students. The focus group interview of teacher participants examined the impact of looping on instructional delivery, understanding of student development in mathematics as it relates to the curriculum standards and relationships with students. The focus group data also determined the teachers' perceived drawbacks to looping at the high school level as well. Appendix B contains the teacher focus group questions.

Summary

The evaluation methods of this study intended to measure the impact of looped instruction at the high school level in the area of mathematics in a comprehensive manner. Measures intended to provide qualitative and quantitative data analysis for triangulation purposes. The researcher proposes that the practice of keeping students and teachers together for two years of instruction in high school mathematics has positive results for students and teachers.

In the next chapter, an examination of each hypothesis determined significant differences in results based on instructional type, comparing looped, semi-looped and non-looped. In an effort to increase validity and reliability of the results, an examination determined differences among looped, semi-looped, and non-looped sample groups for each year of available data including 2008, 2009, and 2010 for each hypothesis. The comparison of results over three years provided comprehensive and conclusive evidence determining effectiveness of the looped instruction at the study setting. Multiple statistical analysis including PI values, Chi-Square tests, ANOVA, *z*-test, correlation, and F-test help determine relationships and differences among results based on instructional type for each hypothesis. Furthermore, focus group responses of teachers and students add qualitative data pertaining to participant perceptions of benefits and drawbacks of looping.

Chapter Four: Results

This study intended to examine the impact of looped instruction by comparing data from sample groups of students who participated in looped instruction to that of semi-looped participants, and non-looped participants. Data related to indicators of student success included MAP/EOC scores, course grades, common assessment grades, attendance, and discipline. In addition, qualitative analyses of student and teacher perceptions identify perceived benefits and drawbacks of looped instruction for high school mathematics.

Null Hypothesis 1

Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by Missouri Assessment Plan (MAP) scores in Mathematics, when compared to non-participants and semi-participants.

Sample data were tested using Pearson Index for Skewness, Chi-Square Goodness of Fit, ANOVA, and *z*-tests.

Null Hypothesis 1, Results for 2008 School Year. Student MAP scores for 2008 show close to normal distribution for looped and semi looped groups. The looped sample had a Pearson Index of -0.59 and the semi looped sample Pearson Index was -0.77. The non-looped student sample showed negative skewness with a Pearson Index of -1.12. Naturally, occurring outliers are acceptable in randomly selected samples (Bluman, 2008, p. 150). Outliers remained because samples selection was random.

A Chi-Square Goodness of Fit test showed there was evidence to reject the null hypothesis: there is no difference in average scale scores and the expected scale score needed for successful performance on the MAP in mathematics for each of the three delivery methods of looped, semi-looped, and non-looped. The Chi-Square Goodness of Fit tested weather or not the average scores met the scores expected for successful performance. The Chi-Square Goodness of Fit table below shows observed 2008 data adjacent to expected data in parenthesis.

Table 7

Chi-Square Goodness of Fit, 2008 Average Results Compared to Expected Results

	Looped O (E)	Semi-Looped O (E)	Non-Looped O (E)	Total
MAP Scale Score	716.48 (708.61)	705.41 (708.61)	703.95 (708.61)	2125.84

Note. α = .05, df = 3-1 = 2, O = observed average, E = expected average

The Chi-Square formula indicated a test value of 0.132 at the 95% confidence level. The test value of 0.132 is less than the critical value of 5.991 indicating that the null hypothesis is not rejected and there is not enough evidence to show that any one instructional type instruction type (looped, semi-looped, or non-looped) indicated a better fit to successful average MAP score results than the other two.

Differences in the average scores within the 2008 data sets using ANOVA (analysis of variance) indicated an F value of 1.27 and a critical value of 3.07. The F value of 1.27 was less than the F critical value of 3.07 indicating non-rejection of the null hypothesis: there is no difference in average scale score for performance on the MAP in mathematics for each of the three delivery methods of looped, semi-looped, and non-looped. There is no difference among the averages. The ANOVA also indicated a P-value of 0.28, which is greater than the alpha value of .05.

Table 8

ANOVA: Single Factor for 2008 MAP Scores

SUMMARY

Groups	Count	Sum	Average	Variance
MAP Score Looped	49	35045	715.2041	1245.04
MAP Score Semi-Looped	32	22573	705.4063	1121.99
MAP Score non-looped	42	29566	703.9524	1564.14

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3365.116	2	1682.558	1.27247	0.28389	3.071779
Within Groups	158673.6	120	1322.28			
Total	162038.7	122				

Note. α = .05

The *z*-tests for difference in means indicated no statistically significant difference in MAP scores among the three different groups. None of the *z* scores fell beyond critical values. The null hypothesis for this test was: There will be no difference in average scale scores on the MAP mathematics exam when comparing participants in different class delivery methods of looped, semi-looped, and non-looped. When comparing looping participants to semi-looped participants the *z*-value of 1.42 was less than the critical value of 1.96. The *z*-tests for semi-looped compared to non-looped participants showed a test value of 0.17, which is less than the critical value of 1.96. Looped participants compared to non-looped participants also showed no significant difference with a *z*-test value of 1.58 compared to the critical value of 1.96. See Tables 8, 9, and 10. Each result indicates non-rejection of the null hypothesis.

Table 9

2008 *Z*-Test: Two Sample for Means, Looped Scores Compared to Semi-Looped Scores

	Looped MAP Score	Semi-Looped MAP Score
Mean	716.48	705.40625
Known Variance	1295.642	1121.991
Observations	50	32
z	1.418138	
P(*Z*<=*z*) two-tail	0.15615	
z Critical two-tail	1.959964	

Note. α = .05

Table 10

2008 *Z*-test: Two Sample for Means, Semi-Looped Scores Compared with Non-Looped Scores

	Semi-Looped MAP Score	Non-Looped MAP
Mean	705.4063	703.9524
Known Variance	1121.991	1564.144
Observations	32	42
z	0.17098	
P(*Z*<=*z*) two-tail	0.86424	
z Critical two-tail	1.959964	

Note. α = .05

Table 11

2008 *Z*-Test: Two Sample for Means, Looped Scores Compared with Non-Looped Scores

	Looped MAP Score	Non-Loped MAP Score
Mean	716.48	703.9524
Known Variance	1295.642	1564.144
Observations	50	42
z	1.576401561	
P(*Z*<=*z*) two-tail	0.114933289	
z Critical two-tail	1.959963985	

Note. α = .05

Missouri Assessment Plan scores determine a student’s level of proficiency. The Missouri Department of Secondary and Elementary Education reports student standardized test score data in scale scores, as examined above, as well as levels. In 2008, a level one indicated a student’s score was below basic; level two indicated basic, level three indicated proficiency; and level four indicated advanced proficiency. The ANOVA test determined differences among average student level data. The null hypothesis was: There is no difference in average scores when comparing MAP proficiency levels for looped, semi-looped, and non-looped students. The F value of 1.91 was less than the F critical value of 3.07; the P-value of 0.15 was greater than the alpha level of .05 indicating that the null hypothesis was not rejected. There is no evidence that one category average level was significantly different from the other two.

Table 12

ANOVA: Single Factor for 2008 MAP Levels

SUMMARY

Groups	Count	Sum	Average	Variance
MAP Level Looped	50	102	2.04	0.52898
MAP Level Semi-Looped	32	60	1.875	0.37097
MAP Level Non-Looped	42	74	1.761905	0.47851

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1.799662	2	0.899831	1.90886	0.152687	3.0711405
Within Groups	57.03905	121	0.471397			
Total	58.83871	123				

Note. α = .05

Subsequent *z*-tests indicated no statistical differences at 95% confidence between average MAP levels when comparing the looped students to semi-looped and non-looped students when comparing the means and supported the results obtained through use of ANOVA. The null hypothesis for *z* testing was: There will be no difference in average performance level on the MAP mathematics when comparing participants in different classroom delivery settings. When comparing looped levels to semi-looped levels, the *z* value 1.11 was less than the *z* critical value of 1.96. Comparing looped to non-looped showed a *z* value of 1.88 also less than the *z* critical value of 1.96. Lastly, the *z*-test comparing semi-looped to non-looped showed a *z* value 0.75 that is also less than the *z* critical value of 1.96. Each result supported the non-rejection of the null hypothesis.

Table 13

2008 *Z*-Test: Two Sample for Means, Looped Levels Compared with Semi-Looped Level

	MAP Level Looped	MAP Level Semi-Looped
Mean	2.04	1.875
Known Variance	0.528	0.37
Observations	50	32
z	1.109346	
P(*Z*<=z) two-tail	0.267281	
z Critical two-tail	1.959964	

Note. α = .05

Table 14

2008 *Z*-Test: Two Sample for Means, Looped Levels Compared with Non-Looped Levels

	MAP Level Looped	MAP Level Non-Looped
Mean	2.04	1.761905
Known Variance	0.528	0.478
Observations	50	42
z	1.877438912	
P(*Z*<=z) two-tail	0.060457962	
z Critical two-tail	1.959963985	

Note. α = .05

Table 15

Z-Test: Two Sample for Means, Semi-Looped Levels Compared with Non-Looped Levels

	MAP Level Semi-Looped	MAP Level non-looped
Mean	1.875	1.761904762
Known Variance	0.37	0.478
Observations	32	42
z	0.746646	
P(*Z*<=z) two-tail	0.455277	
z Critical two-tail	1.959964	

Note. α = .05

Hypothesis 1, Results for 2010 School Year. Student MAP scores for 2010 show negatively skewed distribution for looped and semi looped groups. The looped sample had a Pearson Index of -1.26 and the semi looped sample Pearson Index was -1.78. The non-looped student sample showed normal distribution with a Pearson Index of -.90. Outliers were acceptable because samples selection was random.

A Chi-Square Test for Independence showed no preference in instructional type and therefore, there was not enough evidence to accept the null hypothesis: there is no difference in average scale score and the expected scale score needed for successful performance on the MAP in mathematics for each of the three delivery methods of looped, semi-looped, and non-looped.

Table 16, 2010 Chi-Square Goodness of Fit, average Results Compared to Expected 2010 Results shows observed 2010 data adjacent to expected data in parenthesis.

Table 16

2010 Chi-Square Goodness of Fit, Average Results Compared to Expected 2010 Results

	Looped O (E)	Semi-Looped O (E)	Non-Looped O (E)	Total
2010 EOC Scale Scores	183.2 (180.71)	183.86 (180.71)	175.06 (180.71)	542.12

Note. α = .05, df = 3-1 = 2, O = observed average, E = expected average

The Chi-Square formula indicated a test value of 0.266 at the 95% confidence level. The test value of 0.266 is less than the critical value of 5.991 indicating that there is not enough evidence to show that instruction type (looped, semi-looped, or non-looped) is related to the average MAP score result.

Differences in the mean values of the 2010 data sets using ANOVA indicated an F value of 1.42 and a critical value of 3.06. The F value of 1.42 was less than the F critical value of 3.07 indicating non-rejection of the null hypothesis: there is no difference in average scale score for performance on the MAP in mathematics for each of the three delivery methods of looped, semi-looped, and non-looped. There is no difference among the means. The ANOVA also indicated a P-value of 0.25, which is greater than the alpha value of .05 indicating non-rejection of the null hypotheses when comparing averages among the sets of data for 2008.

Table 17

2010 ANOVA: Single Factor for MAP/EOC Scores

SUMMARY

Groups	Count	Sum	Average	Variance
2010 Looped Geo. EOC score	35	6412	183.2	818.458
2010 Semi - Looped Geo. EOC score	56	10296	183.857142	635.688
2010 Non-Looped Geo. EOC score	53	9278	175.056603	1144.32

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2456.463	2	1228.23133	1.41608	0.24609	3.06029177
Within Groups	122295.3	141	867.342463			
Total	124751.8	143				

Note. α = .05

The *z*-tests indicated no statistically significant difference in MAP/EOC scores among the three different groups at the 95% confidence interval. None of the *z*-test values fell beyond critical values. When comparing looping participants to semi-looped participants the *z*-value of -.0.11 was less than the critical value of 1.96. The *z*-tests for semi-looped compared to non-looped participants showed a *z*-test value of 1.53, which is less than the critical value of 1.96. Looped participants compared to non-looped participants also showed no significant difference with a *z*-value of 1.21 compared to the critical value of 1.96. See Tables 17, 18, and 19 below.

Table 18

2010 *Z*-Test: Two Sample for Means, Looped Scores Compared to Semi-Looped Scores

	Looped EOC Score	Semi-Looped EOC Score
Mean	183.2	183.8571
Known Variance	818.458	635.688
Observations	35	56
Z	-0.1115	
P(*Z*<=z) two-tail	0.911221	
z Critical two-tail	1.959964	

Note. α = .05

Table 19

2010 *Z*-Test: Two Sample for Means, Semi-Looped Scores Compared with Non-Looped Scores

	Semi-Looped EOC Score	Non-Looped EOC Score
Mean	183.8571429	175.0566
Known Variance	635.688	1144.324
Observations	56	53
Z	1.533311537	
P(*Z*<=z) two-tail	0.125199113	
z Critical two-tail	1.959963985	

Note. α = .05

Table 20

2010 *Z*-Test: Two Sample for Means, Looped Scores Compared with Non-Looped Scores

	Looped EOC Score	Non-Looped EOC Score
Mean	183.2	175.0566038
Known Variance	818.458	1144.324
Observations	35	53
Z	1.214276	
P(*Z*<=z) two-tail	0.224642	
z Critical two-tail	1.959964	

Note. α = .05

Missouri Assessment Plan/EOC scores determine a student's level of proficiency. The Missouri Department of Secondary and Elementary Education reports student standardized test score data in scale scores, as examined above, as well as levels. In

2010, a level one indicated a student's score was below basic; level two indicated basic, level three indicated proficiency; and level four indicated advanced. Furthermore, students could also score a zero on the EOC exam. The ANOVA test determined differences among average student level data. The F value of 8.77 was greater than the F critical value of 3.07 indicating rejection of the null hypothesis: there is no difference in average level when comparing student participants in looping, semi-looping, and non-looping, prompting the subsequent *z*-test for difference in means.

Table 21

2010 ANOVA: Single Factor for EOC Levels

SUMMARY

Groups	Count	Sum	Average	Variance
2010 Looped Geo. EOC level	33	60	1.818182	1.028409
2010 Semi-Looped Geo. EOC level	57	160	2.807018	0.97995
2010 Non-Looped Geo. EOC level	53	134	2.528302	1.484761

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	20.6705	2	10.33525	8.769633	0.000258	3.06076
Within Groups	164.9938	140	1.178527			
Total	185.6643	142				

Note. α = .05

The *z*-tests for difference in means indicated statistically significant differences in MAP/EOC levels among the three different groups at the 95% confidence interval. The null hypothesis for each comparison was: there is no difference in average level. When comparing looping participants to semi-looped participants the *z*-value of 4.50 was greater than the critical value of 1.96, which indicated rejection of the null hypothesis. Looped participants compared to non-looped participants also showed a significant difference with a *z*-value of 2.92 compared to the critical value of 1.96, indicating rejection of the null hypothesis. The *z*-tests for semi-looped compared to non-looped participants showed a *z*-test value of 1.31, which is less than the critical value of 1.96, indicating non-rejection of the null hypothesis for this set of comparisons. See Tables 22, 23, and 24.

Table 22

2010 *Z*-Test: Two Sample for Means, Comparing Looped to Semi-Looped EOC Levels

	Looped EOC Level	Semi-Looped EOC Level
Mean	1.818182	2.807018
Known Variance	1.028	0.979
Observations	33	57
Z	-4.4981	
P(*Z*<=z) two-tail	6.86E-06	
z Critical two-tail	1.959964	

Note. α = .05

Table 23

2010 *Z*-Test: Two Sample for Means, Comparing Looped to Non-Looped EOC Levels

	Looped EOC Level	Non-Looped EOC Level
Mean	1.818181818	2.528301887
Known Variance	1.028	1.485
Observations	33	53
Z	-2.919305839	
P(*Z*<=z) two-tail	0.003508119	
z Critical two-tail	1.959963985	

Note. α = .05

Table 24

2010 *Z*-Test: Two Sample for Means, Comparing Semi-Looped to Non-Looped EOC Levels

	2010 Semi-Looped Geo. EOC level	2010 Non-Looped Geo. EOC level
Mean	2.807018	2.528302
Known Variance	0.98	1.485
Observations	57	53
Z	1.310796	
P(*Z*<=z) two-tail	0.189927	
z Critical two-tail	1.959964	

Note. $\alpha = .05$

Summary of Null Hypothesis 1 Results

MAP tests results of 2008 showed no differences in levels or scores using, Chi-square goodness of fit, ANOVA and *z*-tests. Tests of 2010 MAP/EOC data showed differences in EOC levels when comparing mean levels using *z*-tests. Although, not expected by the researcher, the looped mean for EOC level was significantly lower than both the semi-looped mean level and the non-looped mean level. There were no differences when comparing mean scores of looped, semi-looped and non-looped student groups using Chi-Square Test for Independence, ANOVA, and *z*-tests.

Null Hypothesis 2 Results

Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change year-to-year in scores, as measured by Missouri Assessment Plan in Mathematics, when compared to non-participants and semi-participants.

The following tests examined comparisons in year-to-year scores among sample date sets: Pearson Index for Skewness, Chi-Square Test for Independence, ANOVA, *z*-

tests for difference in mean, F-test, and Pearson Product Moment Correlation. The Chi-Square Test for Independence test indicates relationships between two variables and intended to show a better fit between looped instruction and successful EOC score results among the cohort groups. ANOVA tests for differences in mean values of the three cohort data sets by examining variance values of the cohorts. *Z*-tests provided one to one comparisons of mean values between each of the three cohort data sets. First, *z*-tests were calculated comparing 2009 groups to determine differences in year one base line score data. Next, *z*-tests were calculated comparing EOC score outcomes for 2010 instructional groups to determine differences in average outcomes after year two. Finally, z-tests compared the 2009 average score to the 2010 average score to determine changes in EOC scores based on identified differences. "Correlation is a statistical method used to determine whether a relation between variables exists" (Bluman, 2008, p. 552). In this case, the intent was to determine what type of relationship existed, if any, between year-one scores and year-two scores of the cohorts for each group, looped, semi-looped, and non-looped.

The essential difference among data sets for this hypothesis and hypothesis 1 was the inclusion of year one, Algebra I EOC, assessment scores rather than just looking at year two EOC outcomes. Eliminating sample students who did not have a score for both the algebra and geometry EOC exams established cohort data. This permitted an accurate measure of year-to-year changes in sample group data without the influences of scores that may adversely affect the variance or averages.

Looped data indicated negative skewness with a Pearson's Index (PI) of Skewness of -1.72 in 2009 and -1.26 in 2010 due to an outlier score of 100 for both years.

The scores of 100, an extremely low score, remained part of the data set because of random selection. Semi-looped cohort data indicated normal distribution with no outliers. Non-looped scores showed skewed distribution for 2009 with a PI of -2.31, but not significantly skewed in 2010 with a PI of -0.87. Each of these sets of data also had outlier scores of 100 that remained due to random selection of the sample group.

Table 25

Pearson's Index for Skewness, Cohort MAP/EOC Score Data

	Looped	Semi-Looped	Non-Looped
2009 EOC Score	-1.72	0.14	-2.31
2010 EOC Score	-1.26	0.20	-0.87

Differences in averages among the sample cohort groups year-to-year proved to have no preference to instructional type as indicated by Chi-Square Test for Independence results. The chart below shows sample group average scores adjacent to expected average scores in parentheses. The Null hypothesis was: student performance outcome is independent of type of instructional setting. At the 95% confidence level, the chi-square value of 0.211 was less than the critical value of 5.991, indicating non-rejection of the null hypothesis. See Table 26 below.

Table 26

Chi-Square Test for Independence of Cohort Data

Year of EOC Score	Looped Average	Semi-Looped Average	Non-Looped Average	Totals
2009	183.2 (184.86)	190.08 (192.01)	186.89 (183.30)	560.17
2010	183.2 (181.54)	190.49 (188.56)	176.41 (180.00)	550.10
Totals	366.40	380.57	363.30	1,110.27

Note. $\alpha = 0.05$

ANOVA results indicate no significant difference in averages. The null hypothesis was: there will be no difference in average scale scores. F-values were less than the critical values for both 2009, and 2010 data sets. Although all F-values were less than the critical values, subsequent *z*-tests conducted also indicated no differences in mean values for the cohort data sets.

Table 27

2009 ANOVA: Single Factor for Cohort EOC Scores

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Alg. 1 EOC Score	37	6821	184.3514	703.5676
Semi-Looped Alg. 1 EOC Score	38	7217	189.9211	247.2098
Non-Looped Alg. 1 EOC Score	47	8790	187.0213	515.3256

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	582.2191	2	291.1096	0.595427	0.552961	3.072429
Within Groups	58180.17	119	488.909			
Total	58762.39	121				

Note. $\alpha = 0.05$

Table 28

2010 ANOVA: Single Factor for Cohort EOC Scores

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Geo. EOC Score	35	6412	183.2	818.4588
Semi-Looped Geo. EOC Score	56	10296	183.8571	635.6883
Non-Looped Geo. EOC score	53	9278	175.0566	1144.324

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2456.463	2	1228.231	1.416086	0.246092	3.060292
Within Groups	122295.3	141	867.3425			
Total	124751.8	143				

Note. α = 0.05

In 2009, *z*-tests indicated a difference among EOC score averages when comparing looped, semi-looped, and non-looped groups. It is important to consider that these scores represent year one for each group, before any looping could occur. When comparing 2009 looped mean to the 2009 semi-looped mean the *z*-test value of 1.32 was not greater than the critical value of 1.96. The 2009, looped mean compared to the non-looped mean yielded a *z*-test value of 0.65, which is not larger than the critical value of 1.96, also showing no difference in means. Finally, when comparing 2009 semi-looped to non-looped the *z*-test value of 44.58 was larger than the critical value of 1.96 indicating a difference mean values between the two groups. This test result suggests that in year one the semi-looping group scored significantly higher on average than the non-looping group. The mean score for the semi-looping group in 2009 was 190.08

compared to a mean value for the non-looping group of 186.89. See Tables 29, 30, and 31 below.

Table 29

2009 *Z*-Test: Two Sample for Means, Looping Compared to Semi-Looping EOC Scores

	Looped Alg. 1 EOC	Semi-Looped Alg. 1 EOC
Mean	183.2	190.0811
Known Variance	707.34	253.08
Observations	35	37
z	-1.32305	
P(*Z*<=z) two-tail	0.18582	
z Critical two-tail	1.959964	

Note. α = 0.05

Table 30

2009 *Z*-Test: Two Sample for Means, Looping Compared to Non-Looping EOC Scores

	Looped Alg. 1 EOC	Non-Looped Alg. 1 EOC
Mean	183.2	186.8864
Known Variance	707.34	541.17
Observations	35	44
z	-0.64654	
P(*Z*<=z) two-tail	0.517929	
z Critical two-tail	1.959964	

Note. α = 0.05

Table 31

2009 *Z*-Test: Two Sample for Means, Semi-Looping Compared to Non-Looping EOC Scores

	Semi-Looped Alg. 1 EOC	Non-Looped Alg. 1 EOC
Mean	190.0811	186.8864
Known Variance	707.34	541.17
Observations	37	44
z	-44.5821	
P(*Z*<=z) two-tail	0	
z Critical two-tail	1.959964	

Note. α = 0.05

In 2010, *z*-tests also indicated a difference among EOC score averages when comparing looped, semi-looped, and non-looped groups. The 2010 EOC scores were after the completion of year two of looping, semi-looping, or non-looping for each group. When comparing 2010 looped mean to the 2010 semi-looped mean the *z*-test value of 1.34 was not greater than the critical value of 1.96. The 2010, looped mean compared to the non-looped mean yielded a *z*-test value of 0.95, which is less than the critical value of 1.96, also showing no difference in means. Finally, when comparing 2010 semi-looped to non-looped the *z*-test value of 2.69 was larger than the critical value of 1.96 indicating a difference mean values between the two groups. This test result suggests that in year two the semi-looping group scored significantly higher on average than the non-looping group. Although the mean scores are different for the groups, this finding is less significant when considering the scores were also different for year one. The mean score for the semi-looping group in 2010 was 190.49 compared to a mean value for the non-looping group of 176.41. See tables 31, 32 and 33 below.

Table 32

2010 *Z*-Test: Two Sample for Means, Looping Compared to Semi-Looping EOC Scores

	Looped Geo. EOC	Semi-Looped Geo. EOC
Mean	183.2	190.4865
Known Variance	818.46	236.09
Observations	35	37
z	-1.33556	
P(*Z*<=z) two-tail	0.181694	
z Critical two-tail	1.959964	

Note. α = 0.05

Table 33

2010 *Z*-Test: Two Sample for Means, Looping Compared to Non-Looping EOC Scores

	2010 Looped Geo. EOC	2010 Non-Looped Geo. EOC
Mean	183.2	176.4091
Known Variance	818.46	1233.6
Observations	35	44
z	0.947017	
P(*Z*<=z) two-tail	0.34363	
z Critical two-tail	1.959964	

Note. α = 0.05

Table 34

2010 *Z*-Test: Two Sample for Means, Semi-Looping Compared to Non-Looping EOC Scores

	Semi-Looped Geo. EOC	Non-Looped Geo. EOC
Mean	190.4865	176.4091
Known Variance	818.46	236.09
Observations	37	44
z	2.685127	
P(*Z*<=z) two-tail	0.00725	
z Critical two-tail	1.959964	

Note. α = 0.05

Z-tests of the cohort EOC score data showed no difference among averages for any of the instructional types, looping, semi-looping, or non-looping when comparing 2009 scores to 2010 scores within the same cohort. The null hypothesis was: there will be no difference in mean scale scores. *Z*-tests were calculated for each instructional type cohort, 2009 to 2010 looped cohort, 2009 to 2010 semi-looped cohort, and 2009 to 2010 non-looped cohort. A gain in EOC scores, due to instructional group type, did not occur. For the looped cohort, the *z* value of 0 was less than the critical value of 1.96. The semi-looped cohort *z*-test indicated a *z*-test value of 0.11, which is smaller than the critical value of 1.96. Likewise, the non-looping cohort test showed a *z*-test value of 1.65, which is lower than the critical value of 1.96. The null hypothesis was not rejected in each case. See Tables 35, 36, and 37 below.

Table 35

Z-Test: Two Sample for Means, Comparing 2009 to 2010 Looped Cohort EOC Scores

	2009 Looped Alg. 1 EOC	2010 Looped Geo. EOC
Mean	183.2	183.2
Known Variance	707.34	818.46
Observations	35	35
z	0	
P(*Z*<=z) two-tail	1	
z Critical two-tail	1.95996	

Note. α = 0.05

Table 36

Z-Test: Two Sample for Means, Comparing 2009 to 2010 Semi-Looped Cohort EOC Scores

	2009 Semi-Looped Alg. 1 EOC	2010 Semi-Looped Geo. EOC
Mean	190.0811	190.4865
Known Variance	253.08	236.09
Observations	37	37
z	-0.1115	
P(*Z*<=z) two-tail	0.911223	
z Critical two-tail	1.959964	

Note. α = 0.05

Table 37

Z-Test: Two Sample for Means, Comparing 2009 to 2010 Non-Looped Cohort EOC Scores

	2009 Non-Looped Alg. 1 EOC	2010 Non-Looped Geo. EOC
Mean	186.8863636	176.4090909
Known Variance	541.17	1233.6
Observations	44	44
z	1.64969458	
P(*Z*<=z) two-tail	0.099005419	
z Critical two-tail	1.959963985	

Note. α = 0.05

There was no change in mean from year one to year two of the three cohorts, looped, either semi-looped, or non-looped. Considering all of the comparisons of mean values through *z*-tests, for the cohort data the evidence strongly indicates that looped instruction did not affect average EOC scores.

Pearson Product Moment Correlation, as an indicator of hypothesis 2, a correlation coefficient determined results of the null hypothesis: there is no relationship between Algebra EOC scores and Geometry EOC scores when comparing student-to-student in each of the classroom delivery modes of looped, semi-looped, and non-looped. Results indicated that how well a student scores in year one has a strong relationship with their score in year two regardless of the instructional type. A student's Geometry EOC score is likely to be similar to the student's Algebra EOC Score. Correlation tests showed the strongest relationship for EOC scores in the looped cohort group. The looped cohort group had the strongest relationship between Algebra EOC and Geometry EOC with a .77 multiple R-value compared to .60 multiple R-value for semi-looped and .68 multiple R-value for non-looped. See Tables 38, 39 and 40 below.

Table 38

Looped Cohort Correlation Statistics

Multiple R	0.77046
R Square	0.593609
Observations	35

Note. $\alpha = 0.05$

Table 39

Semi-Looped Cohort Correlation Statistics

Multiple R	0.599628
R Square	0.359554
Observations	37

Note. $\alpha = 0.05$

Table 40

Non-Looped Cohort Correlation Statistics

Multiple R	0.680005
R Square	0.462407
Observations	44

Note. α = 0.05

Table 40 indicates correlation statistics results for each sample cohort group's year-to-year data with critical values compared to Multiple R values. Each relationship is statistically significant. Each of the cohort groups' year-one EOC results was determined related to year-two EOC results.

The EOC score itself was determined to be correlated to the next year's EOC score rather than the instructional type as hypothesized.

Table 41

Correlation of 2009 to 2010 EOC Scores

Looped Correlation Statistics	Semi-Looped Correlation Statistics	Non-Looped Correlation Statistics
mRv 0.770 > c.v. 0.325	mRv 0.600 > c.v. 0.325	mRv 0.680 > c.v. 0.304

Note. α = 0.05, mRv = Multiple R Value, critical values obtained from Bluman, 2008, Table I, p. 642.

The R square value results of correlation tests indicate the percent of the variance in algebra scores related to the variance in the geometry scores. Fifty-nine percent of the variance in algebra looped scores related to the variance in looped geometry scores compared to just 35% of semi-looped scores and 46% of non-looped scores.

Table 42

Year-to Year R Square Values for 2009 to 2010 Cohort EOC Scores

Looped R Square Value	Semi-Looped R Square Value	Non-Looped R Square Value
0.59	0.35	0.46

Note. α = 0.05

Considering the relationship between Algebra EOC and Geometry EOC is significant with a .77 multiple R value and 59% of the variance in algebra scores is related to the geometry scores, correlation could be used as a mild predictor of student results.

Although correlation models indicate that looped instruction is possibly a stronger prediction of results in the second year of instruction, a change in EOC scores did not occur when comparing looped instruction to semi-looped and non-looped instruction.

While mean values of cohort groups indicated no difference, it was necessary to test the difference in variances among the groups, looped, semi-looped, and non-looped. The null hypothesis was; there is no difference in variance. F-tests indicated a rejection of the null hypothesis and a difference in variance when comparing year one to year two for the looped instruction cohort group. The F-test value (0.86) was larger than the critical value (0.56). For the semi-looped cohort, the F-test value (1.07) was smaller than the critical value (1.74) indicating no difference in variance. The looped cohort F-test results also indicated no difference in variance with the F-test (0.44) smaller than the critical value (0.60).

Table 43

F-Test Two-Sample for Variances, 2009 to 2010 Looping Cohort EOC Scores

	2009 Looped Alg. 1 EOC	2010 Looped Geo. EOC
Mean	183.2	183.2
Variance	707.3411765	818.4588235
Observations	35	35
F	0.864235507	
F Critical one-tail	0.564312915	

Note. α = .05

Table 44

F-Test Two-Sample for Variances, 2009 to 2010 Semi-Looping EOC Scores

	2009 Semi-Looped Alg. 1 EOC	2010 Semi-Looped Geo. EOC
Mean	190.0810811	190.4864865
Variance	253.0765766	236.0900901
Observations	37	37
F	1.071949172	
F Critical one-tail	1.742973165	

Note. α = .05

Table 45

F-Test Two-Sample for Variances, 2009 to 2010 Non-Looping EOC Scores

	2009 Non-Looped Alg. 1 EOC	2010 Non-Looped Geo. EOC
Mean	186.8863636	176.4090909
Variance	541.172833	1233.596195
Observations	44	44
F	0.438695284	
F Critical one-tail	0.602139857	

Note. α = .05

Summary of Null Hypothesis 2 Results. Although F-tests indicated the EOC score variance increased significantly in the looping cohort from year one to year two, 707.34 compared to 818.46, the average score from year to year did not statistically increase. Statistical analysis determined there was no change in year-to-year EOC scores averages as indicated by chi-square, ANOVA, *z*-tests, and correlation due to instructional type – looping, semi-looping, non-looping. However, correlation tests showed that Algebra I EOC scores were possibly the strongest predictor of Geometry EOC scores. Overall, test results showed that looping had no effect on state standardized test scores when compared to semi-looped and non-looped scores.

Null Hypothesis 3 Results

Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by course grades in Mathematics, when compared to non-participants and semi-participants.

Statistical tests examined student grade results for each instructional type, looped, semi-looped, and non-looped. Statistical analysis included Pearson Index for Skewness to determine normality of the data sets, Chi-Square for Independence to determine a preference between grade average results and instructional type, as well as ANOVA and *z*-tests to determine differences in average grades. Tests included data sets for the 2008, 2009, and 2010 school years.

Student grades represent semester two, final grades in geometry. Student course grades converted from letter grades (A, B, C, D, and F) to grade points using the 4.0 grade point system. A = 4; B = 3; C = 2; D = 1; and F = 0, when converting letter grades to points. All data from student sample groups, looped, semi-looped, and non-looped, for years 2008, 2009, and 2010 showed normal distribution. None of the data sets, looping, semi-looping, or non-looping grades, was significantly skewed. Table 46 below shows the Pearson's index for skewness value for the sample groups examined in this study. Values greater than or equal to +1 or less than or equal to -1 conclude that the data is significantly skewed (Bluman, 2008).

Table 46

Pearson's Index of Skewness 2008 – 2010 Student Grades

School Year	Looped Instruction	Semi-Looped Instruction	Non-Looped Instruction
2008	-0.46	0.04	0.84
2009	0.25	0.13	0.77
2010	0.17	0.31	0.71

The Chi-Square Test for Independence compared the averages of the three sample groups to determine a preference or dependency of grades to instructional type (Bluman, 2008). A Chi-Square Test for Independence showed there was not enough evidence to support the null hypothesis that a change in student success as measured by course grades was independent of instructional type. The chi-square formula indicated a chi-square test value of 0.190 at the 95% confidence level. The chi-square test value of 0.190 is less than the critical value of 9.488 indicating that the null hypothesis was not rejected and there is not enough evidence to support that there is a preference in instruction type (looped, semi-looped, or non-looped) to student grade result. Table 47 below shows observed 2008, 2009, and 2010 data adjacent to expected data in parenthesis.

Table 47

Chi-Square Test for Independence of Student Grades

	Looped Average	Semi-Looped Average	Non-Looped Average	Totals
2008	2.53 (2.18)	1.91 (1.99)	1 (1.27)	5.44
2009	1.76 (1.96)	1.88 (1.79)	1.26 (1.15)	4.9
2010	1.63 (1.78)	1.62 (1.63)	1.20 (1.04)	4.45
Totals	5.92	5.41	3.46	14.79

Note. $\alpha = 0.05$ df = (3-1)(3-1) = 4 cv = 9.488 (Bluman, 2008, Table G pg. 636)

An ANOVA test of the 2008 grade data indicated a difference in means among the three sample groups. The F-value of 19.14 was greater than the critical value of 3.05, which indicated rejection of the null hypothesis: there is no difference in mean grades among the three samples. The P-value of 3.75 is greater than the alpha value of .05. The data supported a difference in means.

Table 48

2008 ANOVA: Single Factor for Grade Averages

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Grades	49	124	2.530612	1.420918
Semi-Looped Grades	58	111	1.913793	1.974894
Non-Looped Grades	50	50	1	1.142857

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	58.87026	2	29.43513	19.14496	3.75	3.054771
Within Groups	236.773	154	1.537487			
Total	295.6433	156				

Note. $\alpha = .05$

Significant difference identified by the ANOVA test prompted *z*-tests to compare the means of each data set. A *z*-test determined significant differences in average grades when comparing looped to semi-looped grade averages, as well as looped to non-looped grade averages for the 2008 data. The *z*-test value of 2.46 is greater than the critical value of 1.96 indicating rejection of the null hypothesis and a significant difference between looped and semi-looped grades. The looped average was 2.53 compared to a 1.91 average grade for semi-looped participants. The *z*-test value of 6.72 is greater than the critical value of 1.96 indicating rejection of the null hypothesis and a significant difference between looped and non-looped grades. The looped average was 2.53 compared to a 1.00 average grade for non-looped participants. Therefore, the null hypothesis was rejected and a significant difference existed between semi-looped participants and non-looped participants. The *z*-test value of 3.83 is greater than the critical value of 1.96. The null hypothesis was rejected and semi-looped participants had an average grade point of 1.91 compared to 1.00 for non-looped participants, which was a significant difference.

Table 49

2008 *Z*-Test: Two Sample for Means, Looped Compared to Semi-Looped Grades

	Looped Grades	Semi-Looped Grades
Mean	2.530612	1.913793
Known Variance	1.421	1.975
Observations	49	58
z	2.456458	
P(*Z*<=z) two-tail	0.014031	
z Critical two-tail	1.959964	

Note. α = .05

Table 50

2008 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Grades

	Looped Grades	Non-Looped Grades
Mean	2.530612	1
Known Variance	1.421	1.143
Observations	49	50
z	6.721233	
P(*Z*<=z) two-tail	1.8E-11	
z Critical two-tail	1.959964	

Note. α = .05

Table 51

2008 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Grades

	Semi-Looped Grades	Non-Looped Grades
Mean	1.913793	1
Known Variance	1.975	1.143
Observations	58	50
z	3.830425	
P(*Z*<=z) two-tail	0.000128	
z Critical two-tail	1.959964	

Note. α = .05

Considering the results of the *z*-tests of sample means, participants in looped instruction, delivered at the high school level in the area of mathematics, show a change in student success as measured by course grades in mathematics, when compared to non-looped and semi-looped for the 2008 school year. Participants in looped instruction had higher average grades compared to semi-looped and non-looped participants. Furthermore, semi-looped participants had higher average grades than non-looped participants did.

An ANOVA test of the 2009 grade date indicated a difference in means among the three sample groups. The F-value of 2.82 was less than the critical value of 3.06, which indicated rejection of the null hypothesis; there is no difference in mean grades among the three samples. The P-value of 0.06 was greater than the alpha value of .05. The data supported a difference in means.

Table 52

2009 ANOVA: Single Factor for Grade Averages

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Grades	50	88	1.76	1.859592
Semi-Looped Grades	50	94	1.88	2.026122
Non-Looped Grades	47	59	1.25531	1.716004

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	10.55499	2	5.27749	2.8216	0.06280	3.0589
Within Groups	269.3362	144	1.87039			
Total	279.8912	146				

Note. α = .05

The larger P-value (.06) than alpha value (.05) prompted *z*-tests comparing the means of each data set. The null hypothesis was: there is no difference in mean grade average. *Z*-tests determined no difference between looped and semi- looped grade averages, nor between looped and non-looped grade averages. The *z*-test value of -0.43

was less than the critical value of 1.96 indicating non-rejection of the null hypothesis and no difference in means for looped participants and semi-looped participants. The *z*-test value of 1.86 was less than the critical value of 1.96 indicating non-rejection of the null hypothesis and no difference in means for looped participants and non-looped participants. The *z*-test indicated a difference in grade averages when comparing semi-looped to non-looped data sets. The *z*-value of 2.25 was greater than the critical value of 1.96 indicating rejection of the null hypothesis and a statistically significant difference in means for semi-looped participants compared to non-looped participants. Semi-looped participant's sample grade average was 1.88, compared to than the non-looped participant sample average of 1.26. Semi looped grade averages were larger than non-looped grade averages in 2009.

Table 53

2009 *Z*-Test: Two Sample Means, Looped Compared to Semi-Looped Grades

	Looped Grades	Semi-Looped Grades
Mean	1.76	1.88
Known Variance	1.86	2.026
Observations	50	50
z	-0.43044	
P(*Z*<=z) two-tail	0.666874	
z Critical two-tail	1.959964	

Note. α = .05

Table 54

2009 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Grades

	Looped Grades	Non-Looped Grades
Mean	1.76	1.255319
Known Variance	1.86	1.716
Observations	50	47
z	1.858882	
P(*Z*<=z) two-tail	0.063044	
z Critical two-tail	1.959964	

Note. α = .05

Table 55

2009 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Grades

	Semi-Looped Grades	2009 Non-Looped Grades
Mean	1.88	1.255319
Known Variance	2.026	1.716
Observations	50	47
z	2.250746	
P(*Z*<=z) one-tail	0.012201	
z Critical two-tail	1.959964	

Note. α = .05

An ANOVA test of the 2010 grade date indicated a difference in means among the three sample groups. The F-value of 1.99 is less than the critical value of 3.05, which indicated non-rejection of the null hypothesis: there is no difference in mean grades among the three samples. The P-value of 0.14 was greater than the alpha value of .05.

Table 56

2010 ANOVA: Single Factor for Grade Averages

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Grades	48	78	1.625	1.303191
Semi-Looped Grades	58	94	1.62069	1.713249
Non-Looped Grades	51	61	1.196078	1.680784

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	6.265803	2	3.132901	1.985915	0.140755	3.054771
Within Groups	242.9444	154	1.577561			
Total	249.2102	156				

Note. α = .05

Subsequent *z*-tests of the 2010 grade data revealed no difference in grade averages among looped, semi-looped, and non-looped groups. The null hypothesis was: there is no difference in mean grades. When comparing looped grade averages to semi-looped grade averages, there was no difference indicated. The *z*-value of 0.018 is less than the critical value of 1.96 indicating non-rejection of the hypothesis and no difference among means for looped and semi-looped participants for the 2010 school year. *Z*-tests also indicated no difference in grade averages when comparing looped to non-looped. The *z*-value of 1.75 is less than the critical value of 1.96 indicating non-rejections of the hypothesis and no difference among means for looped and non-looped participants for the 2010 school year. Semi-looped compared to non-looped grade averages also indicated no difference. The *z*-value of 1.70 is less than the critical value of 1.96 indicating non-rejection of the hypothesis and no difference among means for semi-looped and non-looped participants for the 2010 school year.

Table 57

2010 *Z*-Test: Two Sample for Means, Looped Compared to Semi-Looped Grades

	Looped Grades	Semi-Looped Grades
Mean	1.625	1.62069
Known Variance	1.3	1.71
Observations	48	58
z	0.018123	
P(*Z*<=z) two-tail	0.985541	
z Critical two-tail	1.959964	

Note. α = .05

Table 58

2010 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Grades

	2010 Looped Grades	2010 Non-Looped Grades
Mean	1.625	1.196078
Known Variance	1.3	1.68
Observations	48	51
z	1.750707	
P(*Z*<=z) two-tail	0.079996	
z Critical two-tail	1.959964	

Note. α = .05

Table 59

2010 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Grades

	Looped Grades	Non-Looped Grades
Mean	1.62069	1.196078
Known Variance	1.71	1.68
Observations	58	51
z	1.699479	
P(*Z*<=z) two-tail	0.089229	
z Critical two-tail	1.959964	

Note. α = .05

Considering the results of the ANOVA and *z*-Tests for the 2010 grade data, participants in looped instruction, delivered at the high school level in the area of mathematics, do not show a change in student success as measured by course grades in mathematics, when compared to non-participants and semi-participants for the 2010 school year. Looped instruction had no effect on student grades for the 2010 school year.

Summary of Hypothesis 3 Results. The Chi-Square Test of Independence analysis of all the data sets for school years 2008, 2009, and 2010 showed no change in student grades when comparing looped student grades to semi-looped and non-looped student grades. When considering changes in student grades for each of the three school years separately, differences do exist for the 2008 and 2009 school years, but not for the 2010 school year. The ANOVA tests of means showed differences for both the 2008 data and the 2009 data, but no difference in means for the 2010 school year. *Z*-tests yielded differences in mean grades in 2008, showing looped participants with a higher grade average in geometry than semi-looped and non-looped participants. Also in 2008, semi-looped participants showed a higher-grade average than non-looped participants as indicated by the *z*-test of two sample means. In 2009, *z*-tests indicated a difference in sample means for semi-looped participants and non-looped participants, with semi-looped participants having a higher-grade average. *Z*-tests indicated no other differences in grades when comparing looped participant grades to semi-looped and non-looped participants. In 2010, *z*-tests indicated no difference in grades when comparing looped, semi-looped and non-looped averages.

Null Hypothesis 4 Results

Participants in looped instruction, delivered at the high school level in the area of mathematics, will show a change in student success as measured by common assessment scores in mathematics, when compared to non-participants and semi-participants.

All students in geometry at the high school of this study take a common exam at the conclusion of the first semester. Examining the results of those common exams provides an indicator of the impact of looped instruction on student local, school-wide assessment results. Numeric scores for historical data is not available, although exam grades are reported on student report cards in the form of a letter grade. These letter grades were converted to grade points, A = 4; B = 3; C = 2; D = 1; and F = 0, to calculate descriptive statistics.

Statistical analysis of common exam grades consisted of Pearson Index for Skewness to determine normality of the data sets, Chi-Square Test for Independence to determine a preference between common exam grade averages and instructional type, as well as ANOVA and *z*-tests to determine differences in average common exam grades. Tests included data sets for the 2008, 2009, and 2010 school years.

Each of the student sample groups, looped, semi-looped, and non-looped, for years 2008, 2009, and 2010 showed normal distribution of common assessment grades. The chart below shows the Pearson's index for skewness value for the sample groups examined in this study. Values greater than or equal to +1 or less than or equal to -1 conclude that the data is significantly skewed (Bluman, 2008).

Table 60

Pearson's Index of Skewness 2008 – 2010, Student Common Exam Grades

	Looped	Semi-Looped	Non-Looped
2008	-0.04	0.21	0.50
2009	-0.27	0.04	0.22
2010	0.35	0.38	0.56

The Chi-Square Test for Independence compared the averages of the three sample groups to determine a preference exam grades to instructional type (Bluman, 2008).

A Chi-Square Test for Independence showed there was enough evidence to support the null hypothesis that student success as measured by common exam grades, is independent of instructional type when comparing looping participants to non-participants and semi-participants. The chi-square value of 0.036 was less than the critical value of 9.488 indicating non-rejection of the null hypothesis. Table 61 below shows observed 2008, 2009, and 2010 data adjacent to expected data in parenthesis.

Table 61

Chi-Square Test for Independence of Student Common Exam Grades

	Looped Average	Semi-Looped Average	Non-Looped Average	Totals
2008	2.02 (2.02)	1.63 (1.73)	1.63 (1.53)	5.28
2009	2.25 (2.15)	1.83 (1.84)	1.54 (1.63)	5.62
2010	1.61 (1.71)	1.57 (1.47)	1.30 (1.30)	4.48
Totals	5.88	5.03	4.47	15.38

Note. $\alpha = .05$, df = (3-1) (3-1) = 4, cv = 9.488 (Bluman, 2008, Table G pg. 636)

An ANOVA test of the 2008 common exam grades determined no significant difference in means when considering the F-value of 0.89 was less than the F critical value of 3.07. The null hypothesis, there is no difference in mean exam grades, was not rejected. The P-value of 0.41, was greater than the alpha level of .05

Table 62

2008 ANOVA: Single Factor, Common Exam Grades

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Exam Grades	45	91	2.02222	2.65858
Semi-Looped Exam Grades	38	62	1.63157	1.96870
Non-Looped Exam Grades	40	65	1.625	2.75320

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4.43113	2	2.21556	0.89459	0.41148	3.07177
Within Groups	297.194	120	2.47662			
Total	301.626	122				

Note. α = .05

The *z*-test of 2008 data yielded no changes in common exam grade averages for looped participants compared with semi-looped and non-looped participants. In each comparison, the *z*-test value was less than the critical value. The null hypothesis was: there is no difference in mean exam grades. The *z*-test of means for looped student exam grades compared to semi-looped student exam grades yielded a *z*-test value of 1.17, which was less than the critical value of 1.96, indicating non-rejection of the null hypothesis and no difference in means. The *z*-test of means for looped student exam grades compared with non-looped student exam grades yielded a *z*-test value of 1.11, which is less than the critical value of 1.96, indicating non-rejection of the null hypothesis and no difference in means. The *z*-test of means for semi-looped student exam grades compared with non-looped student exam grades also yielded a *z*-test value that was less than the critical value, 0.02 < 1.96, indicating non-rejection of the null hypothesis and no difference in means.

Table 63

2008 *Z*-Test: Two Sample for Means, Looped Compared to Semi-Loped Exam Grades

	Looped Exam Grades	Semi-Looped Exam Grades
Mean	2.022222	1.631579
Known Variance	2.659	1.969
Observations	45	38
z	1.17302	
P(*Z*<=z) two-tail	0.240788	
z Critical two-tail	1.959964	

Note. α = .05

Table 64

2008 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Exam Grades

	Looped Exam Grades	Non-Looped Exam Grades
Mean	2.022222	1.625
Known Variance	2.659	2.753
Observations	45	40
z	1.110644	
P(*Z*<=z) two-tail	0.266722	
z Critical two-tail	1.959964	

Note. α = .05

Table 65

2008 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Exam Grades

	Semi-Looped Exam Grades	Non-Looped Exam Grades
Mean	1.631579	1.625
Known Variance	1.969	2.753
Observations	38	40
z	0.018941	
P(*Z*<=z) two-tail	0.984888	
z Critical two-tail	1.959964	

Note. α = .05

An ANOVA test for difference in means of the 2009 common exam grades determined no significant difference when considering the F-value of 2.44 is less than the

F critical value of 3.07, which indicated non-rejection of the null hypothesis: there is no difference in mean exam scores. The P-value of 0.09 is greater than the alpha level of .05.

Table 66

2009 ANOVA: Single Factor, Common Exam Grades

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Exam Grades	44	99	2.25	2.09883
Semi-Looped Exam Grade	41	75	1.82926	2.39512
Non-Looped Exam Grade	37	57	1.54054	1.86636

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	10.3706	2	5.18534	2.43660	0.0918	3.07242
Within Groups	253.244	119	2.12810			
Total	263.614	121				

Note. α = .05

Z-tests of the 2009 data yielded differences in the means between looped and non-looped common assessment grades. The null hypothesis was: there is no difference in means. The *z*-value of 2.26 was greater than the critical value of 1.96, indicating rejection of the null hypothesis and the existence of a significant difference.   The average of the looped data set for common exam grades was 2.25 compared to the average of the non-looped data set for common assessment grades of 1.53, indicating rejection of the null hypothesis and the existence of a significant difference. In 2009, students receiving looped instruction had higher average common assessment grades, first semester exam grades, than did the non-looped student group. There were no differences in common exam scores between the looped group and semi-looped group in 2009.   The *z*-test value of 1.29 was less than the critical value of 1.96 when comparing means of these two data sets, indicating non-rejection of the null hypothesis and no difference in means.

Likewise, there was no difference in average common exam grades when comparing semi-looped to non-looped data sets. The *z*-test value of 0.88 was less than the critical value of 1.96 when comparing these two sets of exam grade data, indicating non-rejection of the null hypothesis and no difference in means.

Table 67

2009 *Z*-Test: Two Sample for Means, Looped Compared to Semi-Looped Exam Grades

	Looped Exam Grades	Semi-Looped Exam Grades
Mean	2.25	1.829268
Known Variance	2.098	2.395
Observations	44	41
z	1.29168	
P(*Z*<=z) two-tail	0.196468	
z Critical two-tail	1.959964	

Note. α = .05

Table 68

2009 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Exam Grades

	Looped Exam Grades	Non-Looped Exam Grades
Mean	2.25	1.540541
Known Variance	2.098	1.866
Observations	44	37
z	2.264965	
P(*Z*<=z) two-tail	0.023515	
z Critical two-tail	1.959964	

Note. α = .05

Table 69

2009 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Exam Grades

	Semi-Looped Exam Grades	Non-Looped Exam Grades
Mean	1.829268	1.540541
Known Variance	2.395	1.866
Observations	41	37
z	0.875145	
P(*Z*<=z) two-tail	0.381495	
z Critical two-tail	1.959964	

Note. α = .05

An ANOVA test of variance of the 2010 common exam grades indicates a difference of means. The null hypothesis was: there is no difference in mean scores. The ANOVA yielded an F-value of 0.61, which is less than the critical value of 3.06, and also yielded a P-value of 0.54 that is greater than the alpha level of 0.05, indicating non-rejection of the null hypothesis.

Table 70

2010 ANOVA: Single Factor, Common Exam Grades

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Exam Grades	46	74	1.60869	2.02125
Semi-Looped Exam Grades	53	83	1.56603	2.32728
Non-Looped Exam Grades	44	57	1.29545	2.02695

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2.61377	2	1.30688	0.61164	0.54390	3.0607
Within Groups	299.134	140	2.13667			
Total	301.748	142				

Note. α = .05

The *z*-tests comparing the means of the data sets yielded no significant differences for the 2010 common assessment grades. The null hypothesis was: there is no difference in mean scores. The *z*-test comparing means of looped student exam grades to semi-looped student exam grades showed no difference with a *z*-test value of 0.14, which is less than the critical value of 1.96, indicating non-rejection of the null hypothesis. The same was true of *z*-test results for comparisons of looped student exam grades to non-looped student exam grades. This *z*-test indicated a *z*-value of 1.04, which was less than the critical value of 1.96. Comparison of the semi-looped student exam grades to the non-looped student exam grades also showed no difference in mean with a *z*-value of

0.90, which was less than the critical value of 1.96, indicating non-rejection of the null hypothesis and no significant difference in means.

Table 71

2010 *Z*-Test: Two Sample for Means, Looped Compared to Semi-Looped Exam Grades

	Looped Exam Grades	Semi-Looped Exam Grades
Mean	1.608696	1.566038
Known Variance	2.021	2.327
Observations	46	53
z	0.14393	
P(*Z*<=z) two-tail	0.885555	
z Critical two-tail	1.959964	

Note. α = .05

Table 72

2010 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Exam Grades

	Looped Exam Grades	Non-Looped Exam Grades
Mean	1.608696	1.295455
Known Variance	2.021	2.027
Observations	46	44
z	1.04412	
P(*Z*<=z) two-tail	0.29643	
z Critical two-tail	1.959964	

Note. α = .05

Table 73

2010 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Exam Grades

	Semi-Looped Exam Grades	Non-Looped Exam Grades
Mean	1.566038	1.295455
Known Variance	2.327	2.027
Observations	53	44
z	0.902075	
P(*Z*<=z) two-tail	0.367017	
z Critical two-tail	1.959964	

Note. α = .05

Summary of Hypothesis 4 Results. The Chi-square Test of Independence analysis of all the data sets for school years 2008, 2009, and 2010 showed no difference in student common assessment grades when comparing looped student grades to semi-looped and non-looped student grades. When considering changes in student common exam grades for each of the three school years separately, differences do exist for the 2009 school year. The ANOVA showed differences for each year, 2008, 2009, and 2010 when comparing P-values to the alpha level of .05. *Z*-tests yielded differences in mean exam grades in 2009, showing the looped participant group had a higher common exam grade average in geometry than the non-looped participant group. *Z*-tests indicated no other differences for the 2009 school year. No changes were present for the 2008 or 2010 school years.

Null Hypothesis 5 Results

Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by number of absences, when compared to non-participants and semi-participants.

To examine attendance rates among looped, semi-looped, and non-looped student groups statistical analysis consisted of the PI for Skewness to assess normality of the data sets, Chi-Square Test for Independence to determine preference of instructional type to fewer number of absences, and ANOVA and *z*-tests to compare average number of absences of the data sets.

The PI for Skewness indicated that each of the three sample groups, looped, semi-looped, and non-looped participants for each of the three years of this study, 2008, 2009, 2010. Each of the PI – values was greater than one, indicating that each of the sample data sets was significantly skewed (Bluman, 2008). This naturally occurring, skewed data was selected randomly and therefore acceptable (Bluman, 2008). Each data set had high value outliers resulting in positively skewed date for the group set.

Table 74

Pearson's Index for Skewness, Average Number of Absences

	Looped Instruction	Semi-Looped Instruction	Non-Looped Instruction
2008	1.67	1.14	1.37
2009	1.43	1.67	1.33
2010	1.32	1.20	1.92

Sample data showed lower average number of days absent for students in looped instruction than both semi-looped and non-looped sample groups. Although the averages are lower, the Chi-Square Test for Independence yielded no significant difference in attendance due to looped instruction when considering the data for each of the three years, 2008, 2009, 2010. The null hypothesis was: number of absences is independent of instruction type, when comparing looped, semi-looped, and non-looped. Results indicated no significant difference when comparing each instructional type's average number of days absent to expected number of days absent. The chi-square value of 0.244 was less than the critical value of 9.488 at the 95% confidence level, indicating non-rejection of the null hypothesis and no preference for type of instruction.

Table 75

Chi-Square Test for Independence, Attendance Rate Data

	Looped Average	Semi-Looped Average	Non-Looped Average	Totals
2008	13.44 (13.50)	15.69 (15.03)	17.76 (16.69)	46.89
2009	12.30 (11.92)	13.37 (13.27)	15.73 (16.21)	41.40
2010	12.19 (12.50)	13.15 (13.91)	18.07 (16.99)	43.41
Totals	37.93	42.21	51.56	131.70

Note: $\alpha = .05$, df = (3-1) (3-1) = 4, cv = 9.488 (Bluman, 2008, Table G pg. 636)

ANOVA results for absences in 2008 indicated potential differences in attendance averages among the instructional groups. The null hypothesis was: number of absences is independent of instructional type, when comparing looped, semi-looped, and non-looped. ANOVA yielded an F value of 1.39, which was smaller than the critical value of 3.05, indicating non-rejection of the null hypothesis and no preference for type of instruction. The ANOVA also yielded a P-value of 0.25, which was larger than the alpha level of 0.05.

Table 76

2008 ANOVA: Single Factor, Absences

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Absences	50	671.8	13.436	179.756
Semi-Looped Absences	58	910.25	15.6939	203.182
Non-Looped Absences	58	1030.25	17.7629	159.812

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	502.892	2	251.446	1.3894	0.252	3.051
Within Groups	29498.7	163	180.973			
Total	30001.6	165				

Note. α = .05

Z-test results for absences indicate no significant difference among group types for the number of absences in the school year. The null hypothesis was; there is no difference in number of absences. When comparing looped to semi-looped instruction, the *z*-test value of 0.85 was less than the critical value of 1.96, indicating non-rejection of the null hypothesis. Similarly, the *z*-test value of 1.72 was less than the critical value of 1.96 when comparing looped instruction to non-looped instruction student absences. When considering differences in the average number of absences between semi-looped students and non-loped students there was also no difference with a *z*-test value of 0.83, which was less than the critical value of 1.96, indicating non-rejection of the null hypothesis.

Table 77

2008 *Z*-Test: Two Sample for Means, Comparing Looped to Semi-Looped Absences

	Looped Absences	Semi-Looped Absences
Mean	13.436	15.69397
Known Variance	179.76	203.18
Observations	50	58
z	-0.8475	
P(*Z*<=z) two-tail	0.396716	
z Critical two-tail	1.959964	

Note. α = .05

Table 78

2008 *Z*-Test: Two Sample for Means, Comparing Looped to Semi-Looped Absences

	Looped Absences	Non-Looped Absences
Mean	13.436	17.76293
Known Variance	179.76	159.81
Observations	50	58
z	-1.71702	
P(*Z*<=z) two-tail	0.085976	
z Critical two-tail	1.959964	

Note. α = .05

Table 79

2008 *Z*-Test: Two Sample for Means, Comparing Semi-Looped to Non Looped Absences

	Semi-Looped Absences	Non-Looped Absences
Mean	15.69397	17.76293
Known Variance	203.18	159.81
Observations	58	58
z	-0.82703	
P(*Z*<=z) two-tail	0.408222	
z Critical two-tail	1.959964	

Note. α = .05

ANOVA results for absences in 2009 indicated potential differences in attendance averages among the instructional groups. The null hypothesis was: there is no difference in the number of absences. ANOVA yielded an F value of 1.06, which was smaller than the critical value of 3.06, indicating non-rejection of the null hypothesis. The ANOVA also yielded a P-value of 0.35, which was larger than the alpha level of 0.05.

Table 80

2009 ANOVA: Single Factor, Absences

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Absences	50	614.75	12.295	114.833
Semi-Looped Absences	50	668.5	13.37	162.135
Non-Looped Absences	55	865	15.7272	182.0608

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	326.235	2	163.117	1.059441	0.34919	3.05555
Within Groups	23402.78	152	153.965			
Total	23729.01	154				

Note. $\alpha = .05$

Z-test results for absences indicate no significant difference among group types for the number of absences in the school year. The null hypothesis was: there is no difference in number of absences. When comparing looped to semi-looped instruction, the *z*-test value of 0.45 was less than the critical value of 1.96, indicating non-rejection of the null hypothesis. Similarly, the *z*-test value of 1.44 was less than the critical value of 1.96 when comparing looped instruction to non-looped instruction student absences. When considering differences in the average number of absences between semi-looped students and non-looped students there was also no difference with a *z*-test value of 0.92, which was less than the critical value of 1.96, indicating non-rejection of the null hypothesis.

Table 81

2009 *Z*-Test: Two Sample for Means, Comparing Looped to Semi-Looped Absences

	Looped Absences	Semi-Looped Absences
Mean	12.295	13.37
Known Variance	114.833	162.136
Observations	50	50
z	-0.45675	
P(*Z*<=z) two-tail	0.647851	
z Critical two-tail	1.959964	

Note. α = .05

Table 82

2009 *Z*-Test: Two Sample for Means, Comparing Looped to Non-Looped Absences

	Looped Absences	Non-Looped Absences
Mean	12.295	15.72727
Known Variance	114.833	182.061
Observations	50	55
z	-1.44951	
P(*Z*<=z) two-tail	0.147195	
z Critical two-tail	1.959964	

Note. α = .05

Table 83

2009 *Z*-Test: Two Sample for Means, Comparing Semi-Looped to Non-Looped Absences

	Semi-Looped Absences	Non-Looped Absences
Mean	13.37	15.72727
Known Variance	162.136	182.061
Observations	50	55
z	-0.92086	
P(*Z*<=z) two-tail	0.357125	
z Critical two-tail	1.959964	

Note. α = .05

ANOVA results for absences in 2010 also indicated potential differences in attendance averages among the instructional groups. The null hypothesis was: there in no difference in the number of absences. ANOVA yielded an F value of 2.91, which was smaller than the critical value of 3.05, indicating non-rejection of the null hypothesis. The ANOVA also yielded a P-value that was larger than the alpha level of 0.05, 0.057 > 0.05.

Table 84

2010 ANOVA: Single Factor, Absences

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Absences	48	584.94	12.1862	122.819
Semi-Looped Absences	58	762.46	13.1458	128.529
Non-Looped Absences	57	1029.75	18.0657	298.966

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1086.923	2	543.461	2.91391	0.0571	3.0525
Within Groups	29840.86	160	186.505			
Total	30927.79	162				

Note. $\alpha = .05$

Z-test results for absences indicate significant difference between looped and non-looped instructional group types for the number of absences in the 2010 school year. The null hypothesis was: there is no difference in the number of absences. When comparing looped to semi-looped instruction, the *z*-test value of 0.44 was less than the critical value of 1.96, indicating non-rejection of the null hypothesis. Similarly, the *z*-test value of 1.80 was less than the critical value of 1.96 when comparing semi-looped instruction to non-looped instruction student absences for 2010. These two *z*-tests indicate no difference in the average number of absences when comparing looped to semi-looped and semi-looped to non-looped absences.

Table 85

2010 *Z*-Test: Two Sample for Means, Comparing Looped to Semi-Looped Absences

	Looped Absences	Semi-Looped Absences
Mean	12.18625	13.14586
Known Variance	122.82	128.53
Observations	48	58
z	-0.43916	
P(*Z*<=z) two-tail	0.660549	
z Critical two-tail	1.959964	

Note. α = .05

Table 86

2010 *Z*-Test: Two Sample for Means, Comparing Looped to Non-Looped Absences

	Looped Absences	Non-Looped Absences
Mean	12.18625	18.06579
Known Variance	122.82	298.97
Observations	48	57
z	-2.1047	
P(*Z*<=z) two-tail	0.035318	
z Critical two-tail	1.959964	

Note. α = .05

Table 87

2010 *Z*-Test: Two Sample for Means, Comparing Semi-Looped to Non-Looped Absences

	Semi-Looped Absences	Non-Looped Absences
Mean	13.14586	18.06579
Known Variance	128.53	298.97
Observations	58	57
z	-1.80118	
P(*Z*<=z) two-tail	0.071675	
z Critical two-tail	1.959964	

Note. α = .05

Summary of Null Hypothesis 5 Results. Participants in looped instruction, delivered at the high school level in the area of mathematics, did not show a change in student success as measured by the number of student absences, when compared to non-participants and semi-participants according to the chi-square test. Each data set had high value outliers resulting in positively skewed date for the group set. The chi-square for independence test indicated no preference for fewer absences and instructional type. When evaluating differences in mean for each year separately, ANOVA tests of variance showed potential differences in averages based on P-values larger than the alpha value of 0.05. None of the ANOVA results yielded F-values larger than the F critical value of 3.06. Because P-values were larger than the alpha level for each year, subsequent *z*-tests evaluated for differences in mean absences among the groups. *Z*-tests identified a difference in means for the looped sample compared to the non-looped sample in 2010. A change in absences occurred in 2010 with the looped sample group having an average fewer number of absences, 12.19, compared to the non-looped average number of absences of 18.07. The *z*-value 2.10 fell beyond the critical value of 1.96. In 2010, the looped average number of absences was 12.19 compared to the 18.07, the average number of absences for the non-looped sample group. No other sample group mean comparisons using a *z*-test yielded a difference in 2008, 2009, or 2010.

Null Hypothesis 6 Results

Participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by fewer discipline referrals, when compared to non-participants and semi-participants.

As in previous hypotheses, the PI for skewness described the normality of the data. Chi-Square Test for Independence analyzed the data sets for preference of discipline data to instructional type. ANOVA and *z*-tests analyzed differences in means among the instructional types to determine significant differences among looping, semi-looping, and non-looping discipline referral amounts.

Positively skewed sample data sets in 2008, 2009, and 2010 show that in each of the sample groups, looped, semi-looped, and non-looped, outliers exist and a mean values significantly larger than the median values. This naturally occurring, skewed data was selected randomly and therefore acceptable (Bluman, 2008). Each data set had high value outliers resulting in positively skewed date for the group set.

Table 88

Pearson's Index for Skewness, Discipline

	Looped Instruction	Semi-Looped Instruction	Non-Looped Instruction
2008	3.13	2.79	2.28
2009	1.92	1.52	3.10
2010	2.06	1.83	2.02

The Chi-Square Test for Independence compared the averages of the three sample groups to determine the relatedness or dependency of discipline referral rates to instructional type (Bluman, 2008).

A Chi-Square Test for Independence showed there was not enough evidence to accept the null hypothesis that student success as measured by the number of discipline referrals, is independent of instructional type when comparing looping participants to non-participants and semi-participants. The chi-square value of 0.1454 was less than the critical value of 9.488 indicating non-rejection of the null hypothesis and no preference in the number of discipline referrals to instructional type for the 2008, 2009, and 2010 school years.

Table 89

Chi-Square for Independence, Test of Student Discipline

	Looped Average	Semi-Looped Average	Non-Looped Average	Totals
2008	1.26 (1.51)	6.59 (5.66)	5.22 (5.90)	13.07
2009	2.18 (2.09)	8.88 (7.81)	6.98 (8.14)	18.04
2010	2.42 (2.26)	6.47 (8.47)	10.67 (8.83)	19.56
Totals	5.86	21.94	22.87	50.67

Note. $\alpha = .05$, df = (3-1) (3-1) = 4, cv = 9.488 (Bluman, 2008, Table G pg. 636)

When evaluating differences in the mean number of office referrals for each year separately, ANOVA results indicated differences in averages based on F-values larger than the F critical values. The null hypothesis was: there is no difference in the number of office referrals. None of the ANOVA results yielded P-values larger than the alpha level of 0.05 in any of the years 2008, 2009, 2010, indicating significant differences in one of the instructional types.

In 2008, ANOVA results indicate a difference in the number of office discipline referral averages among the three instructional types. The F-value (5.84) was larger than the F-critical value (3.05).

Table 90

2008 ANOVA: Single Factor, Office Discipline Referrals

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Referrals	50	63	1.26	6.60449
Semi-Looped Referrals	58	382	6.58620	124.176
Non-Looped Referrals	59	308	5.22033	68.0713

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	807.912	2	403.956	5.83698	0.00355	3.05112
Within Groups	11349.82	164	69.2062			
Total	12157.74	166				

Note. α = .05

Z-tests of 2008 office discipline referrals reveal differences between looped and semi-looped average number of referrals. The null hypothesis was: there is no difference in the number of office referrals. The *z*-test value of 3.53 was larger than the critical value of 1.96, indicating rejection of the null hypothesis. Looped students had an average of 1.26 office discipline referrals compared to 6.59 for semi-looped students. Looped students also showed fewer discipline referrals than non-looped students who had an average of 5.22 office discipline referrals. In this test, the *z*-test value was 3.49, larger than the critical value of 1.96, indicating rejection of the null hypothesis. *Z*-test did not indicate a difference between the semi-looped student office referral average and non-looped student office referral average. The *z*-test value was 0.75, less than the critical value of 1.96.

Table 91

2008 *Z*-Test: Two Sample for Means, Looped Compared with Semi-Looped Office Referrals

	2008 Looped	Semi-Looped
Mean	1.26	6.586207
Known Variance	6.6	124.18
Observations	50	58
z	-3.53277	
P(*Z*<=z) two-tail	0.000411	
z Critical two-tail	1.959964	

Note. α = .05

Table 92

2008 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Office Referrals

	Looped	Non-Looped
Mean	1.26	5.220339
Known Variance	6.6	68.07
Observations	50	59
z	-3.49267	
P(*Z*<=z) two-tail	0.000478	
z Critical two-tail	1.959964	

Note. α = .05

Table 93

2008 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Office Referrals

	Semi-Looped	Non-Looped
Mean	6.586207	5.220339
Known Variance	124.18	68.07
Observations	58	59
z	0.752483	
P(*Z*<=z) two-tail	0.451761	
z Critical two-tail	1.959964	

Note. α = .05

The 2009 ANOVA indicated differences in means with an F-value of 6.80 and an F-critical value of 3.06. The values indicate a rejection of the null hypothesis: there is no difference in the mean referral frequency.

Table 94

2009 ANOVA: Single Factor, Office Discipline Referrals

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Referrals	50	109	2.18	11.7424
Semi-Looped Referrals	50	444	8.88	111.658
Non-Looped Referrals	55	384	6.98181	135.758

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1197.042	2	598.521	6.80054	0.00148	3.05555
Within Groups	13377.64	152	88.0108			
Total	14574.68	154				

Note. α = .05

Z-test results indicate significant differences in the number of office discipline referral averages between looped and semi-looped students. The null hypothesis was: there is no difference in the number of office referrals. Looped students had an average of 2.18 referrals to the office for discipline compared to an average 8.88 for semi-looped students. The *z*-test value of 4.26 was larger than the critical value of 1.96, indicating a rejection of the null hypothesis. Looped students also had fewer average referrals than non-looped students did in 2009, with non-looped students having an average of 6.98 office referrals compared to the 2.18 office referrals for looped students. The *z*-test value of 2.92 was larger than the critical value of 1.96 for this comparison of frequencies, indicating a rejection of the null hypothesis. When comparing semi-looped and non-looped average office referrals in 2009, the *z*-test value of 0.89 was less than the critical value of 1.96, indicating non-rejection of the null hypothesis and no significant differences in the average number of office referrals for discipline among these two instruction type groups.

Table 95

2009 *Z*-Test: Two Sample for Means, Looped Compared to Semi-Looped Office Referrals

	Looped	Semi-Looped
Mean	2.18	8.88
Known Variance	11.74	111.66
Observations	50	50
z	-4.26483	
P(*Z*<=z) two-tail	2E-05	
z Critical two-tail	1.959964	

Note. α = .05

Table 96

2009 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Office Referrals

	Looped	Non-Looped
Mean	2.18	6.981818
Known Variance	11.74	135.76
Observations	50	55
z	-2.92058	
P(*Z*<=z) two-tail	0.003494	
z Critical two-tail	1.959964	

Note. α = .05

Table 97

2009 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Office Referrals

	Semi-Looped	Non-Looped
Mean	8.88	6.981818
Known Variance	111.66	135.76
Observations	50	55
z	0.87542	
P(*Z*<=z) two-tail	0.381345	
z Critical two-tail	1.959964	

Note. α = .05

The ANOVA for the 2010 discipline referral data indicated a difference in means of office discipline referrals based on instructional type, looping, semi-looping, non-looping. The null hypothesis was: there no difference in mean referrals. The F-value of

8.93 was larger than the F-critical value of 3.05, indicating rejection of the null hypothesis.

Table 98

2010 ANOVA: Single Factor, Office Discipline Referrals

SUMMARY

Groups	Count	Sum	Average	Variance
Looped Referrals	48	116	2.41666	14.9716
Semi-Looped Referrals	58	375	6.46551	71.7970
Non-Looped Referrals	57	608	10.6666	199.190

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1780.414	2	890.206	8.92954	0.00021	3.05252
Within Groups	15950.76	160	99.6922			
Total	17731.18	162				

Note. $\alpha = .05$

Z-tests of the 2010 office discipline data indicate a significant difference in the number of office discipline referrals when comparing instructional types, looping, semi-looping, and non-looping. The null hypothesis was: there is no difference in the number of office discipline referrals. The *z*-test of the sample means for looped student compared to semi-looped students showed a *z*-value of 3.25, which is larger than the critical value of 1.96, indicating rejection of the null hypothesis and a difference in means. The average number of office discipline referrals for looped students was 2.42 compared to 6.47 for semi-looped students. When comparing looped students to non-looped students, the *z*-test value of 4.22 was larger than the critical value of 1.96 also indicating a rejection of the null hypothesis and difference in means. The average number of office discipline referrals for non-looped students was 10.67 compared to 2.42 for looped students. *Z*-tests showed no difference in means when comparing the average number of office discipline referrals for semi-looped students, 6.47, to the average of non-looped, 10.67, students with a *z*-value of 1.93 compared to the critical value of 1.96, indicating non-rejection of the null hypothesis and no difference in mean values.

Table 99

2010 *Z*-Test: Two Sample for Means, Looped Compared to Semi-Looped Office Referrals

	2010 Looped Discipline	2010 Semi-Looped Discipline
Mean	2.416667	6.465517
Known Variance	14.97	71.8
Observations	48	58
z	-3.25232	
P(*Z*<=z) two-tail	0.001145	
z Critical two-tail	1.959964	

Note. α = .05

Table 100

2010 *Z*-Test: Two Sample for Means, Looped Compared to Non-Looped Office Referrals

	Looped	Non-Looped
Mean	2.416667	10.66667
Known Variance	14.97	199.19
Observations	48	57
z	-4.22858	
P(*Z*<=z) two-tail	2.35E-05	
z Critical two-tail	1.959964	

Note. α = .05

Table 101

2010 *Z*-Test: Two Sample for Means, Semi-Looped Compared to Non-Looped Office Referrals

	Semi-Looped	Non-Looped
Mean	6.465517	10.66667
Known Variance	71.8	199.19
Observations	58	57
z	-1.93118	
P(*Z*<=z) two-tail	0.053461	
z Critical two-tail	1.959964	

Note. $\alpha = .05$

When examining the number of office referrals written by looping teachers in year-one compared to year-two a marked reduction is observable. Of the four teachers who participated, all wrote fewer office discipline referrals in year-two compared to year-one. Teacher A wrote seventeen referrals in year-one compared to five referrals in year two. Teacher B wrote 37 referrals in year-one compared to 16 referrals in year-two. Teacher C wrote 27 referrals in year-one compared to nine referrals in year-two. Teacher D wrote seven referrals in year-one compared to six referrals in year-two. Three out of four of the looping teachers wrote less than half the number of office discipline referral in year two.

Summary of Hypothesis 6 Results. Participants in looped instruction, delivered at the high school level in the area of mathematics, did show a change in student success as measured by the number of office discipline referrals, when compared to non-participants and semi-participants according to the *z*-tests comparison of sample means. Each data set had high value outliers resulting in positively skewed data for the group set. The Chi-square tests of independence did not show any relation between instructional type and discipline results. When examining the sample sets of data using the ANOVA and *z*-tests, a change in discipline rates occurred in each year, 2008, 2009, and 2010, with the looped sample group having an average fewer number of discipline referrals than the semi-looped and non-looped groups. Furthermore, *z*-tests indicated no difference between semi-looped and non-looped office discipline referral averages in 2008, 2009, and 2010. Teachers participating in looped instruction wrote fewer referrals in year two than they did in year-one.

Qualitative Results

During the 2011 school year, two focus groups, one with eight students who participated in looped instruction during the 2010 school year, the other consisting of four teachers, occurred at the high school from which all data associated with this study was gathered. Groups responded to a variety of questions about their experiences with looped instruction in a conversation format (see questions in appendix A). The researcher sorted responses according to research question, and then coded responses as supportive or non-supportive. Specific, quoted responses are included in the results of each research question as examples indicative of the group's perceptions.

Research Question 1 Results. Do students perceive a better sense of connectedness and community at school due to participating in looping?

Comments associated with research question one did not indicate that students perceived a better sense of connectedness and community due to participating in looping. The student focus group did not respond with supportive comments indicating a better sense of connectedness and community at school due to participating in looped instruction. Comments indicating less community and connectedness included those regarding the increased ability to divert the teacher away from learning activities and class work. An example of student comment:

> You get to know their personalities. Like, some kids know what it takes to get them to stop teaching. Like, push their buttons so much that they are just like, "okay, then I won't teach," and everyone just wants that.

In general, looping students had less awareness of the concept of community and school connectedness in their responses.

In contrast, teacher responses indicated increased connection with parents through increased trust and communication. Teachers also reported looping students coming back years after their looping experience for help, to discuss issues, or to visit more so than non-looped students. For example, a teacher stated:

> I feel like my students feel a connection to me in a maternal role. The kids I have looped with as freshmen and sophomores are now seniors and they still come back to me whether it is for advice or because they want a granola bar or some other personal item. I mean they come back to me in that maternal role, like, "Help me with this math problem." And I feel it makes them more connected to the school as well.

Teachers also included parents in the conversation regarding school community. Another teacher commented, "I feel also the connectedness with the parents. It takes a while to get to know parents and to establish trust and going into the second year of looping you already have that trust and communication." These experiences associated with looped instruction by the focus group of teachers indicates that they believe students perceive a better sense of community and connectedness because of the looping experience.

Research Question 2 Results. Do students perceive a better relationship with their math teacher and greater trust in their math teacher because of participating in looping?

Both students and teachers reported better relationships with one another due to participation on looped instruction. Students reported liking their teacher more the second year compared to the first, and that the relationship built has helped them learn better. A student commented:

> And, having a teacher for the same, like, two years, they get to know you better. They know the way you learn, the techniques, and also if you have a teacher for more than one year, you aren't just a student to them. You kind of have a relationship.

Some students reported a negative relationship with the teacher during the first year, but a better relationship the second year. One student commented, "I would say yes because I had [specific teacher's name] freshman year and I didn't like her very much. Then I had her this year, and I started to like her more and understand her." These responses indicate that students perceive a better relationship with their teacher due to participating in looped instruction.

Teachers reported looped instruction providing more time to establish a relationship and that it increases the informal conversations with students regarding school activities or personal interests as we as students coming to them with non-academic concerns and problems. A teacher commented:

> I know that kids I've worked with will come back and they will talk about sporting events or a play. It's a lot more comfortable with them to come up and

> say, "Did you hear about this?" or "Did you hear about that?" or even when they hear that a fight or something is going to go on or something bad. They may come and say, "Hey, you know, I've heard about this," or maybe, you know, "my friend, Sally, she's talking about killing herself and I wanted to talk to somebody." That's a little extreme but you know, it's just an example.

Teachers also connected the improved relationship to better class participation and therefore increased success for the learner. A teacher commented:

> You have a chance to build relationships with those students. In the first year the students might be a little less likely to participate or put themselves out there. By the second year, they have a bigger opportunity because they're more comfortable. They don't mind participating randomly, you know, being exposed or putting their answers out there because they feel more comfortable. To me, the more you participate, the bigger chance you have of success.

Class participation often requires the teacher to build a trusting class community where students feel safe to take risks and share their thoughts, knowing there is a chance they could be incorrect.

Students and teachers reported draw backs of a closer relationship being lower expectations at times due to an increased comfort level. A student commented, "I think that I got so comfortable around that teacher that I was like, it's okay to slack off. You didn't want to take it seriously because you guys are like, friends, I guess." Another student commented:

> I'd say it decreased because your old teacher didn't help you do anything to like, get your grade up at the end of the semester if you didn't give everything your all.

> But when you get a new teacher, you have a new chance for a new first impression and to do good in that class.

Student comments indicated a comfort level that influenced the expectation of the teacher and that of themselves.

Teachers reported concerns for students who became “too comfortable” in their class and began to rely on the relationship with the teacher to avoid meeting expectations.

> And sometimes I think the student may become too comfortable, like, “Oh, that’s just [specific teacher’s name].” Too comfortable and they think that the relationship you have established with them can be, yeah, buddying up and they get maybe a little bit lax toward the goals of what we are trying to achieve here.

Other comments included concern for personality conflicts and less than positive working relationships between students and teachers. “If there isn’t a good student-teacher relationship, the student could suffer”, a teacher commented. This comment underscores the importance of the student-teacher relationship and indicates its necessity for student learning.

Research Question 3 Results. Does perception support the thought that looped instruction increase teacher capacity to meet student needs and an increased understanding of the content curriculum?

Students and teachers reported an increase in knowledge that helped the teacher increase effective instructional practices related to motivation, communication, and matching activities to student learning styles. A student commented that because of looped instruction, “she knows what you know and what you don’t know. And, if you don't do your homework she knows she's got to remind you or something like that".

Another student commented:

> It's (student confidence) increased because my eighth grade math teacher did a terrible job at teaching math, and I never got it. I got like, F's and D's in his class, but, when I got (specific teacher's name), I thought that math wasn't that hard. She made it seem so much easier than what he made it seem like. That increased my confidence and I'm like, 'man! Maybe I can do math.

Students felt that as the teacher was able to meet their needs better, they learned more, and became more confident in their own abilities to use mathematics. Another student commented that his looping teacher knew the he needed information broken down into smaller learning concepts, he learned that way better, and became more confident. "I think it increased because my math teacher broke stuff down and helped me understand how to get it. It helped me," stated the student.

Students reported concerns regarding getting used to a specific teachers teaching methods and then struggling with transitioning to a different teacher after the second year. Students felt that their understanding would suffer if the teacher had an instructional or content weakness that they would experience for two years. Students also felt that a looping teacher may sometimes falsely assume a level of understanding for students based on previous experiences resulting in inaccurate seating arrangements and instructional pace.

Students also expressed concerns regarding the quality of instruction found in looped instruction, particularly if the teacher had a lack of understanding regarding a math concept. A student commented:

> Well also, if you have the same teacher than you know maybe they aren't good at teaching a topic or they aren't good at going up to the board and teaching something. You know that next year, you will be dealing with the same problem.

Just as teachers commented about learning a students learning style, students expressed concerns about only learning one teachers teaching style.

> If you have the same teacher for two years, it won't be good because you will get used to their teaching methods and once you get to college you won't be having the same teacher over and over. You'll get new teachers that have different methods of teaching.

Although students experienced success in looping they were concerned for their ability to adapt to new teaching methods in the future.

Teachers reported knowing students, parents and student learning styles better because of participating in looped instruction. A teacher commented, "Yes, get to know kids better, get to know their parents, guardians, get to know the kids learning styles". One teacher described the benefits of having extended time to build a relationship between teacher and learner, that looping provided, and therefore having the ability to help students be more successful.

> I think that you connect and learn the personality of the student. You learn what triggers the student motivated, what could help maintain discipline, and also you've got their learning styles, what has worked in the past, what things they've really enjoyed, what they didn't enjoy. The thing is, I think, that being able to have some type of rapport where if the student is off track then you'll know what you can do or say or whatever to motivate them.

Teachers reiterated several times their increased ability to learning the students' personalities and motivations as well as gaining knowledge about specific student's skill development.

> Definitely for instruction because you kind of know where the kids are at and with a better idea of where they are at, I think, you could try to pry and get a little more out of them. Since you are familiar with them, you could say, you know, "I know you and I know you can do this. I know you understand this concept so we just need to stretch a little bit until you understand the following concept."

Although these are examples of comments in support of looped instruction, teachers also expressed concerns.

Similar to students' concerns for looped instruction, Teachers were concerned that they would teach to the students perceived learning styles and not vary instruction based on previous success with specific activities.

> I think that they get set to one particular teaching style, you know like, we try to do different things in our classes but realistically we have always fallen back to what works in the past or so. One student had me for two years in a row, they are going to learn the way I teach, whereas if they go to another teacher it would be more hands-on or student initiated learning and they may have trouble adapting to that.

Teachers also felt that they did not get a chance to master instruction of one content are before moving to the second year content; that they were still learning the content and best methods each year while learning about their students.

> I think there are also challenges with curriculum as far as learning the curriculum, not just the content but what works and what doesn't. You're always learning when you're teaching and you don't get to try something new next year because next year you're teaching something different and along with that you don't establish the rapport with your PLC because your PLC is changing.

Teachers were particularly concerned about adapting to new PLCs each year when rotating form course to course because PLCs organization was by course at their particular school.

Summary of Qualitative Results

Overall, both students and teachers felt that the relationship built and established in looping was the primary benefit of looped instruction. When asked, "Would you recommend to a friend that they stay with a teacher for math over two years?" students responded "yes" overwhelmingly. Students only qualified their recommendation with "only if they like that teacher".

Teachers spoke favorably of looped instruction and stated they would recommend it to a fellow teacher. One teacher stated he would not recommend looping during a curriculum revision year because of the increased challenge of learning to use new materials during the same year as the loop. Another teacher stated she would not recommend looping for a teacher who was not generally successful.

> I would recommend it in all situations unless the teacher was not very successful. But, I guess that is a situation where you question if the teacher should even be there, but I think as long as the teacher is following the curriculum and reaching students, then looping is excellent.

Teachers also expressed their belief that perhaps a loop from Algebra I to Algebra II would be more beneficial, rather than from Algebra I to Geometry, because the concepts are more closely related.

Results are mixed regarding the research question one explored in this study when considering both student and teacher perceptions of looped instruction. Although students did not perceive a better sense of connectedness and community at school due to participating in looping, their teachers believed that students did. For research question two, both students and teachers made comments in support of the idea that students perceive a better relationship with their math teacher and greater trust in their math teacher because of participating in looping. The results for research question three indicate that student and teacher perceptions do support the thought that looped instruction increases teacher capacity to meet student needs and an increased understanding of the content curriculum, although several factors were cited that also contribute or hinder student success in looping.

Conclusions by Study Domain

Student Achievement as examined by null hypotheses one, two, three, and four proved to have minimal results indicating changes occurred due to looped instruction. Null Hypothesis 1, participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by Missouri Assessment Plan (MAP) scores in Mathematics, when compared to non-participants and semi-participants, was rejected by the researcher for the 2008 data, but non-rejected for the 2010 data. Although 2008 MAP tests showed no differences among participant groups, the 2010 MAP/EOC data showed differences in means among the participant groups. The 2010 data indicated a lower MAP/EOC mean score among looped participants compared to the mean scores of semi-looped and non-looped participants.

Null Hypothesis 2, participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change year-to-year in scores, as measured by Missouri Assessment Plan in Mathematics, when compared to non-participants and semi-participants, was not rejected by the researcher. Although EOC score variance increased significantly in the looping cohort from year one to year two, 707.34 compared to 818.46, the mean score from year to year did not statistically increase. Chi-square, ANOVA, *z*-tests, and correlation showed that looping had no effect on state standardized test scores when compared to semi-looped and non-looped scores. Algebra I EOC scores were the strongest predictor of Geometry EOC scores. Overall, test results showed that looping had no effect on state standardized test scores when compared to semi-looped and non-looped scores.

Null Hypothesis 3, participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by course grades in Mathematics, when compared to non-participants and semi-participants was rejected by the researcher for the 2008 and 2009 data, but non-rejected when considering the 2010 data. Student successes, as measured by grade averages were different in 2008 and 2009, but showed no difference in 2010, when comparing instructional type. In 2008, *z*-tests yielded differences in mean grades, showing looped participants had a higher-grade average in geometry than semi-looped and non-looped participants, and semi-looped participants had a higher-grade average than non-looped.

The 2009 data revealed a higher-grade average for semi-looped participants when compared to looped and non-looped participants.

Null Hypothesis 4, participants in looped instruction, delivered at the high school level in the area of mathematics, will show a change in student success as measured by common assessment scores in mathematics, when compared to non-participants and semi-participants, was rejected by the researcher for the 2009 data, but non-rejected for the 2008 and 2010 data. Although no differences in common exam grade averages were present in 2008 or 2010, *z*-tests yielded differences in mean exam grades in 2009, showing that looped participants had a higher common exam grade average in geometry than the non-looped participant group.

Given the results of hypothesis testing for student achievement indicators, the researcher cannot conclude that looped instruction has a positive effect for students. Of the four hypotheses tested in the student achievement domain only 2008 course grades, and the 2009 common exam grades, showed increased averages for looped participants compared to semi-looped and non-looped participants. In fact, the 2010 MAP/EOC data indicated lower average scores for looped participants compared to semi-looped and non-looped students.

School Connectedness as examined by null hypotheses five and six, indicated a positive effect for students participating in looped instruction. Null Hypothesis 5, participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by number of absences, when compared to non-participants and semi-participants, was rejected by the researcher for the 2010 data, but non-rejected for the 2008 and 2009 data. In 2010, the looped sample group had an average fewer number of absences, 12.19, compared to the non-looped average number of absences of 18.07. Z-tests indicated no other differences in the number of average number of absences among sample groups in 2008, 2009, or 2010.

Null Hypothesis 6, participants in looped instruction, delivered at the high school level in the area of mathematics, will show no change in student success as measured by fewer discipline referrals, when compared to non-participants and semi-participants, was rejected by the researcher for each year data was compared, 2008, 2009, and 2010. ANOVA and *z*-tests showed a change in discipline rates occurred in each year, 2008, 2009, and 2010, with the looped sample group having an average fewer number of discipline referrals than the semi-looped and non-looped groups. *Z*-tests also indicated no difference between semi-looped and non-looped office discipline referral averages in 2008, 2009, and 2010. An examination of teacher participants showed looping teachers wrote fewer referrals in year-two than they did in year-one.

The results of hypotheses testing for school connectedness indicate a positive effect for student participating in looped instruction. The researcher concludes that looped students have an increased connection to school as evidenced by fewer office referrals in 2008, 2009, and 2010 for looped participants compared to semi-looped and non-looped students.

Student and Teachers' Perceived Benefits of Looping, as indicated by focus group responses, show that students and teachers have different perspectives regarding the benefits of looping. Findings related to research question one, do students perceive a better sense of connectedness and community at school due to participating in looping, suggests students did not perceive a better sense of connectedness and community at school due to participating in looping, while teachers believed that students did. Regarding research question two, do students perceive a better relationship with their math teacher and greater trust in their math teacher because of participating in looping, both students and teachers perceived a better relationship and greater trust because of participating in looping. Comments related to research question three, does perception support the thought that looped instruction increases teacher capacity to meet student needs and an increased understanding of the content curriculum, indicate that student and teacher perceptions support the idea that looped instruction increased teacher capacity to meet student needs and an increased understanding of the content curriculum. Both students and teachers claimed they would recommend looping to a peer given favorable circumstances such as liking the teacher, for students, and during a non-curriculum adoption year for teachers.

As a means of contributing to the body of research regarding looped instruction at the high school level as it pertains to mathematics and potentially other content areas, Chapter 5 discusses both the quantitative and qualitative findings of this study. In so doing, it is the intent of this researcher to provide insight for educators and researchers who wish to examine looping as an instructional model aimed at enhancing educational experiences for students and teachers. Chapter 5 also provides recommendations for the Missouri study location, implications American high schools, and recommendations for further study.

Chapter Five: Discussion

Discussion of Research Question

This study determined differences in three domains, achievement, school connectedness, and student and teacher perceptions when students have the same math instructor over the course of two years. Statistical comparisons occurred in the three domains to determine potential differences among the sub-groups of looping, semi-looping, and non-looping, and to what extent participating teachers and students' perceived benefits and drawbacks of looping. Specifically, this study examined differences in outcomes for students who participated in looped instruction compared with semi-looping students and non-looping students. Looped instruction occurred for students transitioning from Algebra I to Geometry with the same teacher and typically, this occurred at the ninth grade through the tenth grade level. The semi-looping data included in this study were generated by students who participated in year two with the looping teacher and students but were not in the same class setting during year one. Non-looping student data were gathered from those who did not participate in looped instruction for comparison purposes.

The study included data from three school years, 2008, 2009, and 2010, and for each of the comparison groups as a comprehensive examination of looped instruction in the area of high school mathematics. Finding instructional models that have gains for students is a primary concern for mathematics educators and administrators (Bethal, 2005; Bracey, 2005; Rouse & Kemple, 2009; Witzel, 2008-2009; Thompson et al., 2009). Student success in mathematics in high school has far-reaching effects as students continue to pursue higher education, and make career decisions algebra (Morge, 2005;

Trusty & Niles, 2003; Van Leuvan, 2004). Prospective employers, including government agencies, depend upon the American education system to produce students equipped with the math skills necessary to keep the United States competitive in the 21st century economy (Bethal, 2005; Garelick, 2005; Rouse & Kemple, 2009; Zhao, 2009).

Discussion by Domain

Student Achievement as measured by EOC scores, course grades, and common assessment scores indicated no consistent differences among the instructional groups, looping, semi-looping, or non-looping. Students who participated in looped instruction showed no consistent difference in achievement when compared to the semi-looped and non-looped groups, although isolated significant differences did occur.

When examining standardized state test score data, MAP and EOC, for the 2008 and 2010 school years, results indicated only a significant difference in test score levels in 2010, where the semi-looped group and the non-looped group scored at an average level higher than the looping group. What is not known is the level at which student began the looping experience. It is possible that the looping students began at a lower achievement level and merely maintained their level of achievement on the MAP test as in other analysis of MAP and EOC data. There was no difference in the average MAP score among the instructional groups for 2008 or 2010. To account for concerns to validity as discussed with the level data, the researcher examined cohort data.

Cohort data of EOC scores from 2009 to 2010 indicated a difference in mean score in the 2009 semi-looping group compared to the non-looping group. A difference in variance existed in looping scores from year-one to year-two with a larger variance in year two, but no difference in average score. Chi-square analysis showed no preference in instructional type among EOC scores from year one to year two for the cohorts of looping, semi-looping, or non-looping. These findings suggest that the most predictive indicator of year two EOC score was the year one EOC score, not instructional type as hypothesized. No preference based on instructional type indicated that looping scores remained commensurate with semi-looped and non-looped scores. Students in the looping cohort scored comparable to semi-looped and non-looped students indicating that, although there was no benefit to participating in looping, there was also no detriment to participating in looping, or any of the instructional types measured as based on EOC cohort scores.

Report card data revealed a difference in average grades in 2008, with looping grade averages measurably higher than semi-looping and non-looping averages. The looping grade average in 2008 was 2.53 compared to semi-looping of 1.91 and non-looping grade average of 1.00 on a 4.00 grade point average scale. The looping average was higher than semi and non-looping according to ANOVA and z-tests. There was no difference when comparing semi-looping and non-looping grade averages. The 2009 data showed a difference in grades only when comparing semi-looping to non-looping with 1.88 compared to 1.26 respectively. Finally, 2010 data indicated no difference in student grades based on instructional type. Because, differences were inconsistent over the three years of data included in this study, the researcher must reject the claim that differences in grades based on looped instruction occurred conclusively. However, a potential for improved grades based in instructional type exists because the 2008 grade data indicated positive results for students who participated in looped instruction. This finding indicated there might be other factors unidentified by this study that resulted in an improvement for the looped instruction group. Further investigation, regarding contributing factors for successful looped instruction are needed.

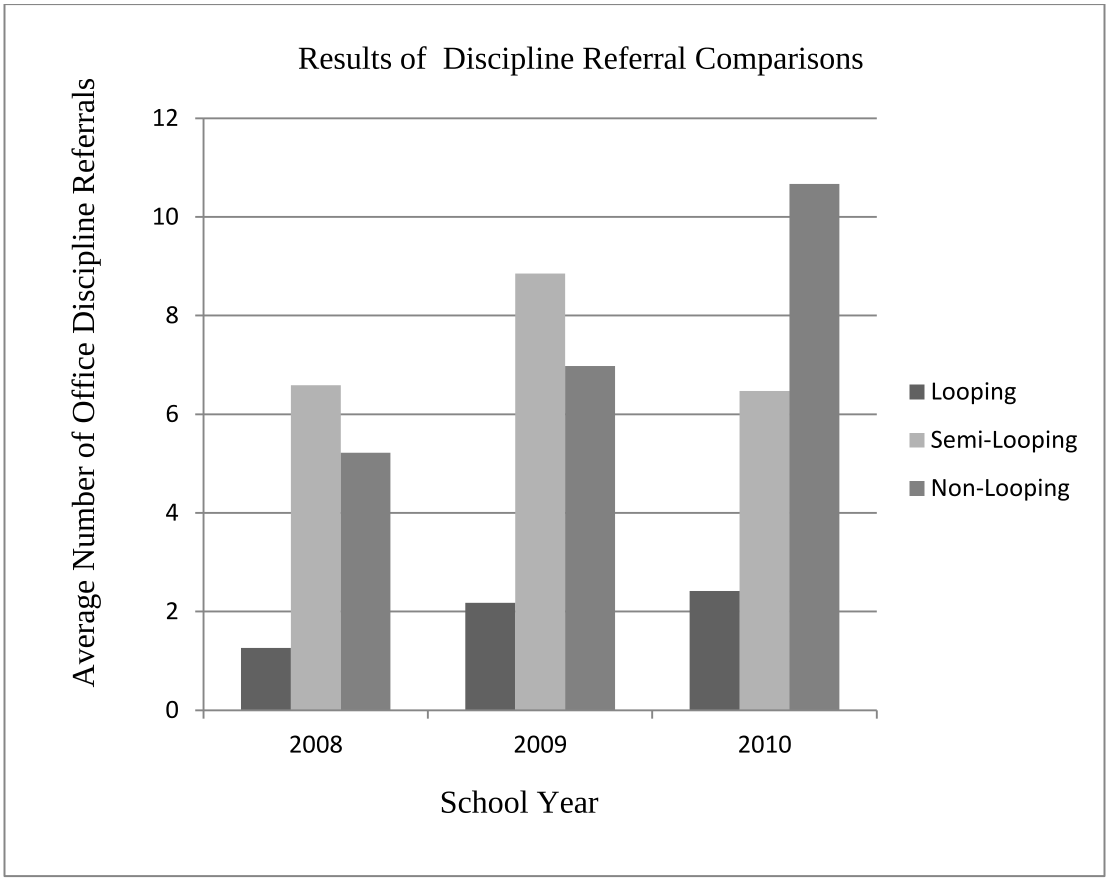
Common assessment data showed only a difference in scores for 2009 looping compared to non-looping, according to *z*-tests. In 2009, students participating in looped instruction had an average common assessment, as measured by mid-term exams, grade point of 2.25 compared to non-looping student average mid-term exam grade point of 1.54 on a 4.00 scale. Statistical analysis revealed no other differences in common assessment scores for 2008, 2009, or 2010. The claim of differences in common assessment scores exists among instructional groups is inconclusive at best when considering the three years of data examined. Evidence from this study suggests that common assessment grades do not differ most of the time when comparing looped participants to semi-looped and non-looped. This study did not conclude that looping is a detriment to student scores on common assessments as looping student scored on average commensurate with students in the semi-looping and non-looping groups.

A discrepancy exists when considering positive differences for looped student data for common assessments in 2009, and grade averages in 2008, but a negative difference for looped student EOC score averages in 2010. The researcher can only speculate that differences among these groups of students and unidentified factors can explain these findings. Qualitative findings also suggest that an increased comfort level among teachers and students may lead to lower expectations and potentially inflated grades. The student comment, “I think that I got so comfortable around that teacher that I was like, it’s okay to slack off. You didn’t want to take it seriously because you guys are like, friends, I guess” identified this potential factor.

School Connectedness as measured by student attendance data yielded a difference in means for the 2010 looped students compared to non-looped students with 12.12 days absent compared to 18.06 days absent. There were no other differences identified for attendance from 2008 to 2010. These findings indicate that looping has the potential to reduce the number of absences for student participants.

Discipline data showed differences in the number of office discipline referrals for each year of study with looped students having fewer office referrals than semi-looped and non-looped student groups. These findings conclusively substantiate the claim that looped instruction contributed to differences in the number of student office referrals compared to semi-looped and non-looped groups. In 2008, looping participants received on average only 1.26 office referrals for the year compared to 6.59 for the semi-looping group, and 5.22 for the non-looping group. The 2009 discipline data indicated significant differences also with 2.18 office referrals for the looped participants compared to 8.85 for the semi-looped and 6.98 for the non-looped participants. The 2010 discipline data yielded the same results with looped participants having significantly fewer office referrals with an average 2.42 number of referrals compared to 6.47 for semi-looping students, and 10.67 referrals for non-looping students.

Figure 1



The greatest threat to the validity of these findings was the selection process for looped instruction. Although all students had the opportunity to participate, it is possible that those who had high numbers of office referrals in general opted out or received recommendations to another teacher by the looping teacher, parent, or counselor. Within the parameters of this study, findings conclusively support the claim that students participating in looped instruction will have a difference in the number of office discipline referrals compared to semi-looping and non-looping student groups. Findings indicate a significant difference in office discipline referrals, with the looped instructional group receiving an average fewer number of discipline referrals compared to semi-looped and non-looped groups. Furthermore, the number of office referrals written by teachers participating in looping showed an observable reduction with three out four of the looping teachers writing less than half the number of office referrals in year two of the looping cycle.

These findings also suggest that student discipline is not a factor that affected looping student math grades, common exam scores, state standardized test scores, or attendance. Students with higher numbers of office discipline referrals are believed to have lower grades, lower achievement on standardized tests, lower classroom test scores (as measured by common exam scores in this study) and higher rates of absences. The finding of this study, when considered comprehensively, indicate that higher discipline did not have a correlational impact on the other student success indicators. Obviously, other factors exist such as the duration of this study, family and socio-economic factors, and types of discipline issues, and this hypothesis was not originally part of the scope of this study. These findings and claims warrant further study.

Student and Teacher Perceptions of looping, as examined through focus group discussions, yielded insight related to the student/teacher relationship, sense of community, trust in the teacher and effective delivery of instruction was examined through focus group discussions. Qualitative findings showed both students and teachers had positive experiences due to looping, as well as drawbacks. Teacher and student perceptions often agreed, but not always.

Teachers perceived a better sense of connectedness and community for students than students themselves did. It is possible that students, having a more egocentric view, did not report a better connectedness to school because of the teacher’s better relationship with their parents, as teachers references as evidence of improved school community. Both students and teachers perceived an improved relationship with each other due to looped instruction, but also discussed concerns associated with better relationships related to effort and diminished expectations. Both students and teachers also perceived an increase in the teacher's instructional knowledge of student's specific needs and learning styles. Both also sighted drawbacks related to the student ability to adapt to new teaching styles and developing strengths and weaknesses in math that match the teachers.

When comparing perceptions to quantitative results, perceptions match the findings related to student discipline. It is reasonable to conclude that a student who has a better relationship with teachers would receive fewer office referrals. Other quantitative results, such as grade, attendance, and exam data associated with this study did not support student and teacher perceived benefits to looping. Students and teachers both discussed enjoyable experiences associated with looping and would recommend it to fellow students and colleagues.

Recommendations for Missouri Study Location

Students who participated in looped instruction had fewer office referrals in year-two than semi-looped and non-looped peers did. Reducing the number of discipline referrals for any student would be beneficial to the individual and potentially the school community. Reducing discipline rates of a larger number of students would impact the overall discipline of the school and should be considered. Although the study did not address that these differences in discipline rates also lead to increased student attendance and achievement continued efforts to improve student and teacher relationships and reduced students discipline may result in better attendance and achievements over a longer period. The study district could benefit from further research in this area. Perhaps sustaining looped instruction as a viable option would yield results for student achievement following a longer timeframe in which teachers participated and gained better knowledge of the curriculum associated with both years of instruction. As suggested by teacher participants, looped instruction for Algebra I to Algebra II would also be worth investigating, as these two courses have concepts more closely aligned than the current sequence of Algebra I to Geometry to Algebra II. This change could have an effect on material purchases, as any change would result in more students taking Algebra II in the first year of implementation.

It is important to note that the study did not indicate statistically significant differences in achievement scores, grades, or attendance for looped instruction groups compared with semi-looped and non-looped groups. This would suggest that, even though evidence does not support increased achievement, looped instruction is not detrimental to students, somewhat accounting for sighted drawbacks from students and teachers.

Furthermore, results of this study indicate that students with fewer office discipline referrals did not have better academic results in mathematics. This should be investigated further to determine specific causes of office discipline referrals and the impact on instruction. Presumably, students are referred to the office for discipline when it is believed that their behavior is interfering with their learning or the learning of others. This notion was not substantiated in the findings of this study.

Implications for American High Schools

Looped instruction, particularly where student discipline is a concern, should be considered as a viable intervention option. As schools across the United States look for ways to create smaller schools within larger urban schools, looping should be considered. In this study, looping was determined to contribute to a positive student and teacher relationship and yielded fewer office referrals for looped student groups compared to semi-looped and non-looped students. Teachers also reported better relationships with parents, attributed to looped instruction. Over a sustained number of years, this improved relationship has the potential to improve student academic outcomes and the overall school- family partnership.

Additional considerations and professional development support should be provided to teachers who participate in looped instruction, particularly when new curriculum is implemented. Teachers reported specific concerns when looping into a course that was also experiencing a change in curricular materials.

Recommendations for Further Study

Year to year changes for cohort data was examined for the 2009 to 2010 EOC scores, but for no other indicator of student success, attendance, grades, common exam grades, or office discipline referral data. Further studies should examine changes within each subgroup, looped, semi-looped, and non-looped, to determine differences in change over time for each group, then compare the changes to determine potential differences based on instructional type. This study only looked at year two data for attendance, discipline, grades, and common exam scores. For the differences identified, it is uncertain how these results compare to year one data. Did the groups have different outcomes in year one, or the same? The researcher assumed that year-one data was similar because students were randomly assigned for year-one, but outcomes for year-one could be different based on instructor or other variables. Other contributing variables could be ascertained through focus group discussion among students and teachers during year one, then compared to follow-up focus group discussion in year two.

Focus groups discussions revealed several negative comments from students and teachers who participated in looping. These findings contrast the positive affects cited in the current literature regarding looping. Although much of the current literature discusses benefits of looping at the elementary and middle school levels, few examine student perception. The researcher recommends a qualitative study examining student perceptions more in-depth because this study's focus group comments differed from current literature regarding the benefits of looped instruction.

Although teachers spoke of improved relationships with parents because of looped instruction, parent perceptions, as well as guidance counselor perceptions, of looped instruction was not included in this study. Certainly, perceptions from parents and counselors could provide further insight regarding the benefits and drawbacks of looping at the high school level.

High school mathematics was the only content area examined in this study, with regard to looped instruction. Results from looping efforts in other content areas, possibly in conjunction with looping in mathematics simultaneously, would provide further evidence of the effectiveness of a two-year instructional placement for high school students. An examination of this type of looping model would potentially help determine the effectiveness of looping as an intervention for students considered at-risk of drop out, or for those with chronic discipline concerns.

This study, although examining outcomes based on looping, semi-looping, and non-looping instruction, discovered no significant or consistent difference in attendance, grades, common exam scores, or EOC/MAP scores. Replication of this study that includes a longitudinal examination of student outcomes following mathematics looping, could reveal differences that this two year study could not. Results from this study call for further study into the factors contributing to discipline and the relationship to academic success. Further research should also investigate longitudinal differences in success related to the number of office discipline referrals when there are no differences in short-term academic success indicators.

Students who participated in looped instruction, developed better relationships with their math teacher and had fewer office discipline referrals. Further study could examine the impact looped instruction has on dropout rates. Future studies should also consider post-high school, college and career choices made by students who participated in looped instruction to determine differences in attitudes toward mathematics after graduation.

Conclusion

As high schools across the United States continue to look for instructional models that yield better results for students, particularly in the content area of mathematics, looped instruction should be considered and studied further to examine the far reaching benefits for students and teachers. This study showed that students participating in looped instruction had reductions in the number of office discipline referrals in each of the three years examined compared to semi-looped and non-looped students. Furthermore, teachers who participated in looped instruction wrote fewer office referrals in year-two of the looping cycle. Results related to the impact of looped instruction on student achievement as measured by grades, common assessments, and standardized state test scores yielded mixed results with no conclusive benefit or drawback from the looping experience for students. Examination of attendance also yielded mixed results with no conclusive benefit or drawback based on instructional type. This study also provides the first known documentation of the impact of looping in high school mathematics. Continued research to find benefits for students at the high school level in mathematics and other content areas is essential as education leaders throughout the United States work to prepare students and our nation for the demands of 21st century.

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Appendix A

Teacher Focus Group Questions:

1. Are there benefits of looping for students in your experience? What would those be?
2. Are there benefits of looping for teachers in your experience? What would those be?
3. Are there challenges of looping in your experience?
4. Are there negative impacts of looping for students in your experience? If So what?
5. Are there negative impacts of looping for teachers in your experience? If so what?
6. Do you believe looping has an impact on student connectedness to school and if so what?
7. Do you believe looping has specific benefits for assessments and instruction and if so what?
8. Are there any benefits associated with the 2 year time frame with students? If So what?
9. Would you recommend looping to a peer? Why or Why not?

Appendix B

Student Focus Group Questions:

1. In what ways did you benefit from staying with the same math teacher for 2 years?
2. Are there any drawbacks of staying with the same math teacher for 2 years?
3. Does your math teacher understand you better than teachers who you have had for only one year?
4. Do you trust your math teacher to have your best interest in mind?
5. Do you plan to attend college? What other math courses do you plan to take?
6. Who plans on taking Trig, Calc, etc? What are your plans after high school?
7. What are your career goals and how is math involved?
8. What is your intended major in college?
9. Has you confidence in mathematics increased or decreased over the last two years and to what would you attribute the change?.
10. Would you recommend to a friend that they stay with a teacher for math over two years? Why or why not?

Vitae

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In 2000, he earned a Bachelor's of Science Degree from the University of Missouri-St. Louis in Elementary Education and Special Education. In 2006, he earned a Master's Degree in School Administration from Lindenwood University. In September of 2011, North County Incorporated recognized John (Mike) LaChance as one of North St. Louis County's Top Thirty Leaders in their Thirties. May 2012 is his anticipated date of graduation from Lindenwood University's Doctoral degree program.