Systematic Interventions for Struggling Students in Mathematics

---

A Special Project

Presented to

Dr. Robert Kraig

Heritage University

In Partial Fulfillment

Of the Requirement for the degree of

Master of Education

Cody B. Mothershead

2012

FACULTY APPROVAL

Systematic Interventions for Struggling

Students in Mathematics

Approved for the Faculty

_____, Faculty Advisor

_____, Date

ABSTRACT

This project was designed to look at a system of intervention used to support students who were struggling academically in mathematics courses at White River High School. Data was collected on the number of D and F grades in Algebra, Geometry, Algebra II, and Pre-Calculus and was compared to a later set of data collected after the system of intervention was implemented. A Chi-Square test of significance was used to analyze the data. The data showed significance at all levels and the null hypothesis was rejected. After the intervention was implemented, the proportion of D and F grades increased instead of decrease; however, many lurking variables influenced the data so the true value of the intervention could not be determined with the given data.

PERMISSION TO STORE

I, Cody B. Mothershead, hereby irrevocably consent and authorize Heritage University Library to file the attached Special Project entitled, *Systematic Interventions for Struggling Students in Mathematics*, and make such Project and Compact Disk (CD) available for use, circulation and/or reproduction by the Library. The Project and CD may be used at Heritage University Library and all site locations.

I state at this time the contents of this project are my work and completely original unless properly attributed and/or used with permission.

I understand that after three years the printed Project will be retired from the Heritage University Library. My responsibility is to retrieve the printed Project and, if not retrieved, Heritage University may dispose of the document. The Compact Disc and electronic file will be kept indefinitely.

_____, Author

_____, Date

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

Introduction

Background for the Project

In 2001, President Bush signed and put into law the No Child Left Behind Act (NCLB) designed to increase student achievement and hold states and schools accountable for student progress. The NCLB Act required all students to be tested annually in reading and mathematics. Starting in the 2007/2008 school year students were required to be tested at least once in science in elementary, middle school and high school. By 2013/2014, all students needed to show proficiency on state assessments. Along with student achievement, NCLB mandated that schools have highly qualified teachers in math, English, and science. From the requirements of NCLB, schools had extra pressure to make sure all students become proficient in the core classes and find interventions for students when they did not understand the first time.

The third question of the Professional Learning Community (PLC) model was what do educators do when students do not get it? From this, many schools came up

with various options for intervention to remediate students so they could be proficient on state assessments. Some of the interventions that schools have tried were offering an extended day or after school help, which White River School District (WRSD) offered. The school also offered an activity bus for students to stay an hour after school to get extra help. Other schools have had students take two core classes like math or English for those who were behind academically. However, White River High School (WRHS) found that the students that needed the most help were the first ones out the door when the end of the day bell rang.

Budget cuts in 2008 sealed the fate of the after school intervention as the funding for the activity bus was cut. With many students still needing help, WRHS introduced a thirty minute period during the school day to provide students with extra support in their classes. Research showed that the most successful interventions for students needed to take place during the school day and be immediate. By having it during the school day, all students had the opportunity for

intervention or enrichment. According to DuFour, DuFour, Eaker, and Many (2010), a multitiered system of intervention was a school wide plan that ensures every student received the additional time and support for learning as soon as the student experienced difficulty in their learning. White River High School put into place a sytem of intervention called Student-Teacher-Access-Time (STAT). The first year STAT was offered it was after first period; many students skipped it and did not take advantage of the time to get extra help. Then the following year, STAT was moved to after second period and given a focus of working on student organization skills to help in learning the curriculum. One of the strategies used was Advancement Via Individual Determination (AVID) strategies, another research based program at WRHS. At this time, students were assigned to their second period teacher for STAT but could get a pass and go to another class at any time. During this time, teachers generally had trouble getting students to come get extra support. The administration and staff brainstormed many ways to make STAT more efficient and useful for students who were

not making the best choices academically when given the option and needed some direction.

In the meantime, the focus was still on what educators were going to do when students did not get it because according to NCLB all students needed to be proficient on state assessments by 2013/2014. As WRHS was looking at ways to improve STAT and motivate students, the school looked at making STAT a directed time and not student choice; furthermore, students who were in good standing would be given options during STAT. For the last year, Glacier Middle School (GMS) in the WRSD used something similar to STAT called PACE. The middle school used the technique that if students were in good standing then they had free time to watch a movie or play games in the gym. So the question was what was the best way the school could get all students the extra support they needed in order to meet the high expectations of state assessments? White River High School staff visited other schools to learn about the interventions provided to their students. In order to see improvement academically and see if STAT was

effective, WRHS was using the amount of D and F grades as the data point.

Statement of the Problem

At the conclusion of 2010/2011 school year, about forty percent of students at WRHS received a D or F in Algebra, twenty percent in Geometry and about twenty-five percent in other math courses combined. With passing Algebra, Geometry, Algebra II or third year alternative math course and the state assessment in Algebra and Geometry a graduation requirement, WRHS would have a huge decline in graduation rate if students performed as they have in the past. Students that earned a D or F in their math class were assumed to not be proficient enough to have met standard on the state assessment; because of this, WRHS offered STAT to provide students the extra support they needed to get the skills needed to meet the Washington State graduation requirements in mathematics.

Purpose of the Project

The purpose of this study was to determine whether the changes in STAT reduced the amount of students with a D or F in mathematics classes compared to previous

STAT expectations. The increase in demand for students to pass State End of Course Exams (EOC), schools were put under extra pressure to make sure students were proficient in course content areas. Students with a D or F were generally not prepared to meet those requirements.

Delimitations

The project was confined to White River High School in the White River School District in 2011-2012 school year. White River High School, located near the base of Mt. Rainer in Buckley Washington, served about 1200 students with about eighty-three percent white, about eight percent two or more races, about six percent Hispanic, about two percent Native American, and about one percent other races according to the Office of Superintendent of Public Instruction (OSPI) website. There was only one high school in the White River School District and about twenty-six percent of the students at the high school received free or reduced lunch. The study did not include running start students or students going part time.

Assumptions

In this study an assumption was made that all grades posted in grade books were up-to-date and accurate. Another assumption was made that all students attending WRHS had opportunities during STAT to get extra support if needed. Finally, it was assumed that every adult in STAT classrooms had the ability to help students in the specific content area in which students needed support.

Hypothesis

The number of students with at least one D or F decreased with the implementation of the new Directed/Super STAT (Student Teacher Access Time) compared to the previous STAT procedures. Students felt they were supported academically more than in the past.

Null Hypothesis

There was no change in the number of students with at least one D or F with the new Directed/Super STAT and the previous STAT procedures. The students will not feel that the new STAT procedures have helped them improve academically.

Significance of the Project

The purpose of this project was to provide data of ways to improve student achievement by reducing the amount of D and F grades in our school. In order to reduce the amount of D and F grades, students needed a system in place to support their learning when they need additional time and support. The results were presented to the principal of White River High School and the next steps of STAT were identified.

Procedure

For the purpose of this project, the following procedures were implemented:

1. Identified need of change.
2. Permission to conduct the study was received from Principal Mike Hagadone (see Appendix A).
3. Reviewed literature and various research studies.
4. Gathered data from previous STAT.
5. Gathered data on number of D and F grades in math courses at end of 2010/2011 school year and end of first semester in January of 2011/2012 school year.
6. Surveyed students on perception of STAT.

7. Gathered data on results of student survey.
8. Chi-Squared Test was performed with data of grades and survey data(See Appendix B).
9. Conclusion was drawn from data.
10. Recommendations made based on conclusion.

Definition of Terms

AVID. The AVID program was a class for a specific group of students to prepare them for college; however, AVID strategies was used in all classes to help make students successful in school. The AVID program also required students to take Advance Placement courses.

STAT. The time provided for students to receive intervention and extra help was STAT. Students had STAT every Tuesday through Friday for thirty minutes after second period.

Professional Learning Community. Teachers were provided one hour every Monday morning to meet with their departments about student performance. Teachers also analyzed data and discussed the students that needed interventions.

Common Formative Assessments. Student learning assessed with the use of the same instrument to the same criteria no matter which teacher a student had for the class. The assessments were intended to identify areas of difficulty for students.

Summative Assessments. Students were assessed to determine if students finally learned a standard or skill in the end of a given time period. Interventions were generally not designed from these assessments.

Acronym

STAT. Student Teacher Access Time

WRHS. White River High School

PLC. Professional Learning Community

AVID. Advancement Via Individual Determination

NCLB. No Child Left Behind

EOC. End of Course Exam

OSPI. Office of Superintendent of Public Instruction

GMS. Glacier Middle School

CHAPTER 2

Introduction

Since 2001 when NCLB bill was signed, student graduation requirements have increased. For example, in Washington State, students were required to earn three math credits and met standard on EOC Exams in Algebra and Geometry. Since graduation requirements increased, the rigor in school has increased and students were required to take higher mathematics courses; furthermore, students no longer earned a high school diploma by only taking basic math in high school. Along with increased expectations of students, teachers were more accountable for student learning and for the curriculum used in the classroom.

With the increase in graduation requirements, more students were falling behind and not meeting standard according to state assessments. At WRHS, students were offered a thirty minute period during the school day four times a week to get extra support needed to fill in the gaps in their learning. This time period, STAT, has transformed since it was implemented. Some of the changes to STAT were: change in the time of day

offered; attached STAT to a class period for attendance issues; and expectations of staff and students. The last change enabled students to have independent STAT under the conditions the students were in good academic standing which consisted of no D or F grades.

This study analyzed the effectiveness of the new STAT procedures and whether the changes reduced the amount of D or F grades which then led to evidence of increased student learning. In the following sections, literature was reviewed and studies were analyzed to show what research says about interventions. This chapter has been organized around the following topics: (a) What Are Students Required to Learn, (b) Evidence of Learning, (c) Academic Interventions, (d) Meaning of a Grade, and (e) Summary.

What Are Students Required to Learn?

In order to set up interventions for students, students must have known what they were expected to learn and teachers needed to shift the focus from teaching to learning. According to *Pyramid Response to Intervention*, it was not simply to ensure all students were taught but also that they learn (Buffumm, Mattos,

Weber, 2009). Students could be taught material repeatedly but made no progress unless students grasped the skills being measured. In the past, schools have made the transition of focusing on learning and not teaching by having a school motto or philosophy; however, Buffumm, Mattos, and Weber (2009) noted that "focus on learning was far more than a school slogan or a catchy motto on its letterhead" (p.50). The authors discussed that if the focus truly shifted to learning, and educators believed that all students were capable of high levels of learning then educators would assume responsibility for making this a reality. The ideas that all students did learn was doubted by some people based on the percentage of free and reduce lunch and learning disabilities; however, Marzano (2003) stated "an analysis of research conducted over a thirty-five year period demonstrates that schools that are highly effected produce results that almost entirely overcome the effects of student's backgrounds" (p.7). Marzano's previous comment was made in reference to the idea that all students can learn and the school controlled the factors that ensured academic success for all students.

While the focus was on learning, there needed to be clear standards and expectations to the students on what information the students needed to know to be competent in the subject matter. Power Standards were used to establish the main skills that students needed to know; furthermore, standards on assessments enabled students to demonstrate their knowledge of a specific content. Standards have been developed by teachers or by state departments of education. According to Buffumm, Mattos, and Weber (2009) some standards were more heavily represented on EOC exams than others. Furthermore, Reeves stated (2005) the validity of standards could be determined by endurance, leverage, and necessity of the standard. Endurance of a standard referenced if the standard addressed knowledge and skill that lasted throughout an academic career. Leverage of a standard addressed the connection the standard has to other content areas; finally, the necessity of a standard determined if the standard had the essential knowledge and skill the student needed in order to move on to the next level. Subjects sometimes tended to over-lap on standards which gave good reasons

for educators to prioritize standards. Robert Marzano (2003) stated that most state curricula was made up with too many standards to have mastered by students; furthermore, students would have attended school for another decade in order to have mastered all the state standards.

Interventions were built off what the student needed to still learn or relearn. Teachers could not develop interventions for these students if clear standards were not set to identify the areas in which students were deficient. In the book *Learning By Doing*, DuFour, DuFour, Eaker, and Many (2010) discussed the importance of teachers collaboratively working with colleagues in clarifying what teachers wanted students to learn. The topics these authors referenced have been known as the standards for the course. Without these standards, educators did not have a clear and precise focus on what the students needed to learn; thus, interventions were not set up to help students who did not meet the standards of a specific subject. Before curriculum was broken into specific standards, student

had to retake a whole broad unit test instead of a specific skill.

Evidence of Learning

Interventions were built to help students with course content they were not proficient on the first time the content was tested; furthermore, in order to set up interventions the expected learning was established by the use of standards. The next step was to give feedback and determine if the students were proficient or needed more instruction on a given standard to have met the expectations of the standard which was done by the use of common assessments broken down into individual standards or skills. In John Hattie's book *Visible Learning* (2009), he looked at many studies and provided formative evaluation had an effect size of d=.90 on learning. DuFour, DuFour, Eaker, and Karhanek (2004) noted the use of assessments to provide feedback impacted student learning higher than many other factors; furthermore, the previous thought showed the importance of assessments broken into standards or skills instead of an averaged score for the assessment which hid the fact that a student

failed to achieve some of the intended outcomes. According to Doug Reeves, learners can only change their thinking when they received feedback in some form, and the timelier the feedback was, the quicker the change occurred (Allison, Besser, Campsen, etc, 2010).

The use of common assessments allowed teachers to frequently measure the progress of student learning and inform teachers of the effectiveness of their practice. The reliability or the extent to which the assessment was consistent was critical in order to assess all students. To achieve high reliability, an assessment needed to be given many times and roughly the same result should be achieved, in that the test should not be designed for the higher achieving student only. The use of common assessments increased the reliability by having the assessment given to multiple classes instead of just a few by a single teacher. Common assessments and a football team prepared for a Friday night game have many similarities. A coach would have introduced the game plan on Monday, practiced on Tuesday, assessed the implementation and designed the intervention or

areas needed to improve on for Wednesday, and then reassessed after the practice on Wednesday. The coach assessed many times throughout the week and did not just go into the game Friday night without the game plan rehearsed and assessed. Common assessments were similar in that teachers gave students feedback throughout a unit, designed intervention to fill holes in the students' knowledge, and then used a summative assessment to assess the students' final understanding of the content.

In *Learning By* Doing, DuFour, DuFour, Eaker, and Many (2010) gave examples of how common assessments did more than just provide feedback on student performance towards mastering a standard or skill, common assessments promoted equity for students with being assessed in the same way to the same standards from the same curriculum and from common pacing no matter if a student had Teacher A or Teacher B down the hallway. Also, common assessments guaranteed curriculum was taught and learned and provided an opportunity to identify achievement gaps and set up interventions.

Student achievement benefited from the use of common assessments. Educators identified the areas of difficulty and developed interventions to fill in the holes in student learning.

Academic Interventions

Once students know the expected learning, how will teachers and schools respond when students do not learn the standard or skill the first time? The natural or easiest response was to have the students stay after school, attend Saturday school, or summer school. Many of the things offered in schools to help the struggling learner were offered outside the school day which brought up other issues of transportation for the students and funding for the program; furthermore, many of the interventions were remediation since the help was coming after the learning already took place. Also, many of the systems that were in place were designed for the students to seek help such as after school tutoring. According to DuFour, DuFour, Eaker, and Many (2010) programs or opportunities like after school tutoring where the students have to elect to seek help often were ineffective because "the students who need

help most were typically the least likely to seek it" (p.115). If many of the things that students were offered were classified as remediation since it took place after the learning, what made a program an effective intervention?

Interventions took place during the learning process and students were assessed using common formative assessments and holes were identified. Before the summative assessment, students were helped to fill in the holes in their learning during the learning process; contradictory, remediation would wait until after the summative assessment to see the holes and attempt to fill in the holes in the learning afterwards. Look at the scenario of a person that just had a heart attack. Remediation was fixing the problem after the heart attack happened; whereas, intervention was changing the diet, exercise, and other things to try and prevent the heart attack from happening after the person was identified of being at risk. The process to identify the risk of heart attack was the formative assessment. Buffumm, Mattos, and Weber (2009) noted effective interventions included characteristics of

directive, timely, targeted, and systematic; furthermore, DuFour, DuFour, Eaker, and Many (2010) suggested the intervention plan was a school wide plan and independent of the individual teacher.

Effective interventions were directive and not student choice. Students that needed the support did not show up unless it was directive; furthermore, Buffumm, Mattos, and Weber (2009) stated "almost all the children who attended the help sessions appeared to be high achieving students" discussing an after school tutorial program (p.62). Robert Eaker and Janel Keating (2012) supported the idea of inventions needed to be directive by stating interventions needed to be "directive rather than invitational" and gave the students direction rather than having the students invited to the intervention (p.129). According to DuFour, DuFour, Eaker, and Many (2010) students needed the direction "rather than the invite to devote extra time" until they experienced success (p.97).

Interventions needed to be offered in a timely manner and not after the students failed. Buffumm, Mattos, and Weber (2009) added interventions were only

effective "when the school responds promptly if students did not learn and provided them additional time to master essential skill and content" (p.63). Academic holes identified by common formative assessments had to be intervened at first indication of difficulty and not a week later when the learning may not be relevant to the student anymore.

Systematic interventions were a key component to successfully help all students learn. DuFour, DuFour, Eaker, and Many (2010) noted students needed to be guaranteed that they received the needed time and support regardless of who their teacher might be. It was also the schools responsibility to guarantee inventions for all students no matter the situation. According to Buffumm, Mattos, and Weber (2009), traditional schools developed a lottery system of support which only students that were fortunate to be assigned to teachers that provided time and effort received the support needed. Students benefited from interventions that were assigned by a design that met the needs of all students and not be chance. Eaker and Keating (2012) mentioned that effective interventions

required a collaborative and school wide approach that provided "interventions and enrichment within the school day, regardless of the teacher to whom the students are assigned" (p.129).

The final characteristic of effective interventions was interventions needed to be targeted. Many times schools created interventions based on a broad idea instead of a specific area that students had difficulty in. Buffumm, Mattos, and Weber (2009) stated the "more targeted the intervention, the more likely it was to be successful" (p.66). DuFour, DuFour, Eaker, and Many (2010) added that more of the same meant by just repeated instruction was not an effective intervention.

Meaning of a Grade

When a student was placed into an intervention based on a grade, the grade must have demonstrated the knowledge of the student and not effort or behavior. According to Reeves (2011), the three most important purposes of grading were feedback to the students, report to parents, and communication to the next teacher. As many teachers agreed with the previous

idea, teachers also included that rewards and punishment were also purposes of grading. Reeves (2011) mentioned that there was impressive evidence that simply stated "grading as punishment does not work" (p.105).

Grading based on behavior, effort, and other things other than the knowledge of the student was having the possibility of giving false interventions. A student that had his/her grade benefited from effort or behavior had a higher grade then the knowledge of the student had represented and consequently the student missed out on critical academic intervention based on student grade. Finally, correct representation of what the grade means was critical since grades was used for college entrance, admissions to honors programs, scholarships, class rank, and honor rolls. Reeves (2011) added since many colleges do not recalculate grades based on rigor or content, "the grades that teachers assign can have a profound impact on future opportunities for their students" (p.3)

Summary

Interventions that were designed to help students in areas of academic difficulty needed to be based from specific targeted areas of learning. Students and schools needed to first establish the expected learning of standards or skills. Once the standards were established, formative assessments were used to identify the areas of difficulty for students. From the use of the formative assessments, schools had designed interventions that were timely, targeted, and systematic to help students fill in academic holes before the summative assessment. Finally, academic interventions that were set up based on student grades, the school needed to ensure that the grade clearly demonstrates student learning and not how good the student behaved or what the student brought into class. DuFour, DuFour, Eaker, and Many (2010) noted "Intervention systems do not require additional resources, but they did require schools to have used their existing resources, time, personnel, and materials differently" (p.101).

CHAPTER 3

Methodology and Treatment of the Data

Introduction

With the increase of graduation requirements and the implementation of end of course exams in academic classes, interventions needed to be designed to support students in areas of academic difficulty. Standards or expected learning targets or objectives were used to identify the specific concepts students needed to know. Common assessments were used and specific areas of deficiency were identified enabled interventions to be built around those areas of difficulty. White River High School used an intervention called STAT. At first, STAT was self-selected in that students decided where to go during STAT. It was difficult for some content areas because students tended to not show up to STAT in some academic core classes such as math and science. The self-selection STAT was then adjusted to directed STAT in that students were assigned to a specific class for STAT based on the grades. Any student with a D or F was placed into a directed STAT for a four week cycle.

If the student had three or more F's, then the student was assigned to super STAT where two professionals were in the classroom to help. If the students were in good standing, students had independent STAT where the students had choices for STAT. This project analyzed the effects of directed STAT in math courses with the academic success of students in math courses at WRHS.

Methodology:

This project started with an identified problem and then literature was reviewed which included books on Professional Learning Communities, intervention, and grading. The literature reviewed standards, the expected learning of the students, common assessments used to assess the learning, intervention used to support students learning, grades, and the purpose of a grade in a classroom.

After the literature review, data was collected on the amount of students who received a D or an F in a math class at the end of the school year in June 2011. Data was then gathered after the first semester in January 2012 this data was used to analyze the effects of new STAT procedures. Data was collected for Algebra,

Geometry, Algebra II Trig, and Pre-Calculus. The intention of the project was to show that directed STAT improved the academic success of students compared to self-selection of STAT. A survey used also analyzed student perception regarding STAT.

Since the data from the survey and grades were organized into a table, a Chi-square text was used in the study. According to Gay, Mills, and Airasian (2009) Chi-square tests could be used when the data was organized by frequencies or proportions in different categories. Data must also have at least two mutually exclusive categories in which data could not be in more than one category. The actual test statistic was calculated by the previous STAT data represented the expected frequencies and the data from the new STAT represented the observed frequencies. The expected frequencies came from the assumptions that all categories received the same response.

Participants:

This project included freshmen, sophomores, juniors, and seniors in 2010/2011 and 2011/2012 school years at WRHS. The project included every student enrolled in

Algebra, Geometry, Algebra II Trig, and Pre-Calculus at WRHS in the previous school years that received a grade in one of the previous courses. The survey was given to students enrolled in STAT in January 2012.

Instruments

Data was collected from the registrar at WRHS in June 2011 and January 2012 and student grades in each math class were recorded based on A, B, C, D, or F. A survey was also given that used a Likert Scale on the perception of students concerning STAT at WRHS. The following was the survey used to collect student perception data:

> This survey was to help determine student perception of the new STAT procedures. Please respond to the number that best represents your feelings at this time to the statements below, understanding that they may change later on in the school year.

Answer Scale:

Strongly Agree: 4

Agree: 3

Disagree: 2

Strongly Disagree: 1

The uses of the current STAT have improved your academic success. _____

Procedure

For the purpose of this project, the following procedures were implemented:

1. Identified need of change.
2. Permission to conduct the study was received from Principal Mike Hagadone (see Appendix A).
3. Reviewed literature and various research studies.
4. Gathered data from previous STAT.
5. Gathered data on number of D and F grades in math courses at end of 2010/2011 school year and end of first semester in January of 2011/2012 school year.
6. Surveyed students on perception of STAT.
7. Gathered data on results of student survey.

8. Chi-Squared Test was performed with data of grades and survey data(See Appendix B).
9. Conclusion was drawn from data.
10. Recommendations made based on conclusion.

Treatment of Data

Data was put into a table that organized student data by math class according to the grade the student received. The survey data was put into a table based on strongly agree, agree, disagree, and strongly disagree from the perception the students had of STAT at WRHS.

CHAPTER 4

Analysis of the Data

Introduction

The addition of passing end of course exam as a graduation requirement has put extra emphasis on student knowledge in those classes. Students no longer had the opportunity to pass by the memorization of topics for short term to pass unit assessment; instead, students needed to retain the material. With the importance of retention, schools provided intervention for students that had gaps in their knowledge. Research showed that the intervention needed to be timely, directed, targeted, and systematic. In order for an intervention to be targeted, students needed to know the expected learning objectives or standards for the course and receive feedback on their progress. This research influenced the decision to make STAT directed and the use of PLCs helped target interventions and gave students feedback. Before, STAT was self-selected by the students and this study intended to show directed STAT improved academic success.

Description of the Environment

The study was confined to WRHS and only used students from WRHS. Students enrolled in a math class at WHRS in 2010/2011 and 2011/2012 school years were used for data collection which include freshmen through seniors. Only those students that had a D or F in a class were directed to STAT. Other students may have gone to STAT for extra help even when they had independent STAT. Data was collected from the registrar in June 2011 and January 2012 for the grades in math classes at WRHS. Student perception data was collected from a survey that used a Likert Scale. Students who were enrolled in STAT in January 2012 were given the survey.

Hypothesis

The number of students with at least one D or F decreased with the implementation of the new Directed/Super STAT (Student Teacher Access Time) compared to the previous STAT procedures. Students felt they were supported academically more than in the past.

Null Hypothesis

There was no change in the number of students with at least one D or F with the new Directed/Super STAT and the previous STAT procedures. The students will not feel that the new STAT procedures have helped them improve academically.

Results of the Study

Table 1: *Initial Data collected June 2011*

Math Course	A	B	C	D	F	Total	Proportion of D/F Grades
ALGEBRA	18	67	62	32	34	213	0.31
GEOMETRY	47	68	65	49	24	253	0.29
ALGEBRA II	49	80	80	61	24	294	0.29
PRE CALC	6	21	16	11	3	57	0.25

Table 2: *Data collected January 2012*

Math Course	A	B	C	D	F	Total	Proportion of D/F Grades
ALGEBRA	6 (14)	21 (53)	40 (49)	39 (25)	63 (28)	169	0..60
GEOMETRY	34 (55)	56 (80)	74 (76)	77 (57)	55 (28)	296	0.45
ALGEBRA II	38 (36)	39 (58)	49 (58)	48 (44)	40 (18)	214	0.41
PRE CALC	22 (11)	29 (40)	24 (31)	21 (21)	13 (6)	109	0.31

The numbers in the parentheses are the expected counts found by using the proportion in the initial data and multiplying the proportion by the number of students in each class of the January Data. The first data was not used as the expected because of the different number of students in each class.

The Chi-Square test was performed on the data from Algebra, Geometry, Algebra II, and Pre-Calculus. According to Gay, Mills, and Airasian (2009), all four sets of data showed significance with the extremely large X^2 values. The Algebra had a X^2 value of 77.14 with four degrees of freedom, the Geometry data had a X^2 value of 48.32 with four degrees of freedom, the Algebra II data had X^2 value of 34.98 with four degrees of freedom, and the Pre-Calculus data had the smallest

X^2 value of 23.77 with four degrees of freedom. The survey data on the perception of STAT by the students had a X^2 value of 28.03 with four degrees of freedom.

Table 3: *Data collected from Survey:*

The uses of the current STAT have improved your academic success.

Strongly Agree	Agree	Disagree	Strongly Disagree
34	48	28	8

Findings

After the Chi-Square Test of significance was performed on all five sets of data, the data showed significance at all levels which included .05, .01, and .001. With the significance, the null hypothesis was rejected with support of the hypothesis which stated the amount of D/F graded decreased. However, the X^2 values showed support for the hypotheses but the data showed the amount of D/F grades actually increased. The proportion of D/F grades increased from thirty one percent to sixty percent in Algebra, twenty-nine percent to forty-five percent in Geometry, twenty nine

percent to forty-one percent in Algebra II and twenty-five to thirty-one percent in Pre-Calculus. In October 2011, WRHS changed the grading scale and widened the range for some grades and moved the D grade down so that a student only needed a fifty percent to pass the course. Because of this, the data from January 2012 had to be converted back to the original grading scale.

Table 4: Distribution of X^2

	p		
df	.05	.01	.001
4	9.488	13.277	18.467

Discussion

Even though the data showed that the proportion of D/F grades increased, many lurking variables could have affected the data. At WRHS, a four point standards based grading system might have affected the grades. Students' grades might not have reflected the knowledge of the student in the traditional grading practice but the implementation of standard based grades had represented the students' knowledge of the subject. The

effectiveness of STAT was also affected by the ability of school personal to efficiently track and deal with attendance issues. The change in the grade scale also effected the motivation of students at WRHS since the scale showed a B but the old scale had the grade as a C+. According to the research discussed in Chapter 2, WRHS had worked toward increased academic success by students but many other factors such as grading practices, attendance, and outside influences had influenced the data and in the end showed the proportion of D/F grades in mathematics increased instead of decreased. According to Reeves (2005) standards needed to have endurance, leverage, and necessity and WRHS had made progress ensuring that course standards have those three characteristics. Also, WRHS have used formative assessments for student feedback and according to Hattie (2009) formative evaluation had an effect size of .90 on learning. These were just a few things WRHS has done that increased student learning even though the data showed otherwise. The data in this study was affected by many outside factors.

Summary

Data on students' grades in math classes was collected and analyzed to help determine if STAT was helping raise the academic success of students at WRHS. After data was compared, it was found that the proportion of D/F grades in Algebra, Geometry, Algebra II, and Pre-Calculus had all increased from June 2011 to January 2012. There were many lurking variables that affected the data that was not controlled in the experiment. The results of the Chi-Squared test of significance did not unveil the work WRHS had done with STAT in an effort to have student achievement increased in mathematics for White River High School students. The focus of WRHS had been on formative assessments, student data, and directed interventions during the school day. White River High School was headed in the right direction and needed to continue to adjust and continue the work towards increasing academic success for all students.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

Since No Child Left Behind was passed in 2001, high school students were held to higher academic standards than children before NO Child Left Behind. In the State of Washington, high school students must have passed EOC Exams in Algebra and Geometry and have earned three high school credits to graduate high school. In the state of Washington and across the United States, mathematics has been an area of concern for students in the educational system with the lowest scores in this content area. Schools across the nation were developing interventions and narrowing the expected learning down to the content of the state tests. At WRHS, many students were earning a D or F in their math courses and had gaps in their knowledge; consequently, a large portion of students have not met standard on the EOC.

In order to support student learning, WRHS developed a system of intervention called STAT and provided students support with their learning at the first sign of difficulty. When the initial data was collected,

WRHS had about thirty percent of their students earned a D or F in Algebra, Geometry, Algebra II, and Pre-Calculus. The purpose of this project was to analyze the effectiveness of STAT by evidence of student learning supported through a system of intervention which increased grades in the mathematics courses at WRHS.

Summary

Students at WRHS have struggled in mathematics. A problem was identified that many students at WRHS were receiving a D or F in their math class and not meeting standard on the EOC. Research was studied concerning best practices in supporting struggling learners' learning. Research showed that students needed to know the expected learning which was called standard and those standards needed to have leverage, endurance, and necessity. Once students knew the expected learning, schools needed an efficient method to have assessed the progress of student learning. Research showed that the use of common formative assessments was an effective way to have provided feedback to students on the learning. The feedback provided areas in which students

needed support. Students received support through a system of intervention and research showed that the system of intervention needed to be timely, directive, targeted, and systematic.

After the researcher looked at research of best practice for interventions, the researcher gathered initial data at the end of the school year in June of 2011 on the number of students that received an A, B, C, D, and F in Algebra, Geometry, Algebra II, and Pre-Calculus. The initial data showed that about thirty percent of the math students at WRHS received a D or F in these courses. At the start of the school year in September 2011, students at WRHS had a system of intervention called STAT which was designed around the best practices that research had shown to be effective. In January 2012 at the end of the first semester, the second set of data was collected. The proportion of students that received a D or F increased dramatically. If a person only looked at data, the conclusion had been that STAT was not helping students at WRHS in mathematics courses; however, many lurking variables had influenced the data. After Chi-Squared test of

significance was conducted, it was conclude to reject the null hypothesis with support of the hypothesis even though the proportions went increased instead of decreased. The survey that was conducted showed that students felt STAT supported their learning.

Conclusions

The research project showed that WRHS had implemented best practices for a system of intervention based on research. However, the data in the project showed that the proportion of student at WRHS that received a D or F in mathematics courses increased after STAT was implemented. The Chi-Squared test of significance showed significance at all levels. Even though the proportion of D and F grades increased, WRHS still supported student learning in mathematics courses and many lurking variables have influenced the data such as new standard based grading system and other outside factors.

Recommendations

At the conclusion of the project, it would be recommended that WRHS still continues to use STAT to support student learning in mathematics courses. After

the new grading system has been in place and the problems worked out, it would be interesting to look at more data to see the effectiveness of STAT without lurking variables. It was still recommended that WRHS still looks at the current mathematics group and how the school was going to support their learning so that they can pass the EOC since the majority of Algebra students are receiving a D or F in their current class and it was a graduation requirement.

References

Allison, E., Besser, L., Campsen, L., Cordova, J., Doubek, B., Gregg, L., … , & White, M. (2010). *Data Teams The Big Picture: Looking at Data Teams Through a Collaborative Lens.* Englewood, CO: The Leadership and Learning Center.

Buffum, A., Mattos, M., & Weber, C. (2009). *Pyramid Response to Intervention.* Bloomington, IN: Solution Tree Press.

DuFour, R., DuFour, R., Eaker, R., & Karhanek, G. (2004). *Whatever It Takes: How Professional Learning Communities Respond When Kids Don't Learn.* Bloomington, IN: Solution Tree Press.

DuFour, R., DuFour, R., Eaker, R., & Many, T. (2004). *Learning By Doing: A Handbook for Professional Learning Communities at Work (2nd ed).* Bloomington, IN: Solution Tree Press.

Eaker, R., & Keating, J. (2012). *Every School, Every Team, Every Classroom: District Leadership for Growing Professional Learning Communities at Work.* Bloomington, IN: Solution Tree Press.

Gay, L., Mills, G., & Airasian, P. (2009). *Educational Research: Competencies for Analysis and Applications (9th ed)*. Upper Saddle River, NJ: Pearson Education Inc.

Hattie, J. (2009). *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement.* New York, NY: Routledge.

Marzano, R. (2003). *What Works in Schools: Translating research into action. Alexandria, VA: Association for Supervision and Curriculum.*

Reeves, D. (2001). *Accountability in Action: A blueprint for learning organizations.* Denver, CO: Advanced Learning Press.

Reeves, D. (2005). Putting it all together: Standards, assessment, and accountability in successful professional learning communities. In R. DuFour, R. Eacker, & R. DuFour (Eds.), *On common ground: The power of professional learning communities (pp. 45-64)*. Bloomington, IN: Solution Tree Press.

Reeves, D. (2011). *Elements of Grading: A Guide to Effective Practice.* Bloomington, IN: Solution Tree Press.

Appendix A

I Mike Hagadone, Principal of White River High School, have given Cody Mothershead permission to conduct his research project here at White River High School. In the research project, students of White River High school was referenced by a given number and not mentioned by student name. No personal information was used in this research project that looked at student grades before and after a system of intervention was put into place.

_____

Mike Hagadone Principal

Appendix B

Algebra Test Statistic:

$$X^2 = \sum \frac{(Observed - Expected)^2}{Expected}$$

$$X^2 = \frac{(6-14)^2}{14} + \frac{(21-53)^2}{53} + \frac{(40-49)^2}{49} + \frac{(39-25)^2}{25} + \frac{(63-28)^2}{28}$$

$X^2 = 77.14 \quad df = 4$

Geometry Test Statistic:

$$X^2 = \sum \frac{(Observed - Expected)^2}{Expected}$$

$$X^2 = \frac{(34-55)^2}{55} + \frac{(56-80)^2}{80} + \frac{(74-76)^2}{76} + \frac{(77-57)^2}{57} + \frac{(55-28)^2}{28}$$

$X^2 = 48.32 \quad df = 4$

Algebra II Trig Test Statistic:

$$X^2 = \sum \frac{(Observed - Expected)^2}{Expected}$$

$$X^2 = \frac{(38-36)^2}{36} + \frac{(39-58)^2}{58} + \frac{(49-58)^2}{58} + \frac{(48-44)^2}{44} + \frac{(40-18)^2}{18}$$

$X^2 = 34.98 \quad df = 4$

Pre-Calc Test Statistic:

$$X^2 = \sum \frac{(Observed - Expected)^2}{Expected}$$

$$X^2 = \frac{(22-11)^2}{11} + \frac{(29-40)^2}{40} + \frac{(24-31)^2}{31} + \frac{(21-21)^2}{21} + \frac{(13-6)^2}{6}$$

$X^2 = 23.77$ df = 4

Survey Test Statistic:

$$X^2 = \sum \frac{(Observed - Expected)^2}{Expected}$$

$$X^2 = \frac{(34-29.5)^2}{29.5} + \frac{(48-29.5)^2}{29.5} + \frac{(28-29.5)^2}{29.5} + \frac{(8-29.5)^2}{29.5}$$

$X^2 = 28.03$ df = 4