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USING A COLLABORATIVE INQUIRY PROCESS AND DATA TO AFFECT CURRICULUM IN AN INDEPENDENT SCHOOL

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Natural Sciences

in

The Interdepartmental Program in Natural Sciences

by
Sheri Lyn Pastor Goings
B.S., Louisiana State University, 1993
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ABSTRACT

Literature clearly supports the use of data to support and drive school policy. Data can be immensely informative; however test scores are not the sole indicator of school effectiveness. To successfully implement a plan for data use, it is imperative to a provide climate of teacher buy-in and collaboration. Multiple sources of data should be considered collectively prior to making any judgment(s) about students, teachers, curriculum, or schools. Data use for effective decision-making is an on-going process that requires strategic planning and a long-term commitment.

Over the past year, I have led the math department through a modified version of the steps identified in the "Using Data Project", which piloted and field tested the "Using Data Process of Collaborative Inquiry". As part of this project, one of the primary data sources we utilized was the ERB standardized test data from 5th through 8th grade tests, which are taken at the end of the school year.

I will show how my school successfully implemented a collaborative inquiry process to inform classroom and curriculum decisions in mathematics. The collaborative inquiry process at The Dunham School had the following aspects: 1) high-quality, extensive data; 2) the collaborative team involved most of the math department on a regular basis; 3) standards were used extensively; 4) scheduled times and tasks were necessary; 5) this project fit the environment, served our recognized needs and had administrative involvement (including awareness, input, oversight, and expectations of deliverables).

CHAPTER 1: INTRODUCTION

Many articles have been written on the culture of large schools that use data as a component of significant decisions. There is a lack of research, however, geared towards smaller independent schools. As an independent school, the legislation of NCLB (2001) does not apply. My school does not have high-stakes standardized testing, and it is not bound by a state or national curriculum. Technology is available and prevalent in classroom use for teaching and learning, but it has not been used to a large extent to house historical standardized test and other data. As an independent, accredited school, Dunham is dedicated to providing the best learning experiences for our students. We offer a college-preparatory education and rigorous academic instruction. Middle school students at Dunham take standardized tests near the end of the school year; however, there has not been a process in place to effectively utilize the results of these tests to improve classroom instruction or the curriculum. We needed a process to connect the current information sources to tangible improvement activities.

Over the past year, I have led the math department through a modified version of the steps identified in the "Using Data Project", which piloted and field tested the "Using Data Process of Collaborative Inquiry". As part of this project, one of the primary data sources we utilized was the ERB standardized test data from 5^{th} through 8^{th} grade tests, which are taken at the end of the school year. The main goals of our collaborative inquiry process are to evaluate our mathematics curriculum through the lens of this data and to improve teaching and learning in the classroom. "Effective data users become aware of and critically examine their frames of reference and assumptions (Wellman & Lipton, 2000)."

In this paper, I will describe the steps we took to analyze student understanding and to use our analysis to recommend changes to our organization and teacher development. The following chapter, chapter 2, will describe the current literature describing how data has been used to affect

school policy and to demonstrate the effective use of the collaborative inquiry process as a tool to understand and utilize data effectively. In Chapter 3, I will discuss the processes and authority structure in place at my school that drive curriculum and classroom instruction. Chapter 4 will provide background information into the existing curriculum and math course sequencing. Chapter 5 describes the specific activities that were taken as part of this thesis project. Chapter 6 elaborates on the analysis of the data. In Chapter 7, I describe the conclusions and recommendations that resulted from the process, and in Chapter 8, I make recommendations for the continuation of the process, while providing suggestions for improvements.

CHAPTER 2: LITERATURE REVIEW

There are numerous research papers in the educational journals indicating that schools respond to "policy requirements" for data-driven decisions in various ways. It is not surprising that the overwhelming majority of research supports the idea that decisions should be based on data. According to the Institute of Educational Sciences (IES) 2009 Practice Guide, there are more than 490 citations in the last 20 years related to data use aimed at supporting instructional decision-making. Research shows, however, that it is difficult and impractical to isolate the contribution of one specific element of data use to academic improvement. Despite this lack of evidence, the IES panel of experts whole-heartedly supports the use of data for the purpose of instructional decisions. Data can be used on multiple levels, including individual classroom improvements, school improvement, and district-wide initiatives. For example, teachers and administrators can examine school-wide data to consider whether and how to adapt curriculum based on student strengths and weaknesses. Regardless of the context of each school or district, "organizational structures and practices" must be in place to support educators who are using and interpreting data.

Responses from schools to the data saturated environment largely depend upon the location of the school (i.e., the state requirements for "high-stakes" testing), technology available at the school, teacher training, and the school administration's view of data. For example, in New York, city-mandated assessment data was given high priority because of the state requirements for school accountability. The "Grow Network" was contracted to provide various reports from grades 3-8 to the district of 30,000 teachers, 1200 schools, and 5000 school instructional leaders. Also, in 2010, 10 Boston public schools were involved in a year-long study that included workshops in using student assessment data (Brunner, 2005). Another study, documented by "The Leadership and Learning Center", reports that a middle school in Tempe, Arizona, had been

labeled as an underperforming school from 2005-2008. After "educators focused intensely on designing effective data teams," the school was designated as a "performing plus school" based on improved proficiency levels from state standardized test scores (Anderson, 2010). While there is still much debate about the best way to utilize achievement data, many studies "have shown that the thoughtful use of student data positively correlates with a range of measures of student achievement" (Wayman and Stringfield, 2006). School improvements go beyond state reporting proficiency levels. "Common findings include teacher reports of greater differentiation of instruction, greater collaboration among school faculties, and improved identification of students' learning as a result of data use (Kerr, 2006)." Research shows that inquiry into student data has contributed to improved school practices, and that data use can be a strong predictor of the effectiveness of school improvement teams (Chrispeels, 2000). "Using data systematically to ask questions and obtain insight about student progress is a logical way to monitor continuous improvement."

In her book, *Using Data to Improve Learning for All*, (2009) Love describes collaborative inquiry as "a process where teachers construct their understanding of student-learning problems and embrace and test out solutions together through rigorous use of data and reflective dialogue". The process described in her book grew from the National Science Foundation project called the Using Data Project, a collaboration between TERC and WestEd. The Using Data project was designed to train data coaches to lead school teams to utilize school data for the purpose of improving instruction. The project boasts significant gains in student achievement correlating with the implementation of the project. Some of the most noted improvements occurred in economically disadvantaged schools in Canton, Ohio, schools with students with disabilities is Johnson County, Tennessee, and rural schools teaching Native American children. (Wolfe, 2009)

The results of Love's Using Data project not only show that "collaborative inquiry continuously improves teaching and learning", but it also shows that simply using data alone is not enough to achieve these continuous improvement results. Teachers and administrators must buy-in to the process of becoming data proficient, and they must also be empowered to contribute their knowledge, skill, and experience. The structure of collaborative inquiry allows for educators to share expertise, discover what they are doing well, and also confront what isn't working in order to change it. (Love, 2009)

The collaborative data process utilizes both formative and summative assessment data as a basis for collaboration. Formative assessments include assessments that are used "for" learning. These provide on-going information and include student self-assessments, questioning and feedback to students, and assessments of student work such as homework, activities, tests, quizzes, and journals. These types of assessments provide information to the teacher to inform the day-to-day progression of teaching practice and daily learning goals. They can be helpful in identifying student learning problems and generating short-cycle adjustments and improvements in the classroom. Summative assessments, in contrast, include capstone projects, end of unit tests, and standardized tests. These assessments provide a gauge as to the success or failure of meeting the specific learning goals of a unit or course of study. Summative assessments can also be used to help determine long-term changes in curriculum.

In summary, literature clearly supports the use of data to support and drive school policy. Data can be immensely informative; however test scores are not the sole indicator of school effectiveness. To successfully implement a plan for data use, it is imperative to a provide climate of teacher buy-in and collaboration. Multiple sources of data should be considered collectively prior to making any judgment(s) about students, teachers, curriculum, or schools. Data use for

effective decision-making is an on-going process that requires strategic planning and a long-term commitment.

Through inquiry-based collaboration, schools have been successful in transforming the culture of teaching and learning by using data to drive improvement. "When schools build collaborative cultures, commit to all students' learning, and use data systematically through ongoing inquiry into improving instruction, they improve results for students. (Love 2009)." In addition to improved testing results, schools have benefitted from a revitalized school culture whereby an increase in collaboration and reflection has supported teachers in making continuous improvement to their teaching practices.

In the remaining chapters, I will show how my school successfully implemented a collaborative inquiry process to inform classroom and curriculum decisions in mathematics. We used both formative and summative assessment data as evidence of student learning, and we made recommendations to the school based on our observations. We now have a data-process in place to inform curricular decisions and improvement.

CHAPTER 3: THE PROCESS OF CURRICULUM UPDATES AT THE DUNHAM SCHOOL

This project, the Collaborative Inquiry Process, is intended to suggest revisions and updates in classroom practice and curriculum at my school. In this chapter, I will describe the institution within which this project was undertaken. It is important to document the processes that are already in place because recommendations and revisions will have to be received by the existing structures. To this end, I will discuss the authority structure and describe how decisions regarding curriculum are made and implemented at my school.

The past 5 years at the Dunham School have included significant updates to and modifications of the curriculum. In 2007, when the process first began, the math department started a tradition of meeting off-site annually for a full day to discuss and map content and skills taught at each grade from 7-12. The first meeting, consisting of sticky notes, markers, and flip-chart paper began a five-year process of identifying what is taught at each grade level. While the department owned binders of curriculum guidelines, most of the curriculum being taught in the classroom(s) at that time was textbook driven.

I began my career at the school at the same time that new procedures for curriculum review were being implemented. I was assigned to teach Algebra 1B, the second semester of Algebra 1 to 9th graders. I was not handed a curriculum guide, simply a textbook and publisher software for generating tests and quizzes. It was up to me to develop lessons and activities to supplement the learning. We did have access to an electronic database, a mapping tool, that provided a list of content, skills, and time spent on each unit for each teacher. The electronic database for the courses I was teaching, however, was not completed. The “maps” for my classes were empty, but as the year progressed, I documented the content and skills that I taught. At the end of that school year, we met as a math department on our first “Math Day Away”. It was

suspected that we were re-teaching concepts from year to year, particularly in our non-honors courses.

In the following two years, 2008 and 2009, we continued the process of documenting our curriculum and identifying content and skill sets that were agreed upon by the department. In 2008, the school created a new position, the academic dean, whose role was to bridge the gap between the lower, middle, and upper school curricula and to review and approve the recommendations of the department chairs. The new dean spearheaded professional development for all departments, and sparked a great deal of curricular modification on our campus. We adopted an ‘experiential’ approach to science education with new science curriculum in grades 2, 3, 6, 7, and 8. Our history department (formerly known as social studies) adopted a stronger emphasis on writing, geography, and using primary documents, thus creating a new or significantly different curriculum in grades 5-12. The English department also saw significant changes, adopting a common rubric for grading writing and making adjustments to the Upper School course sequence. While there were no major revisions to the mathematics curriculum, teachers became more aware of the content and skills that were taught at the grade level below where they were teaching and also the expectations of the higher grades.

In mathematics, we used a top-down approach for curriculum as we discussed the skills that were needed to prepare for AP Calculus and learned ways to incorporate the AP style into earlier high-school grades. Inspection of semester exams by the department chair provided the basis for excellent discussion regarding the expectation of rigor and differentiation of content at each grade level.

In the summer of 2010, all departments were charged with developing “essential questions”. These are general questions that students and teachers should ask repeatedly during every unit in order to focus attention on those aspects of learning that the department feels are

most important. Examples would be, "What model or models should be used to represent a situation, and how do you determine which model it should be? Numerical, Graphical, Analytical, Verbal" and "How does this mathematical topic relate to what I've seen before or might see in the future?" Departments created posters of essential questions that were displayed in the classroom, and they became a focal point of each department meeting and academic council meetings throughout the school year. Further information on the math department essential questions can be found in Appendix A.

In the 2010-2011 school year, all departments were trained in the newest curriculum mapping technology from Rubicon Atlas. We were charged with moving from a "diary mapping" philosophy to a standards based mapping and set curriculum. "Diary mapping" involves documenting what has already been done in the classroom, including content, skills, and timelines. In contrast, our desire to have a set map that communicates curriculum, as a planning tool. The map would include content, skills, standards, and suggested resources. Once developed, the content, skills, and standards would not change from year to year or teacher to teachers. The math department, along with the principals, and the curriculum dean (also known as the academic council) agreed to use the new Common Core State Standards for Mathematics (CCSS-M) as the basis of any curriculum revisions or updates. The math department collectively cross-referenced our curriculum with the CCSS-M, and we adopted standards for each grade level. The CCSS-M standards are now part of the math curriculum, though not necessarily at the same grade level as indicated in the CCSS-M. A significant update to the maps was completed in the summer of 2011. The challenge remaining is to train teachers to understand the depth and interconnectivity of the standards and to revise classroom teaching to teach concepts, reasoning, and understanding, as opposed to mere procedure and "skills".

Since the update in 2011, the curriculum map for each course is considered a "set" document. Teachers are empowered to rearrange the order of content and skills taught at any grade level, but they cannot delete content, skills or standards. The proper authority must approve curriculum updates that require a revision of content, skills or standards, including changes between grade levels. Figure 1 diagrams the basic procedure for curriculum updates. Departments meet bi-weekly under the direction of the department chair to understand, analyze, and diagnose curriculum needs. Using a collaborative inquiry process, the department builds understanding from data, standards, and knowledge of the curriculum. From this understanding, we develop recommendations that are presented to the academic council via the department chair. The academic council – (made up of the lower, middle, and upper school principals, the academic dean, registrar, the college placement advisor, and the department chairs) – meet monthly and advise the academic dean on curriculum recommendations, as well as other school related items. The curriculum dean has the authority to approve, disapprove and / or make recommendations to the head of school for consideration. The cycle is continuous, with new data and curriculum development influencing the collaboration and recommendations of the department to the academic council.

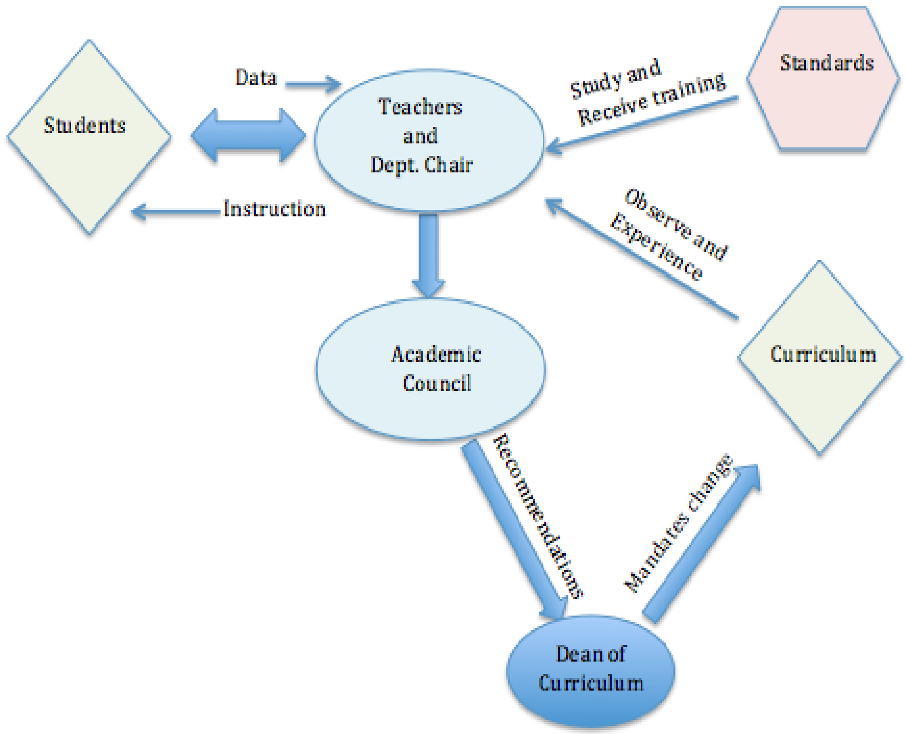

Figure 1: Model of Flow of Information for Curriculum Revisions

CHAPTER 4: THE DUNHAM SCHOOL CURRICULUM - ALGEBRA 1

Since this thesis project will deal primarily with data from the 8^{th} grade, this chapter describes what presently happens in grade 8, mathematically, at Dunham. It includes some information about what happens before and after 8^{th} grade in order to provide understanding for the present 8^{th} grade math curriculum. I will begin by discussing the curricular and student pathways to Algebra 1. This is the primary math course available to 8^{th} grade students. Then, in the second section, I will discuss the current state of the Algebra 1 curriculum.

4.1 Pathways to Algebra 1

Although, there are some students each year who are accelerated in the 7^{th} grade, the majority of students at Dunham follow the same path from Pre-kindergarten to 7^{th} grade math, where they study prealgebra. 7^{th} and 8^{th} grade are the grades at which student math progressions begin to diverge into multiple paths. Students who are accelerated take Algebra 1 honors in the 7^{th} grade in lieu of prealgebra. The remaining students who take prealgebra in the 7^{th} grade will take one of the two Algebra offerings in the 8^{th} grade. They will take either Algebra 1 honors or Algebra 1A. Algebra 1A is essentially the first semester of Algebra 1 taken over the entire 8^{th} grade year. Figure 2 depicts these paths. After geometry, students are required to take Algebra 2 and then precalculus. Students who take precalculus prior to their senior year are required then to take calculus.

Typically, the accelerated 7^{th} grade group is small, 5-10 students out of 50-60 total. In the 2010-2011 school year, this accelerated group was larger, 13 students out of 53 students. In the 8^{th} grade, there were 13 students in geometry, 14 students in Algebra 1 honors and 26 students in Algebra 1A.

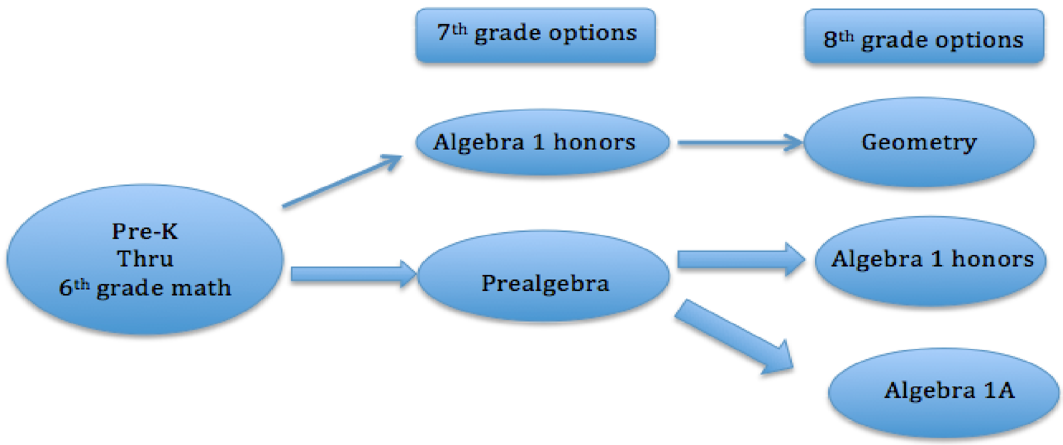

Figure 2: Math Course Progression

4.2 Algebra 1 Curriculum and the Executive Function of This Project

As previously mentioned, the math department met the spring of 2011 to identify the standards from the new Common Core State Standards in Mathematics that were then being taught or at least partially addressed, and to determine at which grade. The maps were updated to include the standards as well as the content and skills for each unit at each grade. One of the major goals of the math department is to train teachers to teach conceptually, to understand the depth of the standards, and to move away from a textbook-controlled curriculum to a standards-guided curriculum. The collaborative inquiry process is one step in meeting this goal. We will identify problem areas in our curriculum based on data, and prioritize professional development and recommend curriculum revisions based on our conclusions.

A significant part of the using data process involves making connections between assessment and the curriculum. We need to be able to verify that we are assessing what

we teach. Further, we need to recognize when we teach it. To assist in this endeavor, I created a "curriculum grouping" document for grades 2-8. This document indicates major themes or units in each grade level. Creation of the curriculum grouping was helpful in that it summarized the flow of curriculum from Grades 2-8. The official curriculum documents now reside in an electronic database program called Rubicon Atlas. The Algebra 1 curriculum map and an overview of content at each grade level prior to Algebra 1 are provided Appendix B and C.

Since the data that this project involves is primarily from grade 8, and Algebra 1 is the course that most of the students at my school take in the 8th grade, the Algebra 1 units are listed below:

- Real numbers
- Properties of equality (problem solving, percents, mixtures, reasoning)
- Linear equations (intercepts, slope, functions, forms of linear equations)
- Linear inequalities
- Absolute value equations and inequalities
- Systems of equations and inequalities
- Statistics (frequency distributions, histograms, stem and leaf plots, measures of central tendency)
- Polynomials (addition, subtraction, multiplication)
- Exponents, exponential growth and decay
- Factoring (solving quadratic equations by factoring)
- Radicals (simplifying and solving quadratic equations by square roots)

- Solving quadratic equations by quadratic formula, square root property, and graphing

After analyzing the data, we will make connections to and recommendations about the current 8th grade curriculum. In the next chapter, I discuss the teacher observations about students based on formative assessments. And then, I will present the analysis of the 8th grade standardized test data as it relates to this curriculum.

CHAPTER 5: THE FIRST STEPS OF COLLABORATIVE INQUIRY: TEACHER VIEWS OF STRENGTHS AND WEAKNESSES

This chapter describes the specific activities that were undertaken as part of this thesis project. The goal of these activities was to make recommendations to the academic council concerning the math program. The recommendations were made by a council of math teachers who met on a regular basis during the 2011-2012 academic year. I will describe who was involved in the collaborative team / council, when we met, and what we accomplished. The inputs to the process were:

(1) – Existing curriculum documents,

(2)- Formative assessments from grades 6 through 12,

(3)- data from the 8th grade standardized tests, and

(4)- the Common Core State Standards for Mathematics (CCSS-M).

The council of math teachers was a subset of the math department. It was directed by the math department chair (myself). While there were 10 members of the math department in the 2010/2011 academic year, out of these 10 teachers, 7 of them had responsibilities outside of math. Three teachers taught both math and science in the 5th and 6th grade. Two teachers taught math part time, with only two math classes assigned. One geometry teacher also taught math part time, with only one math class assigned, and the Algebra II teacher was also the acting science department chair. While all 10 teachers were involved with the collaborative inquiry process at some level, there was a smaller subset of this group, typically 4-5 teachers, who met regularly throughout the year. The teachers in the smaller subset included one of the two 6th grade math teachers, the main 7th and 8th grade teacher, and the two geometry teachers, one of whom also teachers the 7th grade Algebra 1 honors students and one section of Algebra II, and myself as the

department chair, representing precalculus and calculus. The members of this group had teaching experience in math courses from 6th grade math through calculus. The remaining 5 teachers who did not regularly attend the meetings were copied on all correspondence. They provided input as requested outside of the regular meeting times.

The whole math department met regularly on every 1st and 3rd Monday of the month. During these meetings, there was often a need to discuss upcoming school directives, but we were able set aside four of these meetings in the first semester to begin the collaborative inquiry process. In the second semester, we set aside an entire day to address action items from the first semester and to continue the process.

Our first department meeting of the 2011-2012 school year was held on August 9, 2011. This was a kick-off meeting to the academic year. At this meeting, I introduced the main tenets of the collaborative inquiry process and set the goals for the school year of using data, both formative and summative, to affect student learning. The presentation for the Collaborative Inquiry process is given in Appendix D. This document became the basis for communication and curriculum enhancements in the math departments.

The primary goal for this first meeting was to "build a solid foundation for collaborative inquiry by establishing shared values, vision, and parameters for the Data Team work" (Love, 2009). We reviewed curriculum goals as developed and documented in our curriculum maps. We discussed how the students should be assessed and how we should respond individually and collectively when a learning issue is identified. Finally, we discussed our vision for "curriculum and instructions, equity, and critical supports such as professional development and school culture" (Love, 2009).

In the following meetings (August 22, October 10, and November 28), we worked to identify student-learning problems by analyzing multiple data sources as discussed previously, verifying the causes of these problems using research and local data, and finally generating and implementing solutions. After the first 9 weeks of school, teachers were asked to report on the strengths and weaknesses of their students. The basis of their responses was formative assessments, such as classroom observations, questioning, and homework and quiz results. The results of this discussion are summarized in Table 1.

Table 1: Strengths and Weaknesses by Grade Level

Grade / class	**Strengths**	**Weaknesses**
6th grade	Least common multiple Greatest common factor Place Value number sense, "defined as an intuitive understanding of numbers, their magnitudes, relationships, and how they are affected by operations" (http://www.learnnc.org)	Fluency with Multiplication and division of integers
7th grade	Students are motivated; they want to learn; students understand the meaning of signed integers and rational numbers, and they can compare them.	Students do not check to see if final answer makes sense. They rush through problems without thinking them through.
Algebra 1 honors (7^{th} and 8^{th} grade)	Students have good procedural knowledge; they are very rule based.	These students don't like to ask "why" - or think deeply about the "why." They only seem interested in the procedure – the "how".
Algebra 1A and college prep (8^{th} and 9^{th} grade)		Students lack understanding of real numbers and applications including operations of real numbers. They are not motivated to succeed in math understanding.

Table continued

Table continued

		They make numerous errors in operations involving signed numbers.
Algebra 1 B (9^{th} grade)	These students have excellent computer skills. They are not afraid of missing the problem; they are always willing to give an answer.	This group exhibits a lack of work ethic. They resist showing work to solve a problem. They have difficulty simplifying expressions with exponents. They have compartmentalized knowledge; they have difficulty making connections between content and skills. This makes it difficult to solve multi-step problems; they struggle putting different concepts together -- process analysis. They don't like to think deeply about the "why", only the "how". They struggle with addition and subtraction of signed numbers. (also noted that Alg 1 a topics need to be consistently reviewed in Alg 1B)
Geometry	Students are comfortable with using mathxl. They are not afraid of missing the problem; they have a great willingness to participate. They love labs	Mathxl familiarity is also a con for this class. They overuse "View an Example" without thinking deeply about many problems. This group also struggles with the subtraction process, particularly with negative numbers. They have forgotten how to write linear equations. They do not convey a true understanding of slope (as rate of change) They struggle with applications of concepts and word problems. They want single step problems. They don't like to work hard. They struggle with the ability to connect concepts. They are weak in reading comprehension, in discerning what the question is asking?

Table continued

		They are slow processors, lacking automaticity
Algebra 2	These students are not afraid to ask questions. They convey good procedural knowledge.	They struggle with numerical, graphical, analytical, verbal connections. They make errors with adding and subtracting integers, particularly negative numbers. They lack basic fraction sense. They struggle with understanding percentages, especially in a real world context.
Precalculus	These students know how to recognize, write and graph linear equations very well. They understand how to find intercepts.	They struggle with rational expressions. They struggle with finding domain and range for various functions – algebraically. They struggle with understanding of symmetry. They have weak homework effort. They struggle with applications of concepts and word problems.
Dual Enrollment	Students are comfortable using MyMathlab. These students have good organization skills; they keep good notebooks. Overall, they have good time management skills.	They struggle with the MyMathLab Reading Assessment questions -- "which one of these statements is false", etc.
AP Calculus	These students exhibit strong procedural knowledge.	They struggle with applications of concepts and word problems.

From here, the group identified a major theme across all grade-levels. Students want to know step-by-step procedures for solving problems, as opposed to wanting to know “why”. Even students who demonstrated difficulty in recalling procedures for real

number operations resist efforts to engage in classroom discussion about underlying concepts. In addition, many of the weaknesses identified stem from previous year's expectations and curriculum. The long-term work of our collaborative inquiry process is designed to remedy the curriculum issues. However, during this same meeting, we also shared strategies and resources that teacher could begin using immediately to address some of the weaknesses. These immediate strategies and resources are provided in Table 2.

Table 2: Strategies for Strengthening the Weaknesses

Grade / class	**Strategies for Strengthening the Weaknesses**
6th	Consider weekly timed test on facts http://www.playkidsgames.com/mathGames.htm Math games from NCTM Pencil / paper test weekly on facts Use expanded form addition and subtraction vmath live – computer program Spiral concepts Write down rules 1st Continually review "steps" for word problems
7th	When students correct their work, they should give an explanation of what they did incorrectly Provide more open-ended questions that students must think through
Algebra 1	It was noted that this teacher has used number line, counters, tiles, & "rules". There is a need for a good integer "project". Consider unifix cube lesson. Provide timed fact tests Post the "rules", and refer to them often Need to find opportunities to for students to explain and elaborate Students should be able to reason why certain "procedures" work

Table continued

Table continued

	Add sketchpad activities, tasks for students to "discover" the concept in lieu of telling them the procedure Adopt “no work = no credit” philosophy Need to spiral - mixed review / assessment frequently Remove "view and example" from Mathxl; only use "help me solve this" **<u>websites to consider:</u>** • http://www.homeschoolmath.net/teaching/integers.php (several ways of presenting operations with integers — and printable handouts as well) • http://www.mathmammoth.com/worksheets/grade_7.php (this website allows a trial membership, with 300 free worksheets. The percent and expressions worksheets were especially good. They are not just drill and practice, but they have questions that require the students to think through) • http://www.basic-mathematics.com/subtracting-integers-game.html • http://www.aaamath.com/g5_65_x3.htm#section3 (These websites have timed subtraction games: you can email results to teacher on the second one) Also, it includes topics from 5th – 8th grade, both drill and practice as well as application
Geometry	Mathxl can only be a piece of the curriculum – must use multiple resources. Remove "view and example" from Mathxl; only use "help me solve this". Need to spiral - mixed review / assessment frequently. Use sketchpad activities, tasks for students to "discover" the concept in lieu of telling them the procedure. Encourage students to use highlighters to focus attention on what is being asked. Add some timed warm-ups to improve speed. Investigate “v-math live”.

Table continued

Algebra 2	Incorporate tasks that require students to translate from one form to another. Refer often to number line, Model interpreting words into math symbols. Continue to bring in real-world examples
Precalculus	Use sketchpad activities, tasks for students to "discover" the concept in lieu of telling them the procedure. Vary the types of assignments and grade frequently. Students should be required to reason and write frequently (at least twice per unit) -- assess often.
Dual Enrollment	Include reading assessments as warm-ups, and Provide separate assessments where students must explain and justify.
Calculus	Increase exposure to "difficult" application problems – Utilize the College Board Website frequently.

As the table shows, the most common strategies suggested include 1) providing students with more opportunities to reason, explain, and elaborate, 2) using tasks and Geometer's Sketchpad activities in order for students to "discover" concepts on their own, and 3) spiraling review and assessing frequently.

At the conclusion of this meeting, each teacher was charged with incorporating spiraled review and timed warm-ups as part of the normal classroom routine. All teachers were asked to require more "reasoning" and "justifying" questions and tasks. And finally, each teacher was asked to research, plan and present an activity or activities that would strengthen one of the weaknesses identified.

In January of 2012, the math department met for a full day to review data and to learn collaboratively from the presentations prepared as a result of the October strengths and weaknesses meeting. The agenda for the January math day away meeting is included in Appendix E.

CHAPTER 6: USING DATA

In the collaborative inquiry process, we began by organizing the collaborative team, as described in the previous chapter. Ongoing conversation about student strengths and weaknesses, supported by formative assessments such as observation and teacher-made tests, became a regular part of our bi-weekly meetings. The next step in the process was to make use of the standardized test data. This chapter will describe the process of determining the relevance of the specific tests that we use at Dunham to the curriculum process. I am going to report on how our committee received test data, processed, and formed judgments about it, as it relates to the curriculum and how it reveals actions about the curriculum that ought to be taken.

6.1 Description of Test and Summary Results

My school uses tests that were created by Educational Records Bureau, called ERB. ERB is a "not-for-profit member educational services organization offering assessments for both admission and achievement for independent and selective public schools for PreK-grade 12". (www.erblearn.org) [1] The specific ERB test utilized at my school is the CTP4, Comprehensive Testing Program. We use this test in grades 3 through 8 to measure verbal and quantitative reasoning, as well as more content-specific, curriculum based measures of performance. The basis of each grade's mathematics content test is NCTM's principles and standards. The content of the test is designed completely by ERB. The school can select the test, but has no input into the content of the test.

[1] For over 80 years, ERB has created and supported numerous testing programs that are currently utilized by nearly 2000 public and independent schools and districts in 47 states and 52 countries.

The Comprehensive Testing Program, the CTP4, consists of multiple assessments in listening, reading, vocabulary, writing, and mathematics. It also consists of two tests used to measure verbal and quantitative reasoning. ERB recommends teachers and administrators flag discrepancies between "skills" and "achievement" scores as areas of concern.

There are 84 questions on the entire Math1&2 test. The questions are grouped into 7 domains: 1) Number and Number Relationships, 2) Number Systems and Number Theory, 3) Geometry and Spatial Sense, 4) Measurement, 5) Statistics, 6) Probability, and 7) Pre-Algebra. Within each domain, there are 2 to 4 clusters. For example, in the Number and Number Relationships domain, there are 3 clusters: 1-"Understands equivalent forms of fractions, decimals, and percents: Uses estimates of these numbers and square roots; Uses multiple representation of numbers including exponential and scientific notations" (6 questions), 2-"Recognizes the form of number appropriate for use in a given situation; Applies ratio, percent, and proportion in a variety of situations" (6 questions), and 3- "Represents number relationships in 1- & 2- dimensional graphs" (1 question).

In April 2011, 54 students took the CTP4 test. Their mean score was 366.1. The 50^{th} percentile scores of the national, suburban, and independent-school group, as reported by ERB, were 337, 365, and 378, respectively. The standard deviation within the school and within any of the three school groups was about 30. We see that Dunham's performance is typical for suburban schools, that suburban schools perform appreciably better than schools nationally and that independent schools on average, are better yet. Dunham has decided to use independent schools results to set performance

goals. For even more detail about how the school compares to these 3 groups, see the diagrams below.

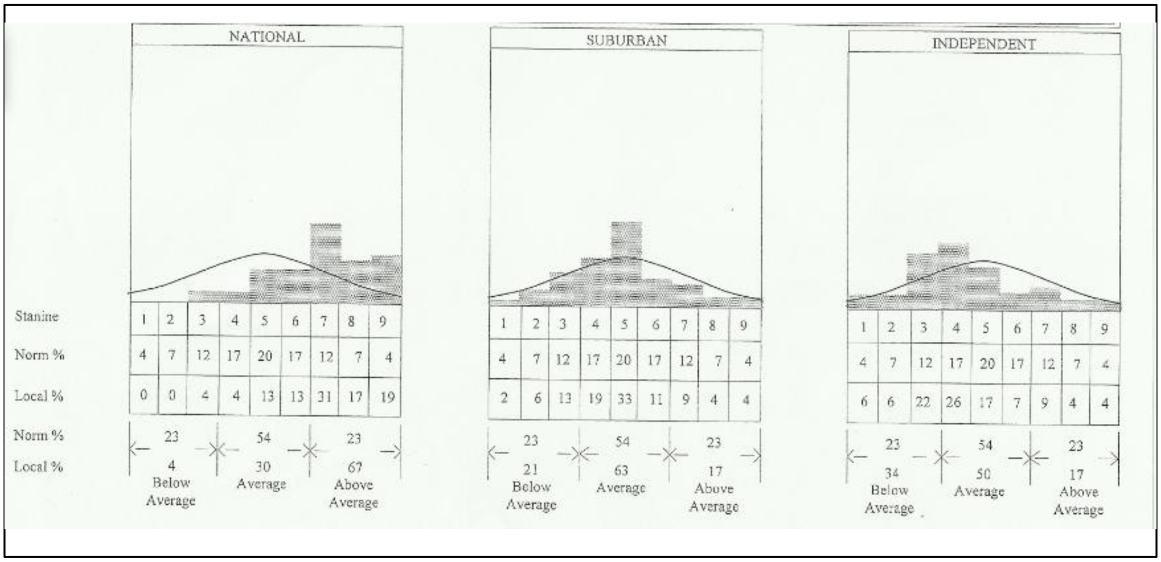

Figure 3: 8th Grade National, Suburban, and Independent curves for Quantitative Reasoning

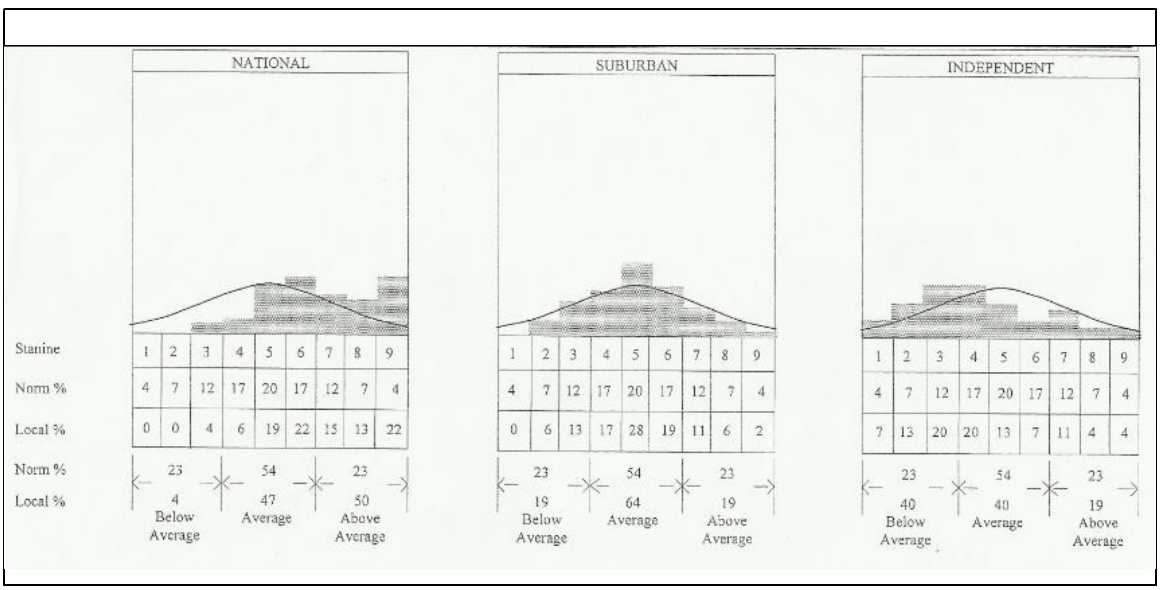

Figure 4: 8th Grade National, Suburban, and Independent Curves for Math1&2

Our goal is to improve results on both the Quantitative Reasoning test and on the Math1&2 content skills test. Fortunately, we found that the results of the two tests tend to be consistent. Inconsistencies, when they are seen, might have the following interpretation. Math1&2 scores appreciably above the quantitative reasoning scores could indicate significant procedural knowledge without depth of understanding. Quantitative Reasoning scores appreciably above the math 1&2 scores could indicate insufficient classroom attention to developing procedural fluency.

6.2 Using the Data

In July of 2011, I received copies of the electronic files from ERB with the test results from April 2011. The data was received as a flat file, an unformatted text file on CD. We converted the file to an excel spreadsheet and prepared various displays of the 8^{th} grade mathematics test results. The process used for reviewing and using data included seven tasks. (1) Compare Math1&2 test scores to the Quantitative Reasoning test scores. (2) Identify domains and clusters. (3) Prepare displays of each domain, separated by cluster. (4) Identify relationships between the ERB tests and the curriculum as revealed by sample items. (5) Look at combined groups as well as groups separated by class, track, or ability. (6) Rank the clusters based on student performance, and ask the group to hypothesize why the performance results are as indicated by the test. (7) Document and revise current classroom practices as necessary, and form committees to research curriculum content, standards, and resources. Tasks (1) and (2) were described in the previous section. In the following paragraphs, I will describe some of the work that the council did towards the remaining tasks.

Task (3) was begun by creating graphs from the data that indicate the percent correct for each skill tested. These graphs are intended to show which skill(s) our 8^{th}

graders were most competent in. The taller bars indicate more competency than the shorter bars. There is one graph for each domain. Each row represents a cluster within that domain. The columns in these graphs are not meaningful. We are simply looking at the relative heights. The school's performance relative to the independent-school group is noted below the graphic. In the council, we examined relationships between the test, as revealed by sample items, and our curriculum (step 4). Beginning in the next paragraph, I will discuss three of the tested domains and the connections we found between the tested content and the curriculum. This will be provided as an example of the type of observation and analysis that is made each time the collaborative inquiry process is repeated. (The graphs and observations made for the remaining domains can be found in Appendix F.)

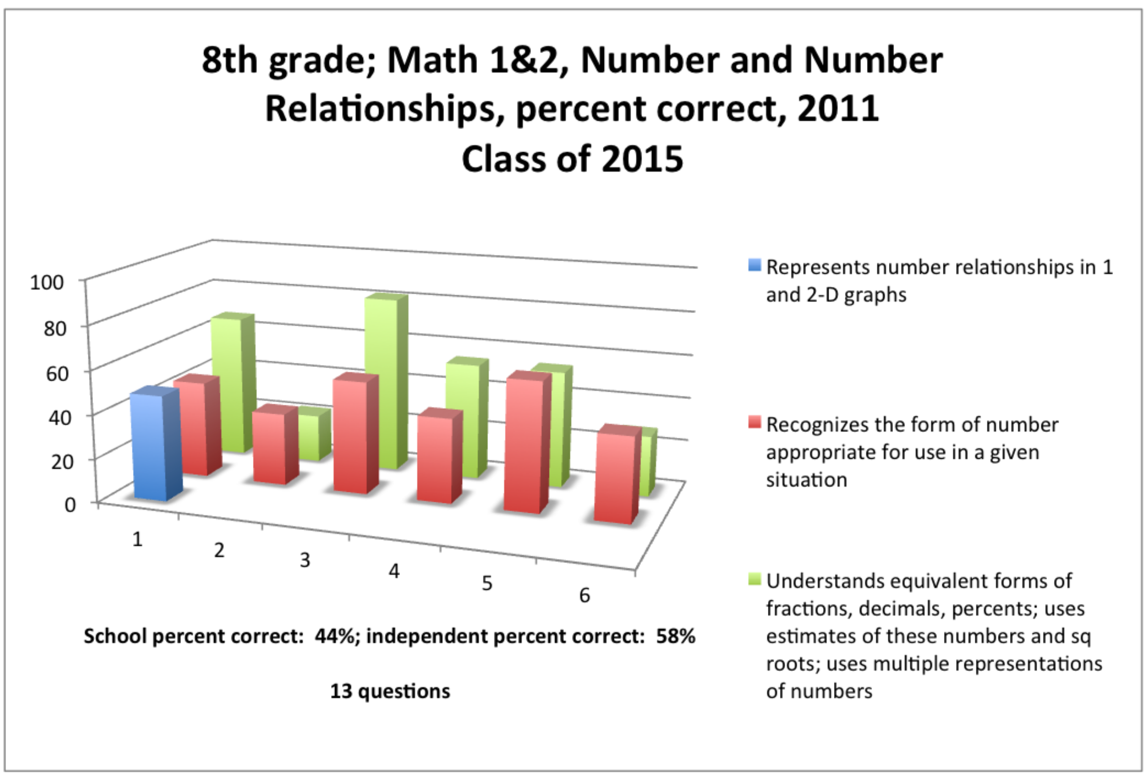

Figure 5: Number and Number Relationships, Percent Correct

There are 13 questions on the 8th grade ERB test regarding number and number relationships. Our 8th grade students answered 44% of these questions correctly. In the "understands equivalent forms of fractions, decimals and percents" cluster, our students answered more questions correctly, reaching 51%. Our benchmark goal is 58%. This is not surprising as these skills are taught and assessed as part of the 8th grade curriculum.

There is only one question regarding "number relationships in 1 and 2-D graphs", and only 40% of our students answered this correctly. Since our 8th grade math offerings all have a heavy emphasis on graphing, I wanted to understand more about this question. After investigating this, however, it was unclear from ERB documentation whether this question actually tests any graphical relationships. The sample questions provided in the on-line practice program under this category do not involve graphs. They deal with solving equations for a variable and solving introductory percent problems. The third cluster in this domain is "recognizing the form of a number appropriate for use in a given situation". This cluster includes procedural type problems including writing ratios and proportions from word problems and working with patterns. While ratios and proportions are part of the Algebra 1 curriculum at The Dunham School, patterns are not. Teachers in grades 5-8 were polled to see whether they believed their students could answer the questions in Figure 6.

The 5th grade math teacher commented that the "pattern-recognition / production" skills illustrated in Figure 6 are taught and practiced throughout the 5th grade unit on patterns and problem solving. In the Common Core State Standards, 5th grade students are expected to create numerical patterns given a starting point and a rule. In 6th grade, patterns are addressed briefly, but not in the form of word problems. And in 7th grade, all of these types of problems are reviewed in the reasoning unit. The reasoning unit

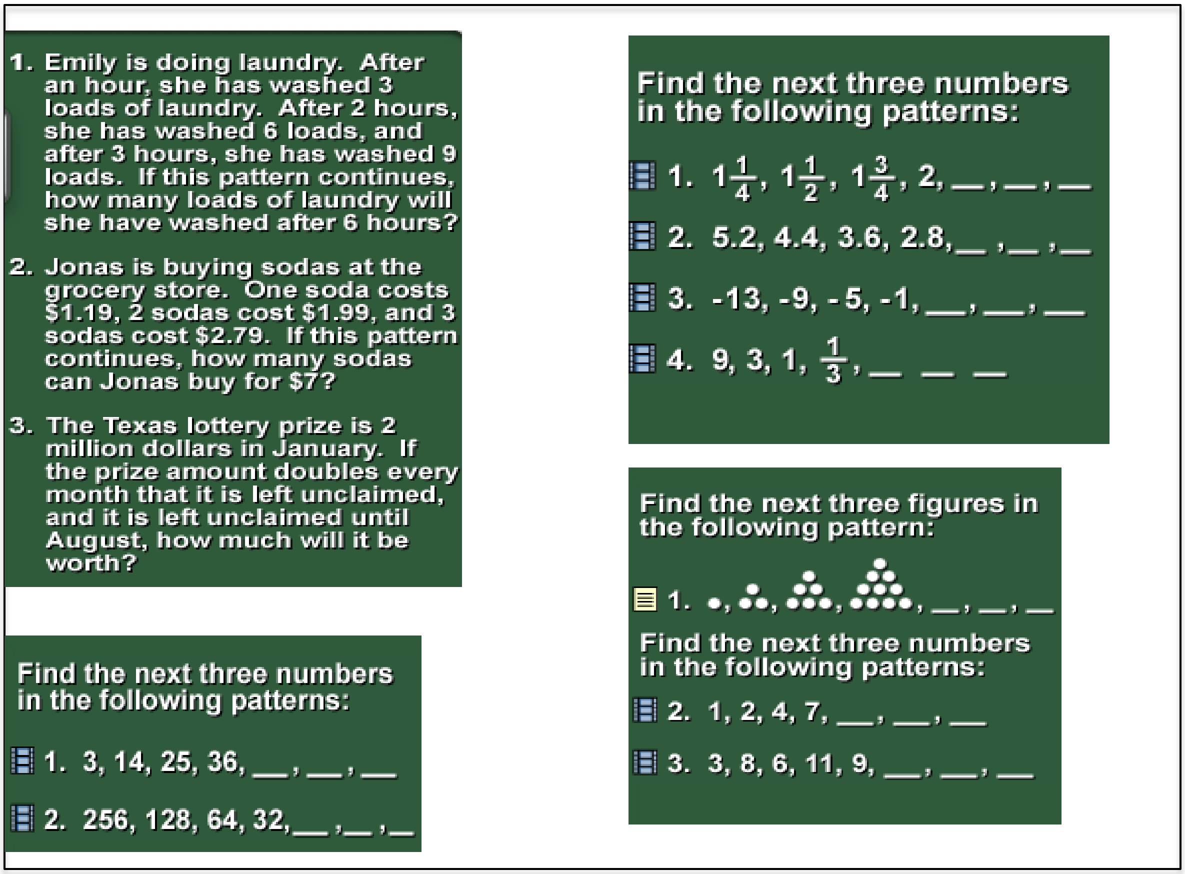

Figure 6: Number and Number Relationship Examples from Math Practice Program

includes patterns, reasoning skills, and sequences, with a heavy influence on geometric sequences. Our students typically do very well on these types of problems.

The next domain I will discuss is Number Systems and Number Theory. The graphic is provided in Figure 7. There are 8 questions on the 8th grade ERB test regarding number systems and number theory. Similar to the previous domain, Numbers and Number Relationships, our 8th grade students answered 44% of these questions correctly. Our benchmark goal is 58%. The four clusters tested in this category are all a

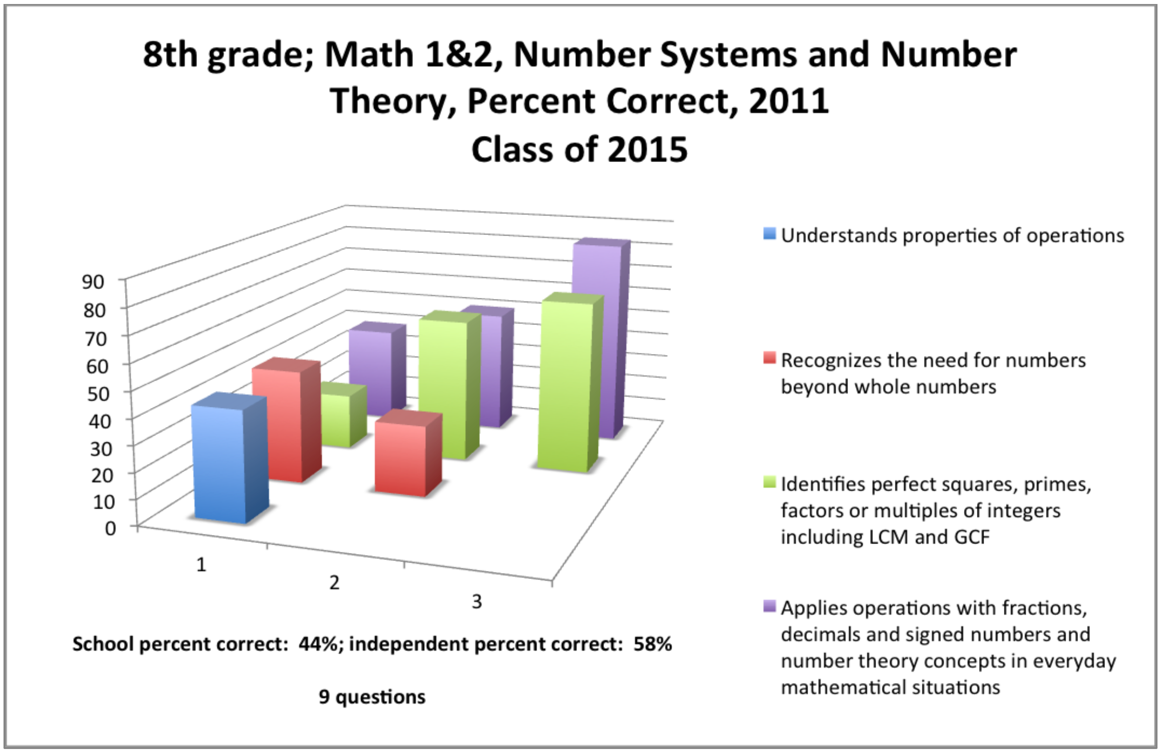

Figure 7: Number Systems and Number Theory, Percent Correct

part of the 8th grade curriculum at The Dunham School. Properties of operations include the properties of equality, the commutative and associative property of addition and multiplication, the multiplicative inverse property and the zero product property. Greatest common factor, prime factorization, and least common multiples are taught in the 6th and 7th grades, but they are reviewed and used frequently in the 8th grade. Fractions and mixed number equations are included at varying levels in Algebra 1; more emphasis on this will be included in future years. Subtraction of negative real numbers was identified by teachers as an area of weakness based on classroom experiences as noted in Table 1. This concept was tested in the ERB and the results confirm that student performance in this area is weak.

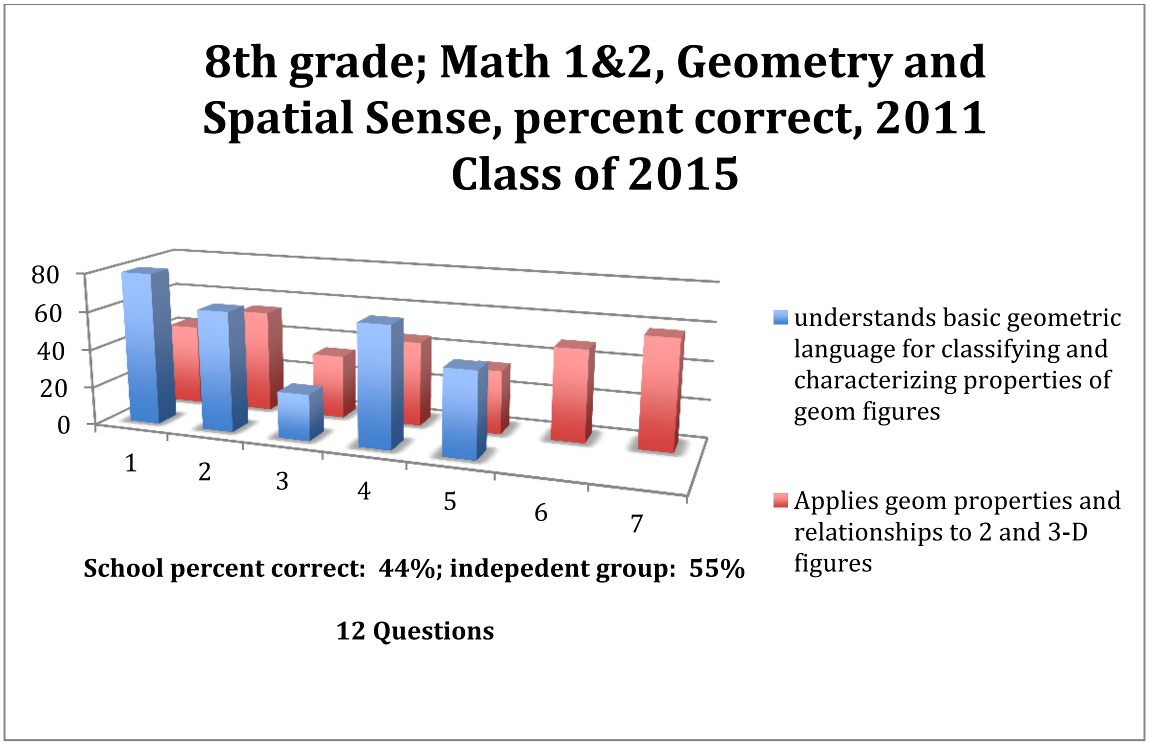

Figure 8: Geometry and Spatial Sense, Percent Correct

The last domain that I will discuss here is Geometry and Spatial Sense. The graphic for this domain is provided as Figure 8. There were 12 questions in this domain; our 8th graders answered 44% correctly. As indicated in Figure 8, our benchmark from the independent school group is 55%. Upon examination of the questions in this category, it was discovered that the majority of skills tested in ERB for geometry and spatial sense are not covered in our middle school curriculum. They are covered instead in our high school geometry class. Many of these items are part of the Common Core State Standards, however. In 5th grade, students are expected to classify two-dimensional figures into categories based on their properties. In 6th grade, students are expected to find the area of triangles, quadrilaterals, and other polygons. In 7th grade, students are expected to construct triangles and notice the conditions that determine a unique triangle.

The following are examples of problems on the 8th grade test that our current 8th graders do not have experience with. These results indicate a need to update curriculum in grades 5-7.

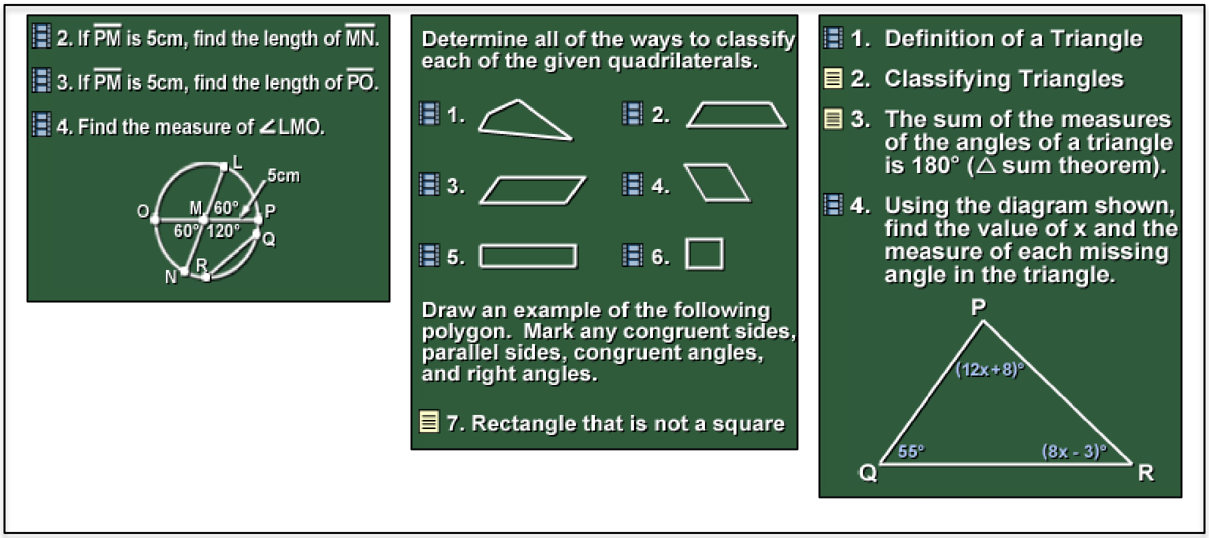

Figure 9: Geometry and Spatial Sense Examples from Math Practice Program

After reviewing the results from the ERB, we moved onto task 6. The content areas were ranked from low to high based on the percent correct of our students. The rank by category / content area is: Measurement, Probability, Geometry and Spatial Sense, Number Systems and Number Theory, Number and Number Relationships, Pre-algebra, and Statistics. On the Quantitative Reasoning test, the rank of student performance from low to high (as a group) is Extensions, Analysis, and Comparison. This ranking was intended to help us prioritize the content in our curriculum that needs to be further studied and upgraded. From here, steps 3 and 4 were repeated, and the discoveries to date were communicated to the math department.

Sample questions for each of the content areas were provided to the members of the math department during the Math Day Away meeting in January, 2012, as we looked at the past years' data from the ERBs. Below are some examples from the ERB content standards booklet. Measurement is used as an example here because it was the domain ranked first, based on lowest student performance.

In the measurement section of the ERB, students are expected to:

- Apply concepts of measure including perimeter, circumference, surface area, volume, weight, and angle measure for regular and irregular shapes.
- Use units appropriately, including units in the metric system, and estimate measures using scale.
- Develop formulas to solve problems of measure and simple rate problems.

Sample measurement questions for grades 7-10 are not provided in the ERB Content Standards manual. They are provided for grades 3-6, however. Figure 10 is an example from this grade band.

> Which of these could be the height of a stop sign?
>
> (A) 2 meters
>
> (B) 6 meters
>
> (C) 800 centimeters
>
> (D) 1,000 centimeters
>
> The height of a stop sign must be estimated. Most stop signs are a little taller than the average adult. So you can estimate that a stop sing is between 6 and 8 feet tall. Of the answer choices, only one is close to this height. The first two choices are in meters. One meter is a little longer than a yard, which is 3 feet. Therefore, 2 meters is a little more than 6 feet....

Figure 10: Measurement Question, grade 3-6

It was unclear until recently what types of skills were tested on the 8th grade Math1&2 test regarding measurement. Further exploration into an on-line resource by ERB has recently revealed specific questions for each content strand. Figure 12 provides some examples of measurement questions in the Math1&2 section of the on-line program.

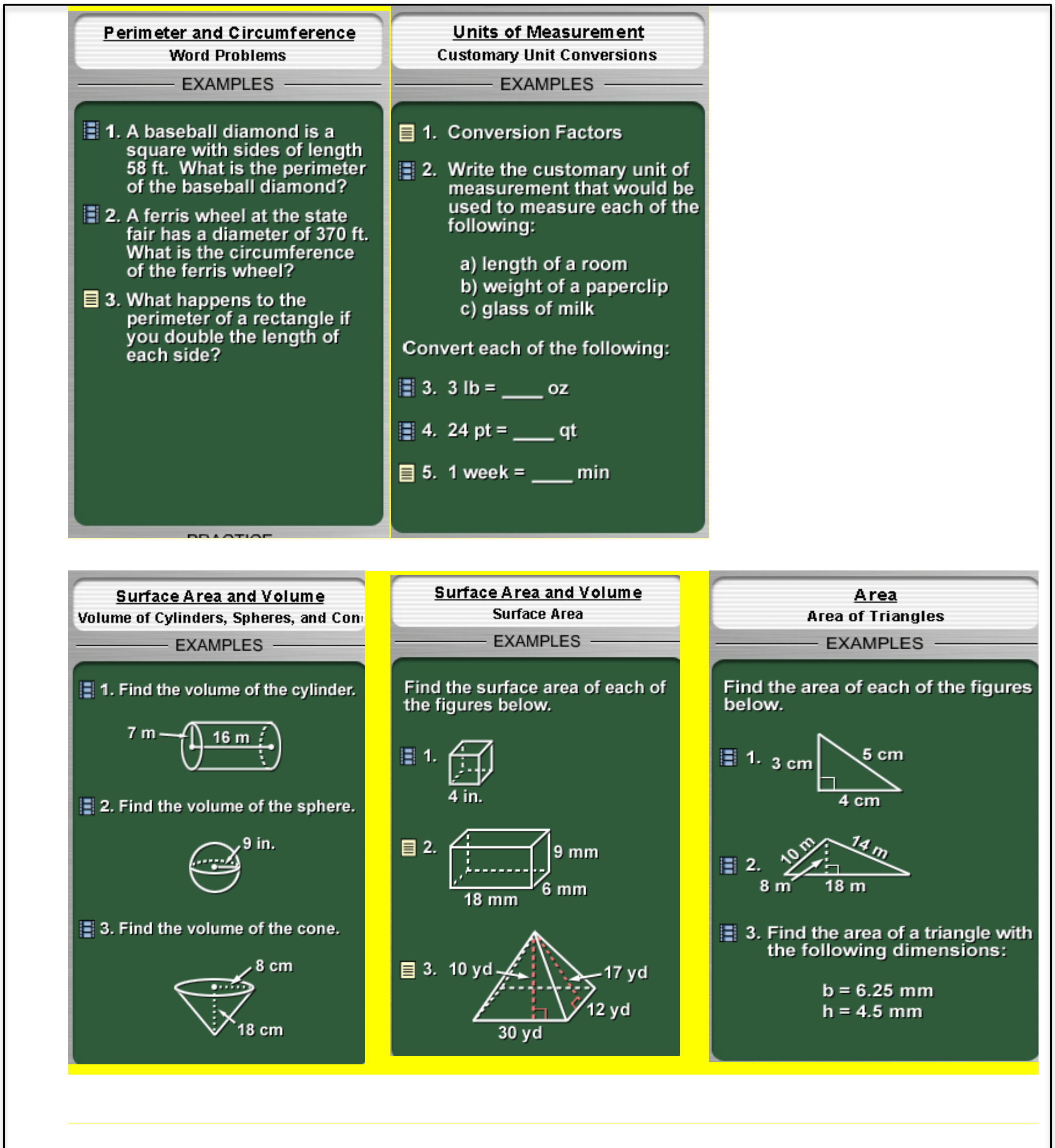

Figure: 11: 8th grade Measurement Examples from Math Practice Program

6.3 Digging Deeper

In March, 2012, I met with a smaller subset of the collaborative council, Algebra 1 teachers. The purpose was to review the previous graphs, determine if other types of data displays would be helpful, and make judgments about our Algebra 1 curriculum based on observations. One of the main concerns raised at that meeting was that we did not know the specific math background of the students in the independent-school group. These students are from independent schools; they are 8th grade students who take the same ERB test in the spring of their 8th grade year; but we do not know what math class these students were taking in their 8th grade year. As previously mentioned, we typically have 3 different levels of math available to 8th graders at Dunham. Gifted students take Algebra 1 honors in the 7th grade and Geometry honors in the 8th grade. Honors students take Algebra 1 honors in the 8th grade. College Prep students, our on-level group, takes Algebra 1A in the 8th grade and Algebra 1B in the 9th grade. Our Algebra 1A course is essentially the 1st semester of Algebra 1 honors, but taught over the course of two semesters.

As a result of this collaboration with the Algebra teachers, I sorted the 8th grade data based on the math track of our students. The following graphs, Figures 12 and 13 reveal more specific information. The blue bars, representing the gifted students, show the percent difference between our students enrolled in Geometry honors in 8th grade and the independent group as negative. This means that these students as a group outperformed the independent-school group in all categories. The honors group did not score as well as the independent-school group, and as expected, the college prep group was the lowest performing group. This comparison was made using the Math1&2 test data and also the Quantitative Reasoning test data.

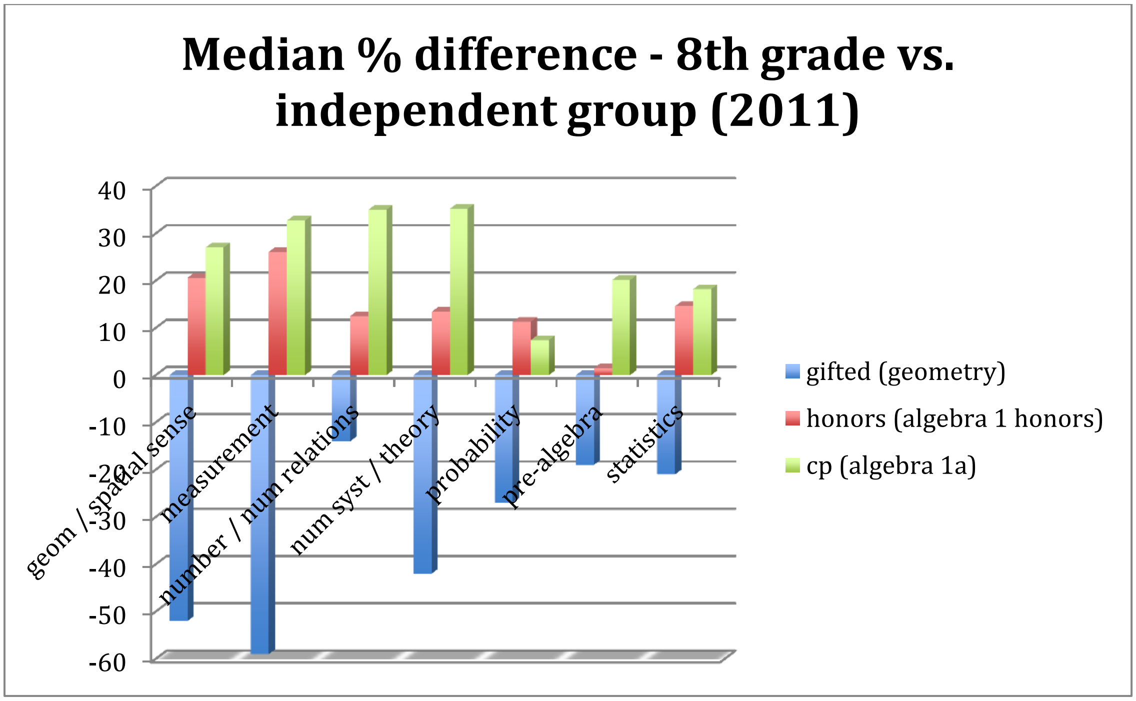

Figure 12: Median Percent Difference Between 8th Grade Groups and Independent-School Group, Math1&2 Test

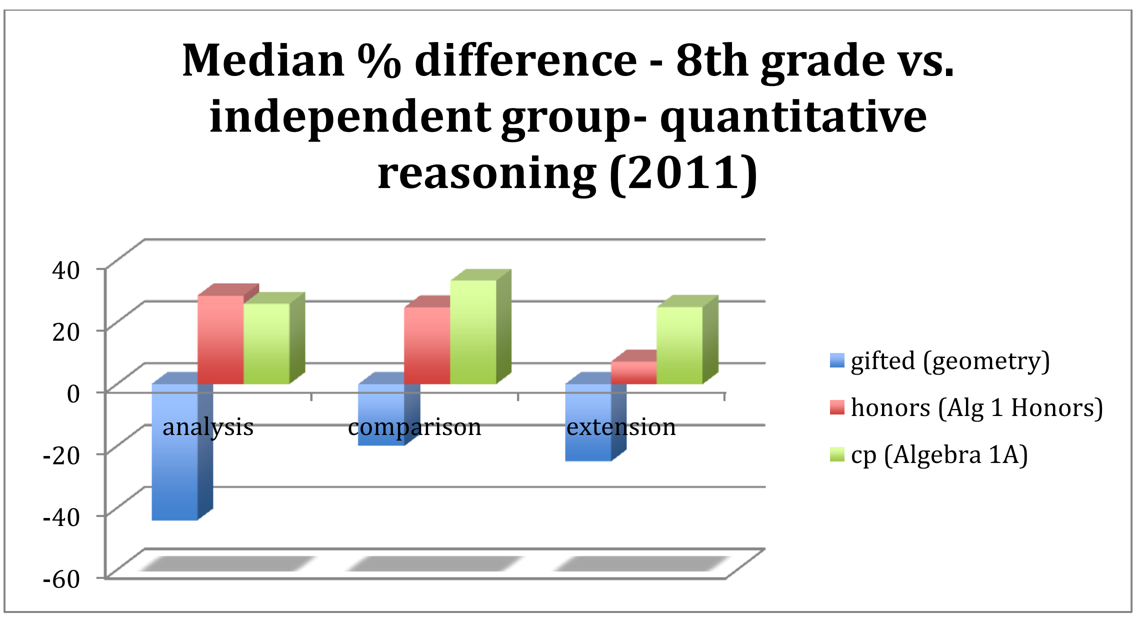

Figure 13: Median Percent Difference Between 8th Grade Groups and Independent-School Group, Quantitative Reasoning Test

It is not likely that the independent-school group is composed of a large number of students enrolled in geometry honors in the 8th grade. While we are very pleased that the gifted students performed well on the mathematics portions of the ERB test, we cannot make any conclusions regarding the Algebra 1 curriculum based on these students' results.

We can, however, use the data from the honors and the college prep classes to help guide us in selecting the weakest areas of our curriculum. We will use this information to help prioritize our curriculum revisions. The domains that will be a focus for the math department next year are measurement and geometry and spatial sense.

As demonstrated in this chapter, our team had a specific data source. We used a systematic procedure to deal with the data. I provided examples of how these procedures were implemented. The analysis of the data was then used as a foundation for recommendations. The recommendations will be discussed in the following chapter.

CHAPTER 7: MAKING CONCLUSIONS AND RECOMMENDATIONS – PART OF THE PROCESS

As previously stated, one of the major goals of the math department is to train teachers to teach conceptually, to understand the depth of the standards, and to move away from a textbook-driven approach of teaching to a standards approach. The collaborative inquiry process is our method of navigating towards this goal. Through this process, we have identified problem areas in our curriculum based on data and prioritized professional development and curriculum revisions based on our conclusions. We plan to continue the collaborative inquiry process with a focus on using standardized test data, providing evidence of classroom teaching and learning, and making curriculum improvements.

This chapter will discuss the conclusions and recommendations that our group made for the upcoming school year. Based on this study, the goals set for the upcoming school year can be categorized into 4 major items:

I. Summer math program for students

II. Updates to curriculum

III. Use of the on-line standardized test practice program

IV. Refine current initiatives

Each of these will be discussed below.

I. Summer math program for students

A common theme across all math teacher comments was the need to spiral review, but not re-teach. Teachers realize that too much time is spent at the beginning of each school year, and even throughout the year, reviewing and re-teaching skills that should be prerequisite knowledge for their courses. According to the National

Association for Summer Learning, students, on average, lose approximately two months of grade-level math skills during the summer if they do not participate in educational activities. Additional research shows that teachers often spend four to six weeks re-teaching material that was "lost" during the summer months. This lost time becomes more and more critical as students enter more challenging math classes in the middle and upper school grades.[1] As such, I spearheaded our new summer math program for middle and high school students. Details of the summer math program for students can be found in appendix G.

II. Updates to Curriculum

There are two significant findings in the study regarding curriculum. First, the curriculum maps are not used effectively to plan lessons. The second major finding was that the standardized test used at Dunham, the ERB, assesses some content that is not currently in our curriculum. These two findings resulted in three recommendations regarding curriculum. I will discuss these in turn.

A close review of the final exams given by the four algebra teachers reveals disparities between the classes, inclusion of material not in the curriculum, and omission of material that is in the curriculum. In three of the algebra classes, a unit was taught and tested on rational expressions and solving radical equations. Only one of the four thoroughly covered exponential functions, and it is not clear if students were ever presented with the opportunity to choose a model that correctly fits a given set of data.

Our curriculum reflects the Common Core Standard A.SSE.1a,1b, and 2, "Interpret the structure of expressions: Linear exponential, quadratic". In the traditional pathway of CCSS-M, this standard is applicable for Algebra 1, and as such, it was selected to be a part of Dunham's curriculum for Algebra 1. Recommendation #1 is:

Significant time needs to be devoted to training teachers in the model pathways for the CCSS. We will begin the school year inservice with a review of the CCSS-M, and teachers will create a year plan for the units they will teach in their respective courses, outlining the standards that are used in each unit. Recommendation #2: At the end of each quarter, teachers will submit a reflection and update on the standards and assessments used for that time period. These updates will also be discussed in the observation feedback meetings discussed earlier in this chapter.

The second major finding was that the standardized test used at Dunham, the ERB, assesses some content that is not currently in our curriculum. For example, questions on measurement involving the volume of cylinders, cones, and spheres are not part of our middle school curriculum. Students who are on the gifted track, in Geometry, at the time of the 8th grade ERB test will have been the only group of 8th grade students exposed to this content. Many of the skills tested in the measurement and number relationships category of the ERB are skills that may be appropriate in the 7th grade prealgebra curriculum. A preview of the resources from this summer's college readiness program at LSU indicates significant work with geometric constructions and solving problems with area, surface area, and volume. Recommendation #3: A detailed look at our 7th grade curriculum compared to the CCSS-M and the topics on the ERB test is necessary. This study / collaboration will begin this summer, and recommendations will be made to the Academic Dean prior to the beginning of the 2012-2013 school year.

III. Use of the on-line standardized test practice program

In the on-line math practice program for ERB, practice problems for grade 8 in the measurement category include calculating volume and surface area of cylinders, spheres, and cones. They include calculating the circumference of a circle and solving

application problems using circumference and perimeter. Measurement problems also included using the Pythagorean theorem to find the missing side length of a right triangle. To do this correctly, students need to understand how to simplify square roots and solve equations using square roots. Students are also required to find area of right triangles and areas of oblique triangles when the height of the triangle is given. Students must be able to compute unit rates. They must be able select appropriate units for given situations, and convert units from one form to another. These topics are not covered as a part of the 8th grade curriculum at my school. Many of the topics have been taught in previous years, and as discussed previously, many of the measurement topics may need to be considered in the 7th grade curriculum. Regardless of the decision to revise curriculum in earlier years, however, the math practice program can be used as a spiral review and to spark good discussion based on applications in the 8th grade classroom.

IV. <u>Refine current initiatives</u>

There are mission-focused initiatives already in place at the Dunham School. The results of this study can be used to refine the details of two such initiatives, including summer learning for teachers and classroom observation and feedback. These two activities are currently expectations of the school for the teachers. There is an opportunity to maximize the effectiveness of these initiatives when the details are aligned with the needs identified from the collaborative inquiry process.

This year, the curriculum dean charged department chairs with determining appropriate summer learning for each faculty member. In the math department, we have various activities going on this summer. While this was not a direct effect of this project, the choice of faculty summer learning for the math department was based on the results of this study. Some faculty members are attending workshops involving vertical teams,

college readiness, and common core resources, some are in school, and others are doing some suggested reading focused on reasoning and task development. I have assisted department members based on their upcoming teaching schedules with finding meaningful and appropriate professional development. Details of the summer learning for teachers can be found in Appendix H.

The second initiative that can be refined is the task of classroom observation and feedback. It is critical that the department chair has the time, opportunity, and obligation to observe and interact with each department member individually at least once per quarter. In the October department meeting, strategies were recommended for each grade level. Currently, there is little oversight, however, that these strategies are being implemented. Bi-annual classroom observations are already a required function of the department chair position. However, I found myself struggling to find a way to provide feedback to teachers that addressed the curriculum. The observations that I did were centered around general teaching practices, student engagement, and classroom management. The math department consists of 7 teachers, including the department chair. Each department member teaches at least 2 different preps. Three class periods should be reserved per teacher observation. Two of them will be used to observe different preps for each teacher, and the third will be used to provide feedback and mentoring. This type of rotation will take 6 weeks to complete, assuming the department chair can dedicate 3 class periods per week to this task. The remaining 3 weeks of the quarter would be used to meet in larger groups, professional learning communities, to collaborate, design tasks and activities, and cross-train team members. In previous years, the department chair did not have enough time dedicated to teacher observation and feedback. This suggestion was made to the administration this year, and the time has been made available for the

upcoming school year. I will teach during 4 class periods, and I will have the remainder of the day (4 class periods) to plan, observe, and mentor.

In summary, there are four areas that we identified or presented concerns. I have recalled the evidence that triggered the concerns, and have described the recommendations made. This is the evidence that the process was effective. Table 3 summarizes the recommendations from our collaborative inquiry team.

Table 3: Recommendations from the process

Category	**Recommendation**
I. Summer Math Program	1. Summer math requirement for all returning students in grades 5-12, and recommended for new students.
II. Updates to Curriculum	1. Train teachers in the CCSS model pathways. 2. Teacher reflections to include progress made towards standards and assessments.
III. Utilization of On-line Math Practice Program	1. Utilize program as a spiral review regardless of connection to current curriculum.
IV. Refine Current School Initiatives	1. Quarterly observations that address curriculum. 2. 3 weeks per quarter devoted to small group collaboration, designing tasks and activities, and cross-training team members. 3. Summer learning recommendations for teachers based on results of collaborative inquiry process.

CHAPTER 8: CONCLUDING THOUGHTS

The collaborative inquiry process was very helpful in getting the math department at my school to take ownership of student learning, to look more closely at what we teach, and how we teach, and to understand how data can inform decisions about our curriculum. We ran into difficulties with meeting attendance, due to department members having many school related obligations. I often had to meet with individuals outside of our regularly scheduled meeting or via email to get their input. This is a common issue in small schools; teachers often have many roles they must fulfill, such as coach, administrator, tutoring, other department meetings, and so on. To improve communication, and to maintain the vision of the process, I have created sample agenda templates and feedback forms. We will use these in the 2012-2013 school year as we repeat the process using 6^{th} and 7^{th} grade data. The forms to guide next year's collaborative inquiry process are attached in appendix I.

The use of data and the collaborative process has affected teacher attitudes towards department meetings in a positive way. Many teachers commented that the Math Day Away was the most useful meetings because they had a better understanding of the level of understanding and reasoning that was expected on standardized tests, and they learned new ways to address areas of concern in their own classrooms. These comments were followed up by reflections from teachers that included action items detailing how they would personally use the information that was presented. As a result of the process, teachers were empowered to contribute, collectively and individually their knowledge, skill, and experience.

In conclusion, my contribution to professional knowledge is showing that the collaborative process can be productive in an independent school, and this thesis demonstrates the steps so that the work may be reproduced.

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APPENDIX A– MATH DEPARTMENT ESSENTIAL QUESTIONS

The math department essential questions are questions that we want our students to continually ask during the course of the year. They are thought provoking and open ended.

The math department essential questions are:

a. In what real life situation would I use what I am learning?

b. What model or models should be used to represent a situation, and how do you determine which model it should be? Numerical, Graphical, Analytical, Verbal (NGVA)

c. How does this mathematical topic relate to what I've seen before or might see in the future?

d. Which tools can help me solve this problem, and how do I organize my information?

e. Can I communicate my findings accurately using appropriate terminology?

In addition, each teacher developed course specific essential questions. Essential questions were displayed in classrooms to remind teachers and students of the over-arching themes of each course.

APPENDIX B – ALGEBRA 1 CURRICULUM MAP

Unit Map 2011-2012
The Dunham School
Math, Department / Algebra I (C) / Grade 9 (Upper School)
Sunday, June 24, 2012, 9:00PM

Unit: Properties of Real Numbers (Review) (Week 1, 1 Week)

Stage 1: Desired Results

Standards
LA: CCSS: Mathematics, LA: Grade 8 , Mathematical Practice
The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: HS: Num/Quantity, Vector & Matrix Quantities
N-VM Perform operations on matrices and use matrices in applications.

- N-VM.8. (+) Add, subtract, and multiply matrices of appropriate dimensions.

Essential Questions

Content	Skills
• The real number line • Addition, subtraction, multiplication and division of real numbers • Adding and Subtracting Matrices • The Distributive Property	• Graph and compare real numbers using a number line • Use real-life applications to find the opposite and absolute values of numbers • Add/subtract real numbers using a number line and rules • Use addition/subtraction/multiplication/division to solve real-life problems • Organize data using matrices and add/subtract matrices (new) • Multiply/divide real numbers using properties • Use the distributive property to combine like terms • Combine like terms/simplify algebraic expressions

Stage 2: Assessment Evidence

Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

<< Previous Year

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Unit: Review of Algebra Concepts (Week 1, 1 Week)

Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: Grade 7 , The Number System

7.NS Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

- 7.NS.1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
- 7.NS.1a. Describe situations in which opposite quantities combine to make 0.
- 7.NS.1b. Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
- 7.NS.1c. Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- 7.NS.1d. Apply properties of operations as strategies to add and subtract rational numbers.

LA: CCSS: Mathematics, LA: Grade 8 , Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: Grade 8 , Functions

8.F Define, evaluate, and compare functions.

- 8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
- 8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
- 8.F.3. Interpret the equation y = mx + b as defining a linear function, whose graph is a

straight line; give examples of functions that are not linear. 8.F Use functions to model relationships between quantities. ▪ 8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. ▪ 8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	
Essential Questions	
Content • Variables in Algebra • Exponents and Powers • Order of Operations • Equations and Inequalities • Equations and verbal phrases • Functions • Graphing data from tables	Skills • Write and evaluate expressions • Check solutions to equations and inequalities using mental math • Using the order of operations to evaluate algebraic expressions • Use verbal and algebraic models to represent real-life situations • Translate verbal phrases into algebraic expressions • Use tables/graphs to organize data • Use functions to show the relationship between inputs and outputs • Graph data from input/output data
Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

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Unit: Linear Equations (Week 1, 1 Week)

Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: Grade 8 , Mathematical Practice
The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: Grade 8 , Expressions & Equations
8.EE Analyze and solve linear equations and pairs of simultaneous linear equations.

- 8.EE.7. Solve linear equations in one variable.
- 8.EE.7a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).
- 8.EE.7b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

LA: CCSS: Mathematics, LA: HS: Algebra, Seeing Structure in Expressions
A-SSE Interpret the structure of expressions.

- A-SSE.1. Interpret expressions that represent a quantity in terms of its context.★
- A-SSE.1a. Interpret parts of an expression, such as terms, factors, and coefficients.

LA: CCSS: Mathematics, LA: HS: Algebra, Creating Equations
A-CED Create equations that describe numbers or relationships.

- A-CED.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

LA: CCSS: Mathematics, LA: HS: Algebra, Reasoning with Equations & Inequalities
A-RE I Understand solving equations as a process of reasoning and explain the reasoning.

- A-REI.1. Explain each step in solving a simple equation as following from the equality of

numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. A-RE I Solve equations and inequalities in one variable. ▪ A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	
Essential Questions	
Content • Multi-Step Equations • Equations with Variables on Both Sides • Linear Equations and Problem Solving • Decimal Equations • Formulas and Functions • Rates, Ratios and Percents • Inductive and Deductive Reasoning	Skills • Solve Linear Equations using Addition/Subtraction/Multiplication/Division • Use linear and multi-step equations to solve real-life problems • Draw a diagram to help solve real-life problems • Use tables and graphs to check answers • Find exact and approximate solutions of equations that contain decimals • Solve formulas for a variable • Rewrite an equation in function form • Use rates, ratios, and percents to solve real-life problems • Identify and use inductive and deductive reasoning
Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

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Unit: Graphing Linear Equations (Week 1, 1 Week)

Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: Grade 8 , Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: Grade 8 , Functions

8.F Define, evaluate, and compare functions.

- 8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
- 8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
- 8.F.3. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F Use functions to model relationships between quantities.

- 8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- 8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

LA: CCSS: Mathematics, LA: Grade 8 , Statistics & Probability

8.SP Investigate patterns of association in bivariate data.

- 8.SP.1. Construct and interpret scatter plots for bivariate measurement data to investigate

patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. ▪ 8.SP.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. ▪ 8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. ▪ 8.SP.4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.
Essential Questions

Content	Skills
• Scatter Plots • Graphing Linear Equations • X and Y intercepts • Slope • Direct Variation • Slope-Intercept Form • Functions and Relations	• Draw a scatter plot and make predictions about real-life situations • Graph a linear equation using a table or a list of values • Graph vertical and horizontal lines • Find the intercepts of the graph of a linear equation • Use intercepts to make a graph of a linear equation • Find the slope of a line using 2 points • Interpret slope as a rate of change in real-life situations • Write linear equations that represent direct variation • Use a ratio to write an equation for direct variation • Graph a linear equation in slope-intercept form • Graph and interpret equations in a slope-intercept form that model real-life situations • Solve a linear equation graphically • Identify when a relation is a function

Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)

Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

<< Previous Year

Unit Map 2011-2012

The Dunham School

Math, Department / Algebra I (C) / Grade 9 (Upper School)

Sunday, June 24, 2012, 9:01PM

Unit: Writing Linear Equations (Week 1, 1 Week)
Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: Grade 8 , Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: Grade 8 , Functions

8.F Define, evaluate, and compare functions.

- 8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
- 8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
- 8.F.3. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F Use functions to model relationships between quantities.

- 8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- 8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Essential Questions

Content	Skills
• Slope-Intercept Form of a Linear Equation	• Use slope-intercept form to write the equation of a line

• Point-Slope Form of a Linear Equation • Standard Form of a Linear Equation • Trend Lines/Lines of Best Fit • Predicting with Linear Models	• Model a real-life situation with a linear function and model • Use slope and any point on a line to write an equation of the line • Write an equation of a line given 2 points • Determine positive and negative correlations • Use point-slope form to write and equation of a line • Write a linear equation in standard form • Determine whether a linear model is appropriate for a real life situation • Collect and analyze linear data using technology
Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

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Unit Map 2011-2012

The Dunham School

Math, Department / Algebra I (C) / Grade 9 (Upper School)

Sunday, June 24, 2012, 9:01PM

Unit: Linear Inequalities (Week 1, 1 Week)

Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: HS: Algebra, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: HS: Algebra, Reasoning with Equations & Inequalities

A-RE I Solve equations and inequalities in one variable.

- A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- A-REI.4. Solve quadratic equations in one variable.
- A-REI.4a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

A-RE I Represent and solve equations and inequalities graphically.

- A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
- A-REI.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Essential Questions

Content	Skills
• Linear Inequalities • Absolute-Value Equations and Inequalities • Graphing Linear Inequalities in 2 Variables	• Graph linear inequalities in one variable • Solve one-step/multi-step linear inequalities • Write, solve, and graph compound

	inequalities • Solve absolute value equations/inequalities • Graph a linear inequality in two variables
Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

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Unit: Systems of Equations and Inequalities (Week 1, 1 Week)

Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: Grade 8 , Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: Grade 8 , Expressions & Equations

8.EE Analyze and solve linear equations and pairs of simultaneous linear equations.

- 8.EE.8. Analyze and solve pairs of simultaneous linear equations.
- 8.EE.8a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- 8.EE.8b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.
- 8.EE.8c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

LA: CCSS: Mathematics, LA: HS: Algebra, Creating Equations

A-CED Create equations that describe numbers or relationships.

- A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

LA: CCSS: Mathematics, LA: HS: Algebra, Reasoning with Equations & Inequalities

A-RE I Solve systems of equations.

- A-REI.5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the

same solutions.

- A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A-RE I Represent and solve equations and inequalities graphically.

- A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

Essential Questions	
Content • Systems of Equations • Systems of Inequalities	Skills • Solve a system of linear equations by graphing • Model a real-life problem using a linear system • Solve a system of linear equations by substitution • Solve a system of linear equations by using linear combination • Choose the best method to solve a system of linear equations • Identify linear systems as having one solution, no solution, or infinitely many solutions • Solve a system of linear inequalities by graphing • Use a system of linear inequalities to model and solve a real-life situation
Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

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Unit: Exponents and Exponential Functions (Week 1, 1 Week)

Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: Grade 8 , Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: Grade 8 , Expressions & Equations

8.EE Work with radicals and integer exponents.

- 8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions.
- 8.EE.3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
- 8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

LA: CCSS: Mathematics, LA: HS: Algebra, Seeing Structure in Expressions

A-SSE Interpret the structure of expressions.

- A-SSE.1. Interpret expressions that represent a quantity in terms of its context.★
- A-SSE.1a. Interpret parts of an expression, such as terms, factors, and coefficients.
- A-SSE.1b. Interpret complicated expressions by viewing one or more of their parts as a single entity.

Essential Questions

Content	Skills
• Rules of Exponents • Scientific Notation	• Use properties of exponents to simplify exponential expressions

• Exponential growth and decay	• Use powers to model real-life problems • Evaluate powers that have zero and negative exponents • Graph exponential functions • Use the division properties of exponents to find a probability • Use scientific notation to represent numbers and perform operations • Use scientific notation to describe real-life situations • Write and use models for exponential growth • Graph models for exponential growth • Write and use models for exponential decay • Graph models for exponential decay
Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

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Unit Map 2011-2012

The Dunham School

Math, Department / Algebra I (C) / Grade 9 (Upper School)

Sunday, June 24, 2012, 9:01PM

Unit: Quadratic Equations and Functions (Week 1, 1 Week)

Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: Grade 8 , Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: Grade 8 , Expressions & Equations

8.EE Work with radicals and integer exponents.

- 8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions.
- 8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where *p* is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

LA: CCSS: Mathematics, LA: HS: Algebra, Seeing Structure in Expressions

A-SSE Write expressions in equivalent forms to solve problems.

- A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

LA: CCSS: Mathematics, LA: HS: Num/Quantity, The Real Number System

N-RN Extend the properties of exponents to rational exponents.

- N-RN.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

Essential Questions

Content	Skills
• Square roots	• Evaluate and approximate square

• Radicals • Quadratic equations • Graphs of quadratic functions and quadratic inequalities Discriminant	roots • Solve a quadratic equation by finding square roots • Use properties of radicals to simplify radicals • Use quadratic equations to model and solve real-life problems • Sketch the graph of a quadratic function • Use quadratic models in real-life settings • Solve a quadratic equation graphically • Use the quadratic formula to solve a quadratic equation • Use the discriminant to find the number of solutions of a quadratic equation • Solve real-life problems involving quadratics • Sketch the graph of quadratic inequality • Use quadratic inequalities as real-life models • Choose a model that best fits a collection of data
Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

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Unit: Polynomials and Factoring (Week 1, 1 Week)

Stage 1: Desired Results

Standards

LA: CCSS: Mathematics, LA: HS: Algebra, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

LA: CCSS: Mathematics, LA: HS: Algebra, Seeing Structure in Expressions

A-SSE Interpret the structure of expressions.

- A-SSE.1. Interpret expressions that represent a quantity in terms of its context.★
- A-SSE.1a. Interpret parts of an expression, such as terms, factors, and coefficients.
- A-SSE.1b. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- A-SSE.2. Use the structure of an expression to identify ways to rewrite it.

A-SSE Write expressions in equivalent forms to solve problems.

- A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
- A-SSE.3a. Factor a quadratic expression to reveal the zeros of the function it defines.
- A-SSE.3c. Use the properties of exponents to transform expressions for exponential functions.

LA: CCSS: Mathematics, LA: HS: Algebra, Arithmetic with Polynomials & Rational Functions

A-APR Perform arithmetic operations on polynomials.

- A-APR.1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

LA: CCSS: Mathematics, LA: HS: Algebra, Reasoning with Equations & Inequalities

A-RE I Solve equations and inequalities in one variable.

- A-REI.4. Solve quadratic equations in one variable.

Essential Questions	
Content • Operations with polynomials • Factoring polynomials • Degree of a polynomial	Skills • Classify polynomials by degree and number of terms • Add and subtract polynomials • Use polynomials to model real-life situations • Multiply two polynomials • Use polynomial multiplication in real-life situations • Use special product patterns for the product of a sum and a difference, and for the square of a binomial • Use special products as real-life models • Solve a polynomial equation in factored form • Relate factors and x-intercepts • Factor a quadratic expression of the x2+bx+c • Solve quadratic equations by factoring • Factor a quadratic expression of ax2+bx+c • Solve quadratic equations by factoring • Use special product patterns to factor quadratic polynomials • Use the distributive property to factor a polynomial • Solve polynomial equations by factoring
Stage 2: Assessment Evidence	
Assessments	Assessments (to be removed)
Stage 3: Learning Activities	
Resources	
Technology Integration	Commonly Used Applications

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Unit Map 2011-2012

The Dunham School

Math, Department / Algebra I (C) / Grade 9 (Upper School)

Sunday, June 24, 2012, 9:02PM

Unit: Data Analysis, Probability and Discrete Math (Week 1, 1 Week)

Stage 1: Desired Results

Standards

Essential Questions

Content	Skills
▪ Bar Graphs, Pie Graphs, Line Graphs,Box and Whisker Graphs ▪ Probability ▪ Measures of Central Tendency	▪ Determine what type of data display is appropriate for a situation ▪ Use technology to organize and display data using graphs (bar, pie, line) ▪ Determine the most appropriate measure of central tendency for a set of data based on its distribution and use technology to calculator 1 variable statistics ▪ Use technology to collect and organize data using box-whisker plots and use the plots to interpret quartiles and ranges ▪ Use simulations to estimate probabilites ▪ Define probability in terms of sample space, event and outcomes ▪ Use basic counting techniques to compute the number of outcomes ▪ Explain the relationship between probability and odds ▪ Explain the difference between experimental and theoretical probability ▪ Calculate single and multiple event probabilites ▪

Stage 2: Assessment Evidence

Assessments	Assessments (to be removed)

Stage 3: Learning Activities

Resources

Technology Integration	Commonly Used Applications

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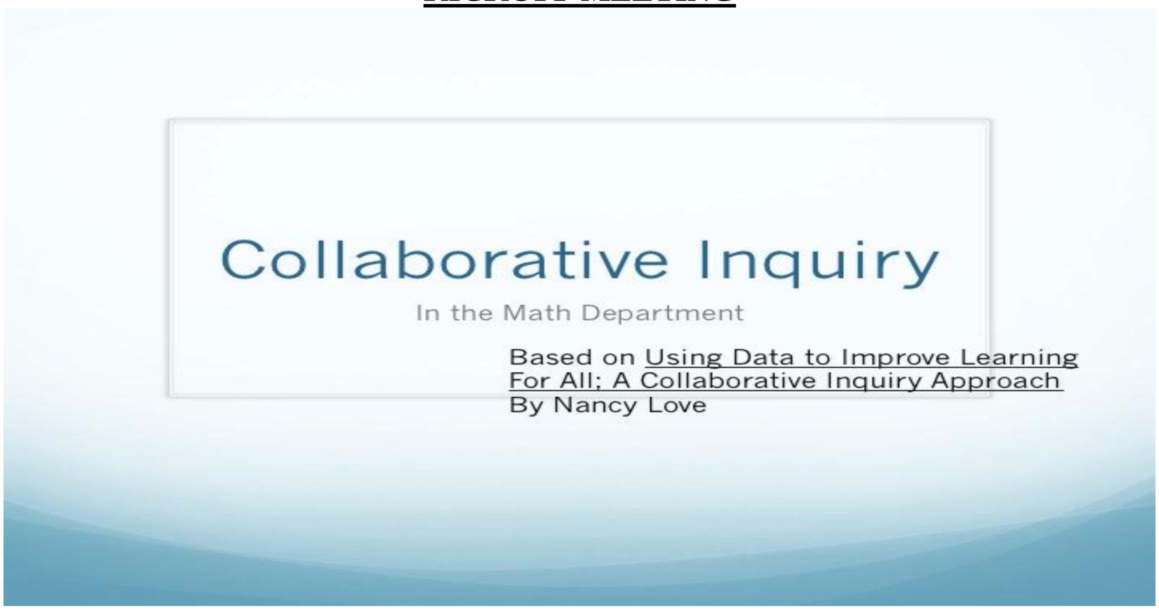
APPENDIX C – CURRICULUM GROUPING

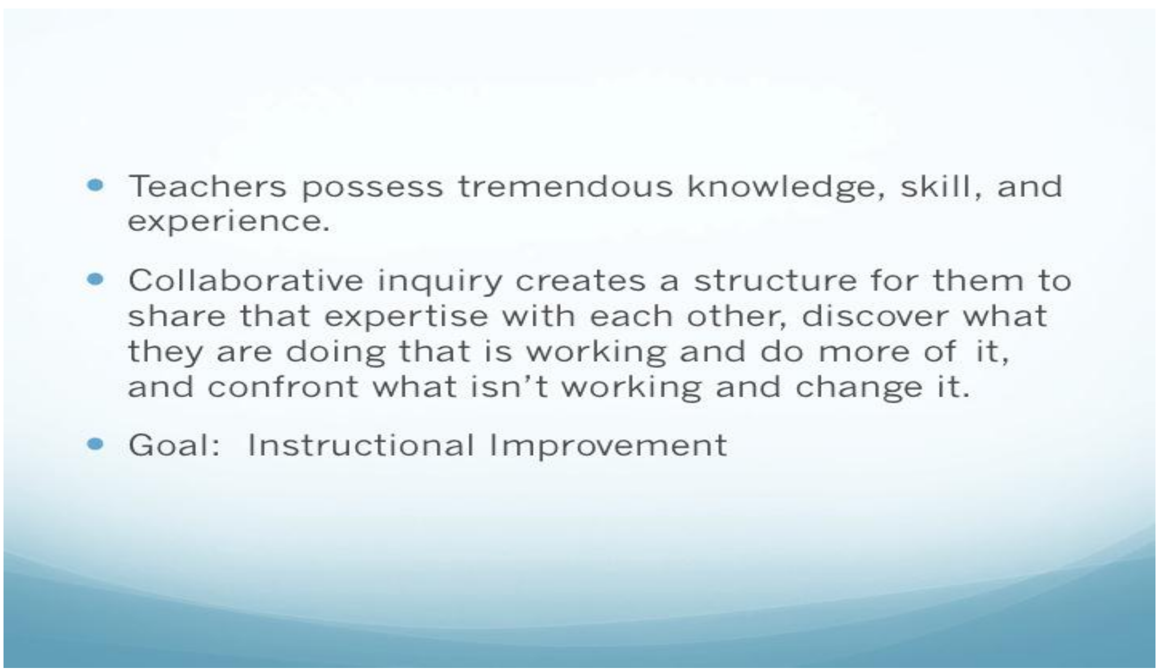
2nd grade – Everyday Math	**3rd grade– Everyday Math**	**4th grade– Harcourt**
• Money, time, place value – 10 wks • addition / subtraction - 7 wks • geometry – 3 wks • whole numbers (+/- ,×/÷)- 4 wks • measurement – 4 wks • statistics - ½ wk • number operations, patterns - 1-1/3 wks • fractions - 4 wks	• addition/subtraction whole numbers - 5 wks • linear measures and area - 3 wks • multiplication and division -9 wks • place value - 5 wks • Geometry - 3 wks • Fractions - 3 wks • measurement and data - 1-1/2 wks • statistics (data) - 1-1/2 wks	• place value - 2 wks • compare whole numbers - 2 wks • addition and subtraction -whole numbers - 2 • algebra - addition properties of equality - 2 wks • measurement (time) - 2 wks • multiplication and division (one and two digits) - 15 wks • algebra - multiplication properties of equality , order of ops - 2 wks • statistics (mean) - 1/2 wks • number theory (factors, multiples, squares, square roots) - 2 wks • Fractions - 3 wks • Geometry - 4 wks

5th grade – traditional	6th grade– traditional
• place value – 2 wks • subtraction – 4 wks • graphs (line, bar and plotting ordered pairs) – 2 wks • statistics (range, mode, median, histogram, stem and leaf) – 2 wks • multiplication (one to four digits)-3 wks • division (two digit divisors and decimals in dividend) – 3 wks • algebra (mult/div order of ops; properties of equality)- 1 wk • fractions (+/-, ×/÷)- 6 wks • number theory – 3 wks • geometry • integers (+/-) 1 wk • measurement (volume) - related to fraction unit	• problem solving with algebra and geometry (order of operations, exponents, equations) - 1-1/2 wks • decimals (fractions) - 3 wks • fractions, ratios, percent - 3-1/2 wks • patterns, probability - 1/2 wk • algebra with integers (number line, coord plane, transformations) - 4 wks • algebra - solving equations and inequalities; graphing (functions as ordered pairs and solutions of equations with 2 variables) • Using fractions with geometry and measurement; unit analysis - 4 wks • Fractions - proportional reasoning (ratios, rates, scale drawings) - 4 wks • Geometry - Area (irreg., triangles, trapezoids, circles) and Probability with area models - 5 weeks

7th grade – Prealgebra	8th grade– Algebra 1
• algebra - solving equations & inequalities properties of equality; order of operations - 4 wks • algebra with integers (number line, coord plane, - reasoning pattern) - 5 wks • equations and inequalities – mathematical modeling and graphing -3 wks • Geometry - perimeter and area - 1 wk • Fractions and factors (including exponents) - 4 wks • Real numbers • Geometry - sequences (Fibonacci and geometric) • Statistics (central tendency: mean, median and mode) • Ratios, proportions and percents (% increase, decrease) probability - 4 wks • Functions and graphs (scatter plots, point plotting, functions, slope, linear inequalities) - 4 wks • Irrational numbers (square roots – the real number system; pythag thm)-5 wks	• Real numbers • Properties of equality (problem solving; %, mixtures, reasoning) • Linear Equations (intercepts, slope, functions, forms of linear eqns) • Linear Inequalities • Absolute Value equations and inequalities • System of equations / inequal • Statistics (freq. dist, histograms, stem and leaf, measures of central tendency) • Polynomials (+.-,×) • Exponents; exponential growth and decay • factoring (solving quad eqns by factoring) • Radicals (simplifying and solving quad eqns by sq roots) • solving quad eqns by quad formula, sq root property, and graphing

APPENDIX D – COLLABORATIVE INQUIRY PRESENTATION – KICKOFF MEETING





Guiding Questions

- How are we doing?
- What are we doing well? How can we amplify our successes?
- Who isn't learning? Who aren't we serving? What aren't they learning?
- What in our practice could be causing that? How can we be sure?
- What can we do to improve? To deepen our knowledge of our content and how to teach it?
- How do we know if it worked?
- What do we do if they don't learn?

The Research Results

- Schools implementing collaborative inquiry not only improved student achievement on state tests and other local measures, they changes their school culture be increasing collaboration and reflection among teachers.
- Teachers increased the frequency with which they used multiple data sources and engaged in Data-Driven Dialogue, and they made improvement in their teaching response to data

Key Points to Success

- Distribute leadership and capacity
- Build collaborative teams
- Use data frequently and in depth
- Focus on instructional improvement
- Nurture a collaborative culture based on commitment to equity and trust

Data Use– Formative and Summative

- Individual class formative assessments: Student self-assessments, descriptive feedback to students, use of rubrics with students, multiple methods of checking for understanding, examination of student work such as math notebooks, tests and quizzes
- Common formative assessments: journals, notebooks – teams of teachers administer these assessments together and then meet weekly to analyze
- Benchmark common assessments –end of unit or quarterly
- Data about people, practices, and perceptions (demographic data, survey, observation, interview data)
- Summative data

Benchmark Common Assessment

- Administered by teachers teaching the same content, either at the same grade level or in the same subject or course.
- Should be closely aligned with the local curriculum
- Results should be reported on each individual item and the items themselves should be available for the teachers' examination
- Should include robust performance tasks that provide evidence of student thinking
- Multiple choice items should be analyzed item-by-item to uncover patterns in student choices and confusion underlying incorrect answer choices.

Instructional Improvement

- Keep conversation focused on improving instruction
- Establish ground rules for not blaming students, their circumstances, other teachers, or factors outside their control
- Use multiple data sources at the strand and item level to identify specific knowledge and skills student may be having difficulty with
- Use national (and local) standards and misconceptions research to deepen teachers' content knowledge about the particular content or skill students are struggling with, thereby enhancing teachers' ability to analyze the work for student thinking and misconceptions

Summative Assessment Data

- Analyze in as much detail as possible
- Aggregated and disaggregated
- Data trends
- Strand or content domains
- Item-level data
- Use to set annual improvement targets

Generating inferences

- Are our learning goals, instruction, and assessment aligned?
- Did we teach this concept/skill? Did we teach it in enough depth? At the appropriate development level? In the best sequence?
- Did we use appropriate and varied instructional strategies to meet each student's needs?
- Did we use quality questions to extend student thinking?
- Did we use formative assessment data to give students feedback on their own learning and to identify student confusion and refocus our teaching?

Cont'd

- Did all students have access to this content and best practice?
- What content knowledge and pedagogical content knowledge will strengthen our ability to teach this content?
- Did we apply principles of cultural proficiency toa assure the best learning opportunities for culturally diverse learners?

APPENDIX E – AGENDA FOR MATH DAY AWAY MEETING

MATH DAY AWAY
JANUARY 13, 2012
8AM – 2:30PM

8:00-9:15 CURRICULUM PROGRESS AND MEASUREMENT

- *What do our Summative Assessments actually test? Comparing Assessments to Curriculum Goals, Part 1*

9:15-9:30 Break

9:30 – 12:00 INDIVIDUAL TEACHER PRESENTATIONS
Strengthening our Weaknesses

- *Mental math and Reasoning: Erin Bailey*
- *Solving Word Problems: Singapore Math: Cheryl Causey*
- *Functions: Fallon Lambert*
- *Google Earth: Curtis Tupper*
- *Polynomial Functions; NAGV connections: Deborah Koch*
- *Multiplying and Dividing Fractions using paper strips: Laura Heroman*
- *Modeling Linear functions with technology –for multiple grade levels: Beth McInnis*
- *Number sense – integers and exponents: Joey Thibodeaux*
- *Project Based Learning Assessments: Amanda McIllwain*

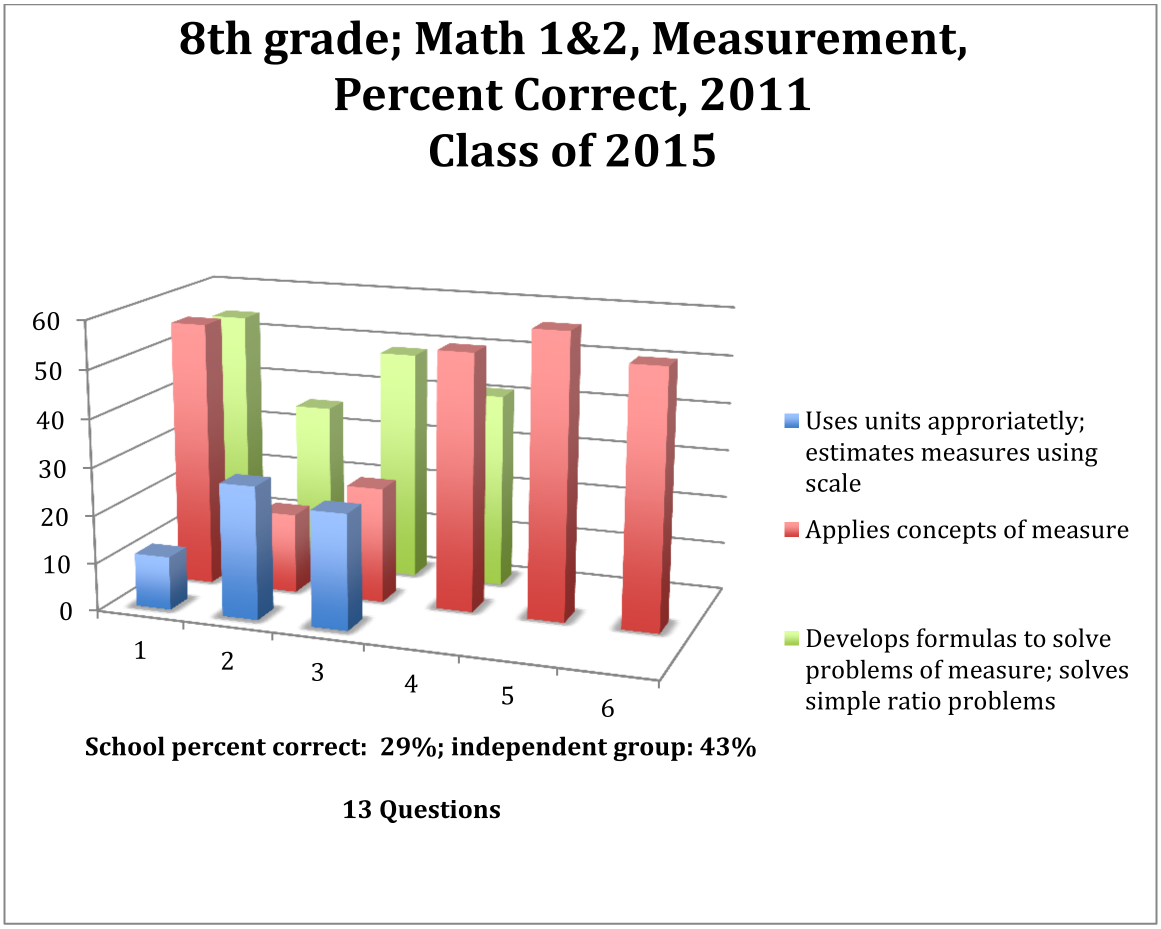
12:00 – 12:45 Lunch

12:45-1:45 Evaluation of Test Results: ERB, PSAT, ACT

1:45-2:30 Action Item Planning and 2nd semester Adjustments -Professional Development

APPENDIX F – GRAPHS AND OBSERVATIONS FOR REMAINING DOMAINS

Students answered fewer questions correct in the measurement domain than in any other domain.

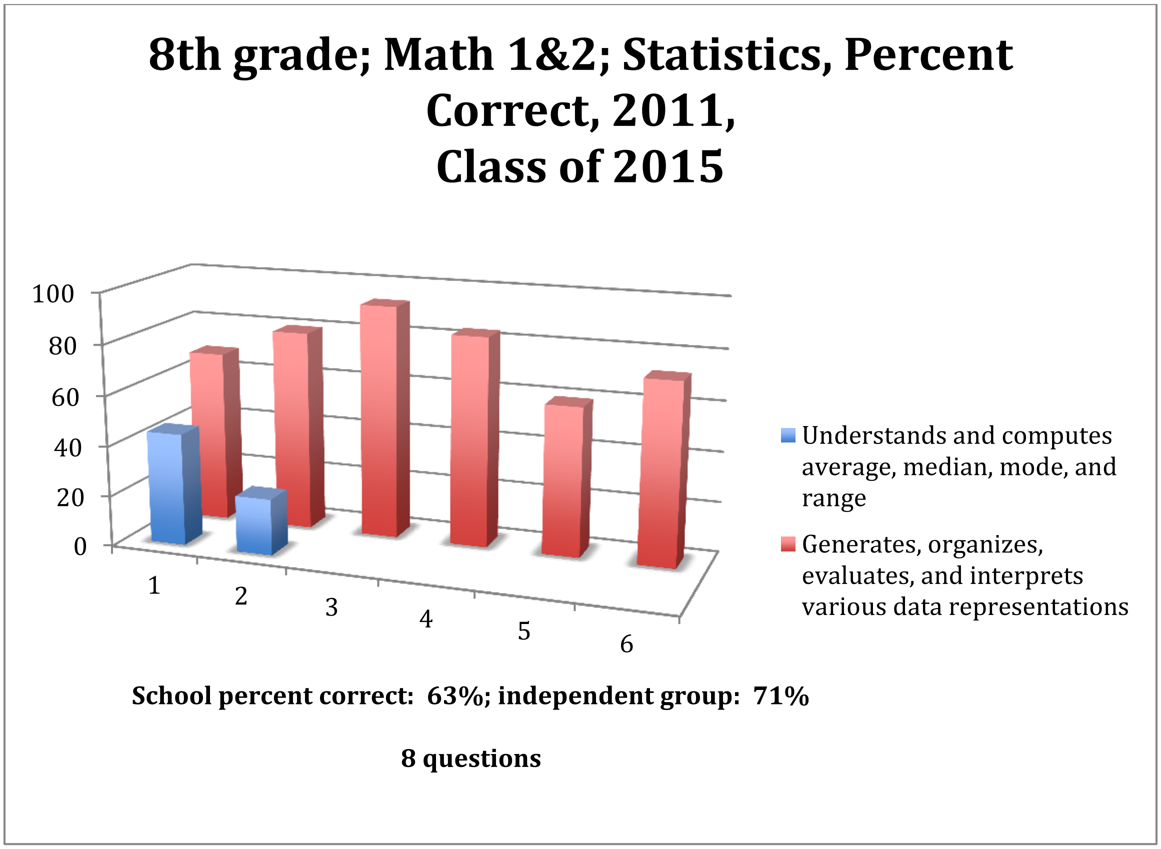


In the measurement domain, there are several concepts that are not taught in 8th grade or the preceding years. For example, knowing specific unit conversions are not part of the math curriculum, but using given conversions is a part of the math curriculum. The ERB includes conversions in time, length, weight, and liquid volume. Students are tested on their knowledge of length conversions between feet, miles, yards, and inches. Time conversions include seconds, minutes, hours, days, weeks, months and years. Weight conversions include pounds, ounces, and tons. Liquid volume conversions

include pints, quarts, and fluid ounces. It would not be difficult to include these items in the curriculum; the appropriate place to do so is the second unit of Algebra 1. Unit rates and proportions appear in the Common Core State Standards as early as 6^{th} grade. By the 7^{th} grade, students are expected to be able to compute unit rates with ratios of fractions. They are also expected to be able to represent proportional relationships by equations. The main area of weakness from the 8^{th} grade ERB test that is not addressed in middle school curriculum at this time is the application of the measurement of figures, particularly surface area and volume of three-dimensional figures including prisms and pyramids. This content is part of the Common Core State Standards in 7^{th} grade, but it is not reflected in my school's middle school curriculum.

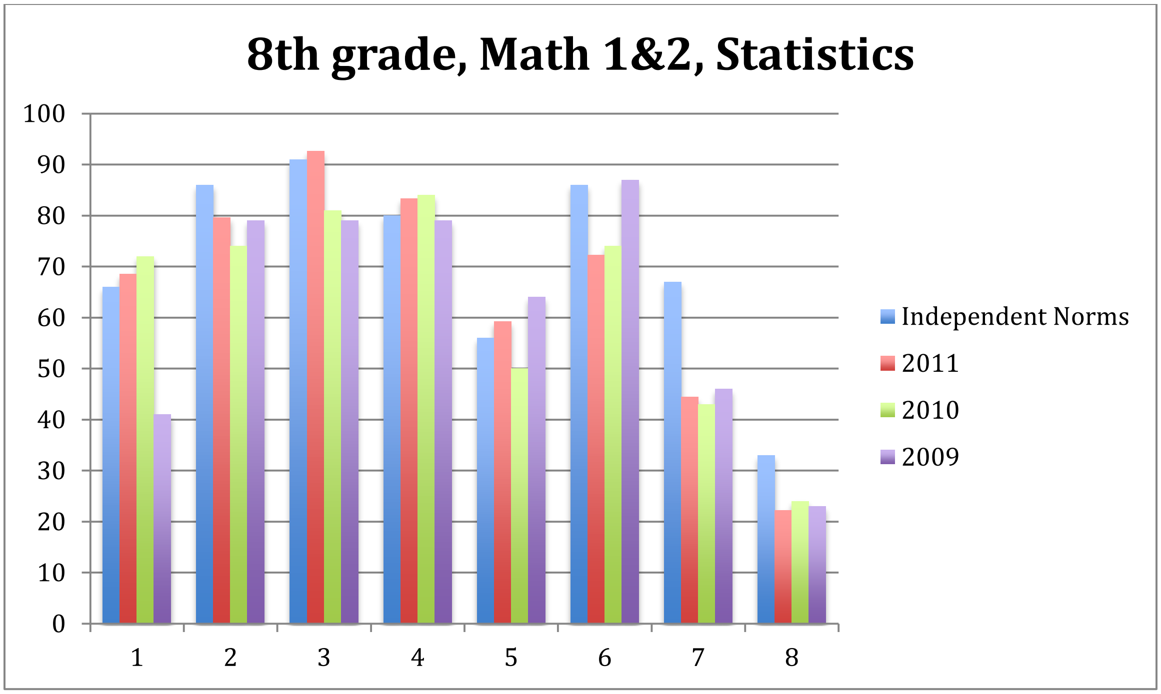
The next content domain tested on the ERB is Statistics. Our 8^{th} grade answered more questions correctly in this domain than in any other, 63%.
Our students did very well with the graphical questions. The skill tested included reading, interpretting, generating and organizing various types of graphs, including bar charts, single and double line graphs, circle graphs, histograms, stem and leaf plots, pictoral graphs, and tables. Our 8^{th} graders correctly answered 76% of these questions correctly. There has been an empahsis on graphical representations in the math department for since 2008. This emphasis was a result our high school science teacher recognizing this weakness in science classes and on high school ACT scores in science. In our math department meetings, it is standard practice discuss and share relevant examples.

A different type of display was made for all of the domains, based on last 3 years of our school's data compared to the independent-school group. The graph below shows the results of the 8^{th} grade scores in Statistics for the past three years, as well as the



independent-school group reslt. There are 8 total questions in this domain. They are not sorted by cluster. The blue bar represents the perent correct for each question in this domain of the Independent-school group; the red bar is the percent correct of the 8th graders tested in April 2011; the green bar is the percent correct of the 8th graders tested in April 2010, and the purple bar is the percent correct of the 8th graders tested in April 2009. This type of display would be helpful in identifying the impact of curriculum revisions.

The last two questions, identifed as 7 and 8 on this graph deal with average, median, mode, and range concepts. Our students scored 44% and 22% correct on these two problems, indicating the need to continue discussions of these measures of central



tendency during the 8th grade. These concepts have been taught in earlier grades, but they should be extended in the 8th grade to include applications and conceptual problems. Examples of these questions are shown below.

Example 1: A group of students was asked how many "best friends" they had. The results showed 3 had 0 "best friends", 6 had 1 "best friends", 6 had 2 "best friends" and 5 had 3 "best friends". Find the mean number of "best friends".

Example 2: The table below shows the prices and quantities of items needed for the family reunion picnic. If 5 cases of drinks are added at a price of $5.10 each, how will that change the mean?

Item	Price ($)	Quantity
Hot Dogs	2.40	8
Buns	1.80	10

Mustard	1.50	2
Relish	1.80	1
Chips	3.30	3
Brownies	3.20	6

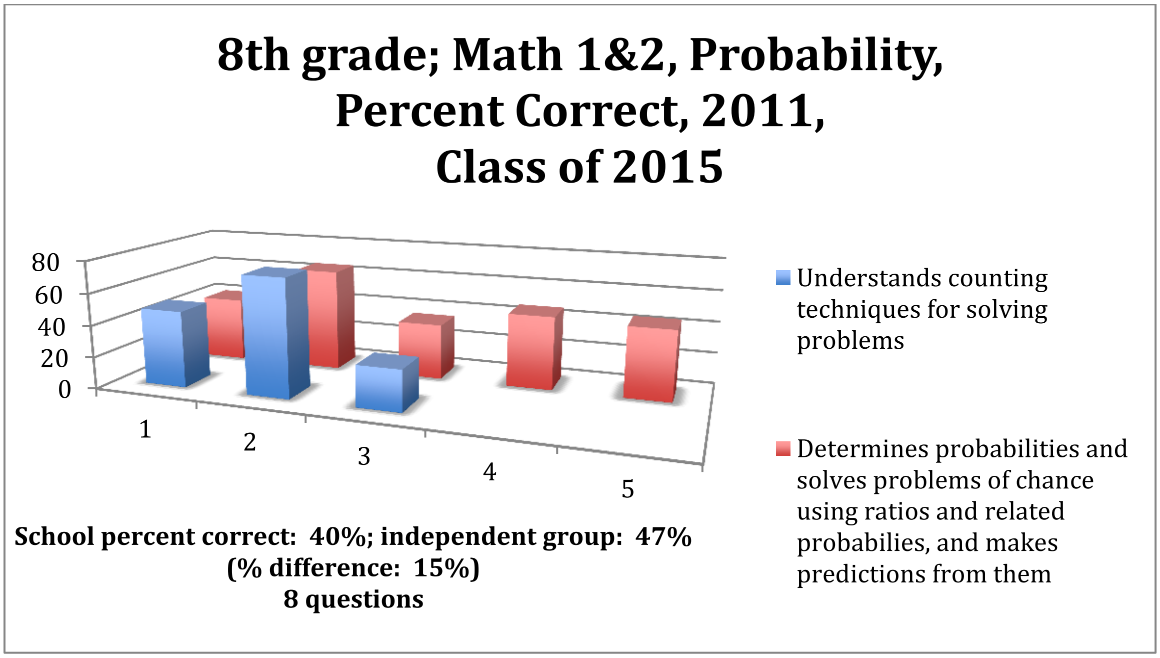
An action item from the review this information is to verify that classroom assessments provide students with the opportunity to solve problems similar to these, which provide more opportunity for reasoning as opposed to finding the measures of central tendancy of a set of given numbers.

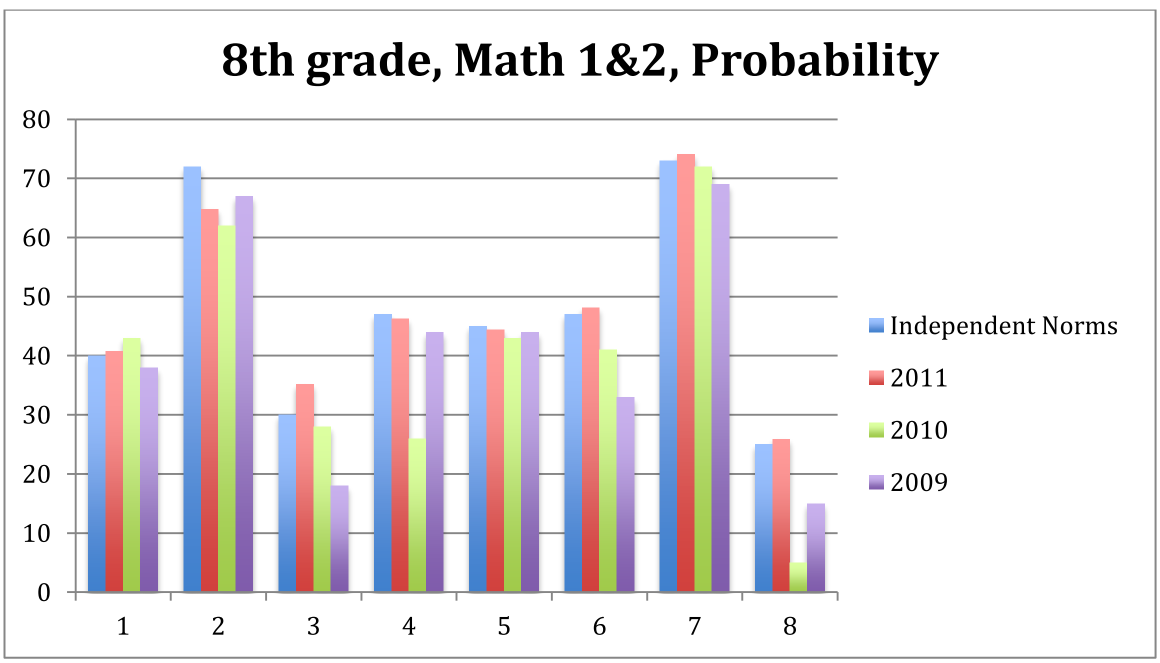
The probability and statistics content tested on the 8^{th} grade ERB is material that is part of the 8^{th} grade curriculum at The Dunham School. Most of the questions on the ERB probability section relate to computing probability of independent and dependent events.

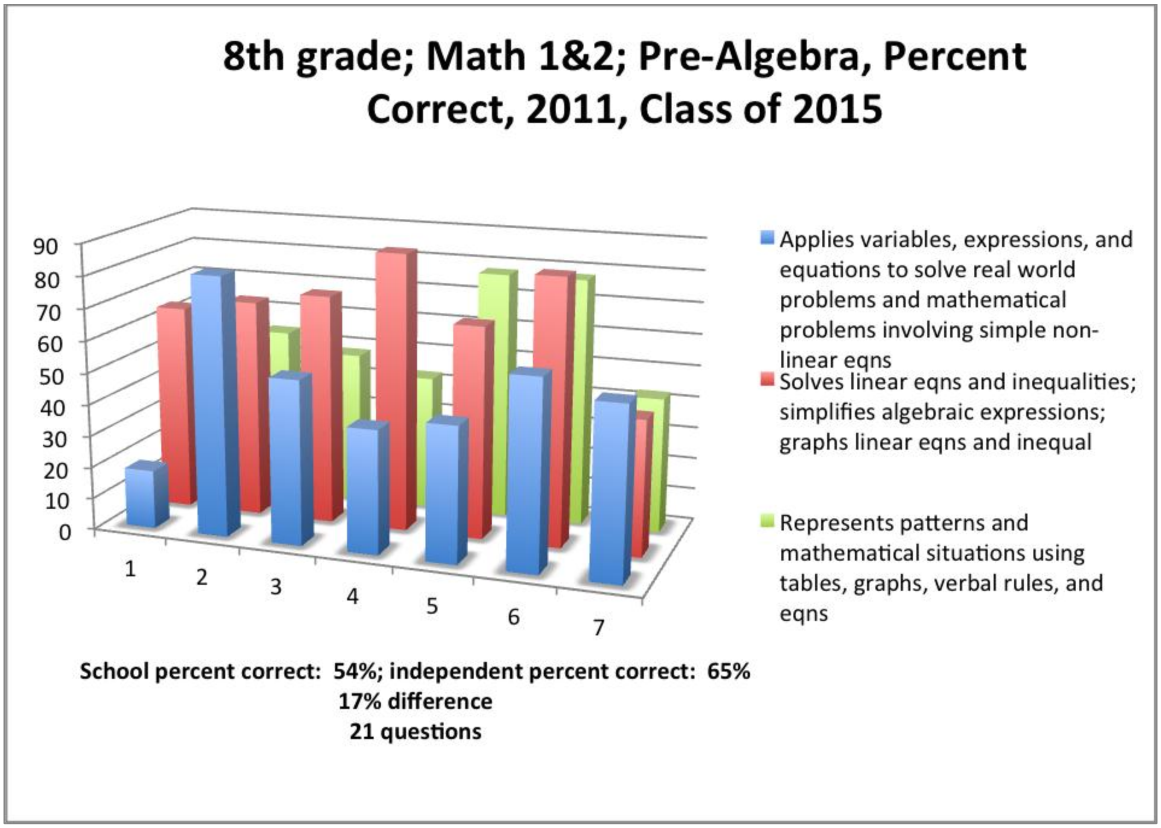
The three-year trend (below) indicates that there has been improvement in this area over the last three years. In prealgebra, our students scored the highest on basic equation and inequality solving. There is a considerable amount of time spent on this topic both in prealgebra (7^{th} grade math) and in algebra (both Algebra 1A and Algebra 1 honors). Our students answered 69% of these questions correctly. The weakest area was the application of variables, expressions, and equations (both linear and non-linear) to solve real-world problems and formulate equations from word sentences.

The Quantitative Reasoning tests assess students on analysis, comparison and extensions. Our 8^{th} graders scored 15-22% below the independent group in these categories, with the highest percent correct in the analysis category. Analysis includes

interpretation of algebraic representation and the evaluation and interpretation of probabilities.






8th grade; Math 1&2; Pre-Algebra, Percent Correct, 2011, Class of 2015
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
Applies variables, expressions, and equations to solve real world problems and mathematical problems involving simple non-linear eqns
Solves linear eqns and inequalities; simplifies algebraic expressions; graphs linear eqns and inequal
Represents patterns and mathematical situations using tables, graphs, verbal rules, and eqns
School percent correct: 54%; independent percent correct: 65%
17% difference
21 questions

APPENDIX G – SUMMER MATH PROGRAM FOR STUDENTS

Rising 5th and 6th grade students will complete math packets that have been created for them by the current 5th and 6th grade teachers. The 5th grade packet focuses on single and multi-digit multiplication and division of integers. The 6th grade packet includes addition, subtraction, multiplication and division with decimals, ordering and naming of decimals, solving simple equations, division with 3-digit dividends, and problem solving.

Middle school students entering Pre-algebra, Algebra 1A, and Algebra 1 honors are utilizing an on-line diagnostic program called catch-up math. High school students are utilizing MathXL for their summer math. The goal of our summer program is:

1) Ensure that students maintain the prerequisite skills that are needed for their upcoming math classes.
2) Provide extra practice for students that need extra through an individualized tool.
3) Allow students who are stronger in math to complete the activities in less time than students who are not as strong.
4) Provide students the opportunity to start the school year on a positive note. The work they have completed over the summer will count as their first grade of the new quarter.

It is anticipated that the average student will spend approximately 20 minutes, 3 times per week working in the program. The 7th and 8th grade summer math assignments were designed to address the concern of re-teaching fraction and decimal calculations each year and to re-enforce number systems and number relationships. The catch-up math program assigned to this group of students is a review of 5th and 6th grade math

content. It is considered a subject proficiency course that contains 6 sections. The content in each section is listed in the following table.

Section 1	Adding and Subtracting Decimals Adding and Subtracting Fractions Adding and Subtracting Negatives Basic Operations Converting Fractions to Decimals Equivalent Fractions Evaluating Expressions Integers Mean, Median and Mode Rectangle Simplest Form Word Problems Involving Integers
Section 2	Adding and Subtracting Decimals Adding and Subtracting Fractions Adding and Subtracting Negatives Basic Operations Irrational Numbers Least Common Denominator (LCD) Mixed Numbers Order of Operations Percents Percents and Decimals Prime and Composite Numbers Rational Numbers Simplest Form of a Fraction Square Square Roots

Section 3	Adding and Subtracting Fractions Adding and Subtracting Negatives Basic Operations Comparing Fractions Converting Fractions to Decimals Exponents Greatest Common Factors Improper Fractions Least Common Denominator (LCD) Mixed Numbers Multiplying and Dividing with Negatives Order of Operations Percent Prime Factorization Simplest Form of a Fraction
Section 4	Distributive Property Dividing by a Fraction Exponents Multiplying a Fraction by a Fraction Order of Operations Prime and Composite Numbers Quadrants Range of Data Reciprocals Simplest Form of a Fraction Solving Equations Variables Word Problems

Section 5	Adding and Subtracting Fractions Dividing by a Fraction Divisibility Tests Graphing on the Coordinate Plane Least Common Denominator (LCD) Median Mixed Numbers Multiplying a Fraction by an Integer Percent Prime Factorization Rounding Numbers Simplest Form of a Fraction
Section 6	Dividing by a Fraction Least Common Denominator (LCD) Mixed Numbers Multiplying a Fraction by an Integer Multiplying and Dividing with Decimals Multiplying and Dividing with Negatives Percent Rates and Ratios Simple Interest Simplest Form of a Fraction Square Square Roots

The learning material in the catch-up math program includes:

- Short written lessons
- Tutorial videos
- Interactive exercises
- Required practice problems and activities
- Extra practice problems and activities
- Flashcards for basic skills
- Math-related games

The students are instructed to complete the assignments without the use of a calculator.

The program begins with a quiz, and following the quiz, there are "required problems"

for the student to review / complete based on the questions missed on the quiz. If there are no problems missed, the program will automatically move the next section. Once the 6 sections of the Essentials course are completed in catch-up math, the program automatically reassigns the student to the next course, pre-algebra. The summer assignment is officially completed, but students do still have the opportunity to continue working in catch-up math at the higher level.

Students entering Algebra 1 B and higher will be working in MathXL for their summer assignment. The format for each course is the same: 6 quizzes and 6 homework / practice assignments. Students begin with quiz 1. After submitting quiz 1, the student will work on "Practice what I missed on quiz 1". Students may re-take quizzes after working on the "Practice what I missed" assignment. The "Practice what I missed" assignment is diagnostic. It will automatically assign problems based on what was missed on the quiz. To move onto the next quiz, the student must score a minimum of 70% on the quiz and 90% on the practice what I missed assignment. Once the required score has been made on the quiz and homework, the student may progress to the next quiz. In addition to the mathxl assignment, students entering AP Calculus must also complete a math packet to be turned in on the first day of class.

APPENDIX H – SUMMER LEARNING FOR TEACHERS

The 5^{th} and 6^{th} grade math teacher, a new teacher with 1 year experience, will be reading *Good Questions; Great Ways to Differentiate Mathematics.* The book focuses on open-ended questions and parallel tasks. The goal of the strategies is to provide inclusive learning conversations that promote broader student participation and mathematical thinking required by CCSS. Specific strategies and examples for each grade band are organized around NCTM content strands: Number and Operations, Geometry, Measurement, Algebra, and Data Analysis and Probability.

The pre-algebra and Algebra 1 honors teacher along with the pre-AP precalculus teacher will be attending the local AP Institute this summer to study pre-AP math. The goal of the training is to provide training in vertical teaming.

The Algebra 1A and Algebra1B teachers will be reading a book that I have purchased for the math department from NCTM entitled *Rich and Engaging Mathematical Tasks: Grades 5-9 .* This goal of this selection is to help us build more conceptual learning and reasoning into middle school and our Algebra 1 A and B courses. The first chapter discusses the benefit to combining procedural knowledge with tasks that require reasoning and application. Specific lessons that can be used in the classroom are given in each chapter.

The book is broken down into 7 chapters based on content strand, and there are multiple activities / tasks provided for each of these. The content strands are:

1- The meaning of, and operations on rational numbers

2- Ratios, Rates, and Proportional relationships

3- Numbers and number theory

4- Patterns and Functions

5- Linear Equations

6- Measurement

7- Geometry

8- Statistics

Each teacher will choose two tasks to implement in the first quarter of next year. One of the tasks will be presented to the math department at our inservice department meeting in August.

The geometry and Algebra 2 teacher will be attending the College Readiness training at Louisiana State University this summer. At the training, new resources will be introduced, and teachers will receive training on using the newly aligned resources. The resources have been updated to align with the Common Core State Standards.

Finally, I will be completing my graduate studies at LSU, and also attending an AP Institute for BC Calculus.

APPENDIX I – COLLABORATIVE INQUIRY PROCESS FORMS

COLLABORATIVE INQUIRY TEAM

NAME	TITLE
1.) ____________________	____________________
2.) ____________________	____________________
3.) ____________________	____________________
4.) ____________________	____________________
5.) ____________________	____________________
6.) ____________________	____________________
7.) ____________________	____________________

MEETING SCHEDULE

AUGUST __________ KICKOFF	JANUARY __________ - DAY AWAY
SEPTEMBER __________	FEBRUARY __________
OCTOBER __________	MARCH __________
NOVEMBER __________	APRIL __________

SAMPLE MEETING AGENDAS

1ST MEETING – AUGUST

1.) Review Collaborative Inquiry process
2.) Establish Team
3.) Set meeting dates for the year
4.) Review curriculum process, prior year's progress, and any process changes / updates
5.) Review summer professional development and discuss how this ties into collaborative inquiry process
6.) Display and discuss new data graphs; identify questions from graphs
7.) Set goals for meeting #2

2nd MEETING – SEPTEMBER

1.) Review action items from meeting #1
2.) Discuss early observations of student strengths and weaknesses
3.) Update graphs and charts
4.) Establish action items for research-based solutions
5.) Set goals for meeting #3

3RD MEETING – OCTOBER

1.) Report on 1st quarter assessments
2.) Report on curriculum progress
3.) Continue discussion on observations of student strengths/ weaknesses
4.) Review action items from meeting #2
5.) Plan professional development to address concerns
6.) Set goals for meeting #4

4th MEETING – NOVEMBER

1.) Review action items from meeting #3
2.) Correlate test results with curriculum
3.) Establish action items for research based solutions and day away presentations (Day Away presentations should be based on developing curriculum unit(s) based on the inquiry process and the Common Core State Standards.)

APPENDIX J – IRB APPROVAL FORM

Unless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research/projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

Institutional Review Board
Dr. Robert Mathews, Chair
131 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.6792
irb@lsu.edu
lsu.edu/irb

– Applicant,Please fill out the application in its entirety and include the completed application as well as parts A-E, listed below, when submitting to the IRB. Once the application is completed, please submit two copies of the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at http://research.lsu.edu/CompliancePoliciesProcedures/InstitutionalReviewBoard%28IRB%29/item24737.html

– A Complete Application Includes All of the Following:
- **(A)** Two copies of this completed form and two copies of part B thru E.
- **(B)** A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1&2)
- **(C)** Copies of all instruments to be used.
  - *If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
- **(D)** The consent form that you will use in the study (see part 3 for more information.)
- **(E)** Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (http://phrp.nihtraining.com/users/login.php)
- **(F)** IRB Security of Data Agreement: (http://research.lsu.edu/files/item26774.pdf)

1) Principal Investigator: Sheri Goings **Rank:**

Dept: **Ph:** 225-281-9145 **E-mail:** sheri.goings@dunhamschool.org

2) Co Investigator(s): please include department, rank, phone and e-mail for each
*If student, please identify and name supervising professor in this space

IRB# E 6023 LSU Proposal #
✓ Complete Application
✓ Human Subjects Training

3) Project Title: Using a Collaborative Inquiry Process and Data to Affect Curriculum in an Independent School

Study Exempted By:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/irb
Exemption Expires: 6/24/2015

4) Proposal? (yes or no) no **If Yes, LSU Proposal Number**

Also, if YES, either ◯ **This application completely matches the scope of work in the grant**
OR ◯ **More IRB Applications will be filed later**

5) Subject pool (e.g. Psychology students) 8th grade students

*Circle any **"vulnerable populations" ~~to be used~~**: (children <18; the mentally impaired, pregnant women, the ages, other). Projects with incarcerated persons cannot be exempted.

6) PI Signature Sheri Goings **Date** 6/12/12 (no per signatures)

**** I certify my responses are accurate and complete.** If the project scope or design is later changes, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

Screening Committee Action: Exempted ✓ Not Exempted ____ Category/Paragraph 4

Reviewer Mathews **Signature** Robt C Mathews **Date** 6/25/12

Sheri Goings Wednesday, June 20, 2012 9:08:38 PM Central Daylight Time

VITA

Sheri Lyn Pastor Goings was born in New Orleans, LA to Anthony Pastor and Suellyn Elliott Dowell. She is the youngest of three children. She graduated from Louisiana State University with a Bachelor of Science in Mechanical Engineering in May 1993. She is married to Troy Wayne Goings, and is the mother of Dylan James Goings and Justin Luke Goings. She received her teaching certificate through the Alternative Certification Program at Louisiana State University in 2003. She has taught Algebra 1 and 2, Advanced Math, Pre-calculus and AP Calculus. Her teaching experience includes Parkview Baptist School, Lexington Christian Academy, and The Dunham School. She is currently the Math Department Chair and teaches mathematics at The Dunham School in Baton Rouge.