A VOCABULARY ANALYSIS OF THE NEW YORK STATE 2017 MATHEMATICS ASSESSMENT CONSTRUCTED RESPONSE QUESTIONS (GRADES 6-8)

by

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CERTIFICATION OF THESIS/PROJECT CAPSTONE WORK

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ABSTRACT

Reports of New York State Mathematics assessment results from the New York State Department of Education indicate that across the state only 40.2% of students 3rd grade - 8th grade received a proficient score on the 2017 mathematics assessment. The goal of NYS is to have 100% of student perform at the proficiency level. With students expected to take these assessments each year of six years the question is raised as to why more students are not performing at the proficiency level. One factor that may lead to the low proficiency levels received is the literacy expectation within the mathematics assessment. The research questions are; How does vocabulary affect the readability of the NYS Mathematics Assessments? And Is there a correlation between the vocabulary difficulty and students performance on the New York State Mathematics Assessments?. This research determines the vocabulary difficulty within the 6th - 8th grade 2017 NYS Mathematics Assessments. The finding of this research include; First, mathematics vocabulary that is included in the constructed response questions is not included in the NYS Common Core Standards. Second, the assessment includes ten constructed response questions which include many words with little or no necessity to the mathematics concepts. Assessments become focused on extensive word problem instead of focusing on the mathematics concepts. Third, there is no progression of vocabulary difficulty within the constructed response questions. Finally, there is a need for mathematics instructors to be familiar with not only mathematics concepts but also literacy as it relates to mathematics.

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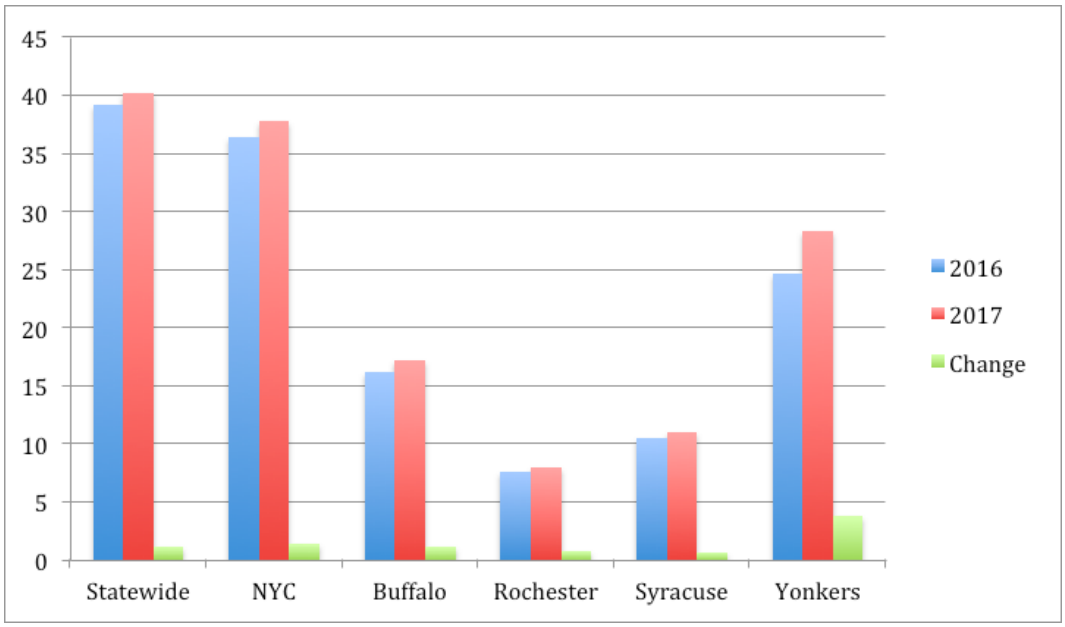
Chapter One: Introduction

Statement of the Problem

The New York State mathematics assessments are designed to assess students on their mathematics proficiency, at their grade level. The goal of New York State is to have 100% of students perform at the proficiency level. However, this goal seems distant given that New York State students as a whole are not even performing at 50% proficiency (NYS Education Department, 2017). For the 2017 New York State mathematics assessments across the state, only 40.2% of students received a proficient score. When examining individual cities throughout New York, the percent of students who received a proficient score is even lower. With the city of Buffalo performing at 17.2% students proficient, the city of Rochester performing at 7.9% students proficient, the city of Syracuse performing at 11.0% students proficient, and New York City performing at 37.8% students proficient (NYS Education Department, 2017). Comparison of the 2016 and 2017 scores shows a slight increase in the number of students performing at proficient levels across the state, with a 1.1% increase.

Figure 1: Percentage of Students who scores Proficient on the New York State Mathematics Assessment across grade 3-8



However, the number of students receiving proficient scores are not where they ideally should be, according to the goals set by New York State. These assessments are intended for students to complete each year from 3rd through 8th grade. With assessments that are completed by students six years in a row, it is important for school districts and teachers to gain an understanding as to why students are not performing at the proficient level set by New York State. Through discussions with fellow education professionals, one possible factor of these low proficiency levels is the readability levels of the mathematics assessments. While this is not the only possible factor discussed, it is one factor that does not currently have any research investigating its relevance. Therefore, the issue of standardized test readability is worth studying because the findings may contribute to a further understanding of student assessment performance. By understanding and knowing the correlation between the New York State mathematics readability levels at each grade level, teachers will be better equipped to help students perform at a proficient level and master the Common Core State Standards for each given grade level.

Background

During my student teaching experience in a third and fifth-grade classroom during the New York State ELA assessment time, I spoke with teachers about their opinions of the assessments. A common theme heard from these teachers, and other teachers I have worked with since, was that they believed the readability levels of the selected passages were too difficult for the students at that grade level. This idea became prevalent in my life again this year in my position as an Mathematics Academic Intervention Specialist. During school-wide teacher meetings, we

continually discuss how to help students grow as readers and what we can do as educators to prepare for the reading they will be exposed to on the New York State Assessment. While talking about the questions on the assessments, most teachers are not sure what to expect when it comes to the difficulty of the language. This discussion with different teachers and parents had lead to the question for this empirical research study. The hope for this research is to provide data to support or reject the belief that the vocabulary levels of the New York State Mathematics Assessment are too difficult for the intended grade level.

Definition of Terms

There are a few key terms, which will be used throughout this thesis and require clarification for the specific topic definition. The first term is “proficiency score”, specifically the proficiency score on the ELA assessment. According to New York State, in order for a student to earn a proficiency score at a given grade level, they must score a 3 or 4 on a New York State Assessment (NYS Education Department, 2017). Scoring on New York State assessments are separated into four individual levels. Each student's assessment is given a level out of four which is determined by their scale score. Each Level is accompanied by an explanation of the individual student's proficiency on the given grade level New York State P-12 Common Core Learning Standards.

New York State Level 1, identifies students as “well below proficient in standards for their grade” and determines that students “demonstrate limited knowledge, skills, and practices embodied by the New York State P-12 Common Core Learning Standards” (NYS Education Department, 2017). New York State Level 2, identifies students as “partially proficient in standards for their grade” and determines that students “demonstrate knowledge, skills, and

practices embodied by the New York State P-12 Common Core Learning Standards" (NYS Education Department, 2017). Level 2 also states that students "are considered on track to meet current New York high school graduation requirements but are not yet proficient on Common Core Learning Standards at this grade" (NYS Education Department, 2017).

New York State Level 3, identifies students as "proficient for their grade" and determines that students "demonstrate knowledge, skills, and practices embodied by the New York State P-12 Common Core Learning Standards" (NYS Education Department, 2017). evel also states that students "are considered sufficient for the expectations at this grade" (NYS Education Department, 2017).

New York State Level 4 identifies students as "excel in standards for their grade" and determines that students "demonstrate knowledge, skills, and practices embodied by the New York State P-12 Common Core Learning Standards" (NYS Education Department, 2017). Level 4 also states that students "are considered more than sufficient for the expectations at this grade" (NYS Education Department, 2017). These key terms will be used throughout this thesis and will follow the provided definitions above.

Another set of vocabulary that will be used throughout this research study includes Tier 1, Tier 2, and Tier 3 words. Tier 1 words "consists of the most basic words: warm, dog, tired, run, talk, party, swim, look. These words typically appear in oral conversations, children are exposed to them at high frequency from a very early age." Tier 1 words rarely require instructional attention to their meaning in school. Tier 1, "Everyday words familiar to most students primarily learned through conversation"(Beck, McKeown, and Kucan, 2013, p. 9).

Tier 2 words are “high utility for mature language users, found across a variety of domains.” Tier 2 words include contradict, circumstance, proceed, auspicious, fervent, and retrospect. Students are less likely to learn these words independently compared to Tier 1 words. Students are able to understand and learn Tier 2 words because they have another way to express the word using a different word, usually Tier 1 word that is similar in meaning” (Beck, McKeown, and Kucan, 2013,p. 25). Tier 2, “high-utility academic vocabulary found in many content texts, cross-curricular terms” (Beck, McKeown, and Kucan, 2013, p. 9).

Tier 3 words “has a frequency of use that is quite low and often limited to specific topics and domains”. Tier 3 words include filibuster, pantheon, and epidermis. A rich understanding of Tier 3 “words would not be of high utility for most learners”, these would should be taught when specific needs arises. Tier 3, “domain-specific academic vocabulary” (Beck, McKeown, and Kucan, 2013, p. 9).

Research Questions

This thesis consists of an introduction, history of assessments, review of literature, methodology, results, and discussion. A vocabulary analysis was completed on the 2017 New York State Mathematics assessment constructed response questions. Two research questions were written to focus and drive the discovery of this thesis analysis. The two research questions are: How does vocabulary affect the readability of the New York State Mathematics Assessments? And If there a correlation between the vocabulary difficulty and students performance on the New York State Mathematics Assessments?.

Significance and Implications

Students take the New York State Mathematics assessments each year from 3rd grade to 8th grade. Thus, it is important for teachers and schools to have an understanding and familiarity of what is expected of students in order to be successful on these assessments. It is the responsibility of the schools and teachers to gain the necessary knowledge and understanding in order to prepare their students. With the proper knowledge and understanding of the vocabulary on the New York State Mathematics assessments, teachers are able to adapt and design lessons that will prepare their students. After 8th grade, students begin to take mathematics state Regents exams, which are crucial for graduating from high school and getting into college. When students are prepared and successful in the younger grades on the New York State Mathematics assessments, they will have a strong understanding of the basics of mathematics before moving on to more advanced levels of mathematics. Students will then be more prepared with the necessary prior knowledge in order to be prepared for upper level mathematics in high school and college. This data collect and analyzed also shows the importance that mathematics is more than numbers, students need to be familiar and prepared to read in order to be successful in mathematics. It is not enough to know the concepts in number form, students must know the corresponding vocabulary to the mathematics concepts.

Teachers may take the findings and information from this research to help drive their mathematics instruction. Teachers should also consider implementing literacy strategies into their mathematics instruction. Students need to know how to read, approach, and answer mathematical word problems. They need to be able to find the information they need to answer the problem successfully and ignore the other unnecessary information. These are skills and strategies that must be taught to students in order for them to successfully implement. These

strategies are not just important for the assessment but for preparing students for upper-level mathematics in their future. Teachers at every grade level should take the time before the beginning of the year to become familiar with mathematics standards of grade levels above and below the level they are teaching. Being familiar with all standards will allow the teacher to have a better understanding of what the students should already know and what they will need to know in order to be successful in future grade levels.

Chapter Two: Review of Literature

Introduction

In order to address the research questions: how does vocabulary affect the readability of the New York State Mathematics assessments?; and is there a correlation between the vocabulary difficulty and student performance on the New York State Mathematics assessments?, a review of related research on the topic was conducted. Before completing the literature review, a conceptual framework was created to establish a background for the literature. The review of the literature began with an initial search of the education database. Keywords and phrases in this search included readability, word choice, standardized assessments, mathematics, elementary, instruction, leveling, text difficulty, proficiency, reliability, validity, and tier vocabulary. The researcher began the literature review by examining readability formulas to provide an overview of readability while also examining the criteria needed to calculate overall readability. The studies most relevant to the research questions are arranged below according to their topic focus. The first group focuses on readability as a whole, the second focuses on readability and standards of standardized assessments, and the third focuses on tiered vocabulary.

Conceptual Framework

Brief History of Assessments in the United States

During 1840 to 1875, American educators shifted assessments from oral examinations to formal written examinations. During this time there was also a shift in American education as a whole from a mission of serving the elite to a mission to educate all levels of social status. “In 1845 educational pioneer Horace Mann had an idea. Instead of annual oral exams, he

suggested that Boston Public School children should prove their knowledge through written tests (Gallagher, 2003)". These witten assessments were used to assess students' progress while also used to drive administration and policy decisions. From 1875 to the end of World War I, new assessments were developed and used to assess the mental ability of individuals and assessments were designed to assess college readiness. In 1890, Harvard's President Charles William Eliot proposed the idea of common college entrance exams across the United States which brought the College Entrance Examination Board into the mix in 1901. he first common exams were administered across the United States in nine subject areas.

By World War I, standardized testing became standard practice across the United States in and out of schools. Many of these standardized assessments focused on individuals levels of intelligence. "Between 1908 and 1916, Edward Thorndike and his students at Columbia University developed standardized achievement tests in arithmetic, handwriting, spelling, drawing, reading, and language ability" (Fletcher, 2009). By 1918, over 100 standardized assessments were designed and implemented in order to assess students in elementary and secondary schools. By 1925, intelligence and achievement standardized assessments were being used across the United States in order to classify students and in 1926 the first SAT test was administered. In 1929, the first major statewide assessment for high school students was designed and administered in Iowa by the University of Iowa. By the late 1930's, Iowa made their statewide assessment available to other states. In 1965, new government acts across the United States on elementary and secondary education were passed to require the use of norm-referenced assessments. In the 21st century, testing is used across the United States in order to classify students and assess for proficiency. In 2001 with the implementation of the No

Child Left Behind reform, there was a push for state-mandated standardized assessments which lead to most students being assessed across the United States each year.

Brief History of Assessments in New York State

In 1865, the first Regents Exams were administered to New York State students at the beginning of high school. It was not until 1878 that the first Regent Exam was administered to high school students at the end of the year. Regents Exams began as assessments to identify student prior knowledge before completing a high school class and shifted to assessing students' gained knowledge after the completion of a high school class. In 1999, New York State began administering ELA and Math assessments to all 4th and 8th grade students at the end of the school year. With the implementation of the No Child Left Behind Act in 2002, there was a push for additional assessments throughout more grade levels. This lead to the administration of ELA and Math assessments to all 3rd through 8th grade students across New York State in 2006. These assessments remained unchanged until 2013 when they were redesigned to align with the new Common Core Standards. With the implementation of the Common Core Standards came a shift in Mathematics regents testing. In 2014 the first Algebra I Regents Exam was administered, in 2015 the first Geometry Regents exam was administered, and in 2016 the first Algebra II Regents exam was administered, all of these new mathematics assessments Common Core aligned. In 2016, the ELA and Math assessments for 3rd through 8th grade were changed from having a time limit to no longer have a time limit for students to complete the test. New York State Mathematics assessments consist of three days with three separate booklets, one for each day. The first two days consist of multiple choice questions, the number of questions depends on the grade level. Students are allowed to complete work

throughout the test booklet, however, all answers must be recorded on the students assigned scantron. Any answers or work completed in the booklet during the first two days will not be scored, as the scantron is the only item that is scored. The third day consists of ten constructed response questions, every test has ten constructed response questions no matter the grade level. Students complete all work within the designated space for each constructed response question. Although each question contains a designated spot for the student's final answer, in order to receive full credit, either 2 or 3 points, the student must show all their work. Beginning in 2018, the New York State ELA and Mathematics assessments will be shortened from three days with three test booklets to two days with two test booklets. The Mathematics assessments will consist of only multiple choice questions on the first day. Then, the second day will consist of ten or more multiple choice questions and ten constructed response questions. The expectation of students to record their work and answers will remain the same. These standardized assessments are used "to assign students to appropriate classes and to identify areas where the students need extra help, or where he or she may be ready for more challenging material".

Standardized Testing

Accountability. According to Robert Linn in *Assessments and Accountability* (2000), for the past 50 years assessments have been used to drive education reform. Starting in 1950, assessments were used across the country for tracking students' achievement and selecting high-achieving individuals for specific classes, to attend schools. In 1960 assessments began to be administered in order to help assess program's accountability. Then in 1970, assessments were used to assess individuals "minimum competency". In the 1980s there was a shift in newly designed assessments in schools to assess the accountability of schools and entire

districts on their student's performance. In 1990 where assessments began being designed and driven by specific designed “appropriate” standards for the entire assets. Similarly according to Davis Hursh, since the 1990s the implementation of standardized tests to students from 3rd through 12th grade has increased steadily. Students are expected and/or required to take at least one large standardized assessment each year, starting in 3rd grade. Many of these assessments are mandatory and are required in order to receive a New York State High School Diploma. In 2002, the No Child Left Behind Act brought even more standardized assessments across New York State. In addition, these assessments were no longer simply assessing the individual students who completed the test but also the schools of the students taking the test. This new assessment of schools brought the possibility of the low performing schools to be changed or taken over due to the lack of performance. After this implementation had become normal practice, the Race to the Top competition brought a new use for these standardized assessment scores. Not only were schools being assessed and classified based on students’ performance, now teachers were being classified as “effective” or “ineffective” based on their overall class performance on the standardized assessments.

Validity & Reliability. According to the CollegeBoard, “tests themselves are not valid or invalid. Instead, we validate the use of a test score.”. Tests are administered in many different forms and the form they are administered in is important to acknowledge when assessing a tests validity. However, in order to truly assess a test's validity it is crucial to look at how the scores from the test are being used. A test can be completely valid for one situation and invalid for another situation depending on the intended use. “Validity is a matter of degree, not all or none” (citation). Assessments measure a sample of an individual or a behavior, thus

one assessment cannot give a complete representation of an individual. While assessing a test's validity, many questions will arise that do not have a set answer, part of assessing a test's validity relies on the individual's judgment. Whether an assessment is valid or not, is not a concrete answer. Many questions need to be taken into consideration in order to truly assess a specific test's validity. Similarly, according to Mary Lee Smith (2000), "the words *validity* and *accountability* rarely occur in the same sentence.". Mary Lee Smith (2000) believed that that the ideas of *validity* and *accountability* are at "odds" with one another. "*Accountability* arises from the polis, or political community. *Validity* is the standard of quality that professionals place on test" (Smith, 2000). Validity is looking to make sure the given test is assessing the correct content while accountability is looking to "blame" someone if the performance on the test is not up to the standards.

Literature Review

Readability Overview

Fry (2002) constructed an early definition and comparison of readability and leveling in order to help teachers select appropriate books for individual students' needs. Fry investigated similarities and differences between readability formulas and leveling procedures throughout the years. The examination and comparison of ten different readability formulas and leveling ranges lead to the discussion of their use in schools. The discussion of this comparison showed that "leveling has the strength of taking more factors into account than traditional readability formulas" (Fry, 2002, p. 291) and "different formulas have fairly good agreement in ranking a set of books but less agreement on assigning grade levels" (Fry, 2002, p. 291). Next, Begeny and Greene (2013) set out to examine if the readability discussed by Fry (YEAR) could

actually gauge the difficulty of reading materials. The researchers aimed to "assess the link between leveled reading passages and students' actual ORF (oral reading fluency) rates" (Begeny & Greene, 2014, p.198). The participants in this study consisted of 360 elementary-aged students and their oral fluency rates were compared to grade level reading passages. Results of this study showed that few readability formulas alone are good indicators of grade level readability.

After gaining an understanding of readability as a whole and the possible effectiveness of readability formulas, the literature looks at specific readability formulas. Harris and Jacobson (1980) investigated the comparison of the Fry, Spache, and Harris-Jacobson readability formulas for primary grades, specifically examining second and third-grade reading materials. Each selected reading material was evaluated using the three different readability formulas and formulas were assessed using six criterion. The researchers concluded that the "Fry graph seriously overestimated the difficulty of second and third-grade reading materials" (Harris & Jacobson, 1980, p. 923) and "the Spache tends to underestimate the difficulty of new second and third grade basal readers" (Harris & Jacobson, 1980, p. 924). Similarly, Crossley, Allen, and McNamara (2011) set out to discover the effectiveness of readability formulas, specifically focusing on the deep comparison of cognitive readability levels. These researchers set out to compare the Coh-Metrix Second Language (L2) Reading Index to "traditional readability formulas" (Crossley, Allen & McNamara, 2011, p. 84). The researchers compared readability levels of 100 Advanced, 100 Intermediate, and 100 Elementary passages, using the Coh-Metrix Second Language (L2) Reading Index, and "traditional readability formulas". The "traditional readability formulas" included the Flesch-Kincaid Grade Level and the Flesch

Reading Ease Score. The researcher's analysis of the data found that the "Coh-Metrix index is better able to discriminate between different levels of texts" (Crossley, Allen & McNamara, 2011, p. 96). From the research on the use of a single readability formula to determine the difficulty of a text, Hiebert (2011) questions whether one formula was enough. The researcher examines the effectiveness of the Common Core State Standards for English Language Arts offering a single measure of text complexity, Lexile level. The analysis of different text complexity formulas was used to compare the text to the expectations of the Common Core State Standards for different grade levels. This comparison showed that test complexity varies when multiple text complexity formulas are used, rather than a single formula. Researchers, including the ones above, focused on specific yet different readability formulas used throughout the years. Benjamin (2012) set out to examine the readability formulas used over the past two decades within one research report. Benjamin (2012) reviewed the "developments in the field of readability during the past two decades" (p. 63). The research reviewed the methods for predicting text difficulty over the past two decades starting in the 1980's. Benjamin found that with each new readability formula came with it controversy, however, "researchers continue to develop methods to overcome past weaknesses" (p. 84). The formulas and methods being used to determine readability levels are always advancing and improving based on the information gained from the professional using them.

Readability of Standardized Assessments

With the shift of increased standardized assessments within the United States, researchers use the readability research discussed above in order to examine standardized assessments and instructional standards. With the implementation of Common Core State

Standards in the United States, Fang (2016) examines the expectations of text complexity within the standards. Fang (2016) has examined and developed an understanding of what exactly text complexity is. Once Fang (2016) developed this understanding and complex definition of text complexity, he continue to explain how a teacher can use this information to help students. Fang (2016) concludes by supporting the idea of teachers understanding what text complexity is, providing students with texts of different complexities, and helping students develop strategies to help them when work through challenging texts.

From readability expectations within the standards correspond with readability within standardized assessments, Hewitt and Horman (2004) wanted to focus on the effects readability levels have on students' ability to answer standardized assessment questions. Hewitt and Horman (2004) investigated standardized test items in order to discover their individual readability levels and overall difficulty. Using the Homan-Hewitt Readability formula, the researchers "analyzed 20 items from grade levels 3, 4, & 5 on the Social Studies subtest and 20 items from grade levels 3, 4, & 5 of the Reading comprehension subtest of the CTBS [Comprehensive Test of Basic Skills]" (Hewitt & Horman, 2014, p. 7). The researcher's data collection and analysis suggest "that the higher the item readability level, the more students miss the item" (Hewitt & Horman, 2014, p. 13).

Tiered Vocabulary & Mathematics Language

According to Beck, McKeown, and Kucan (2013), Tier 1 words "consists of the most basic words: warm, dog, tired, run, talk, party, swim, look. These words typically appear in oral conversations, children are exposed to them at high frequency from a very early age" (p. 9). Tier 1 words rarely require instructional attention to their meaning in school. Tier 1 words can

be described as “everyday words familiar to most students primarily learned through conversation” (Beck, McKeown, and Kucan, 2013, p. 9). Tier 2 words are “high utility for mature language users, found across a variety of domains. Tier 2 words include contradict, circumstance, proceed, auspicious, fervent, and retrospect” (Beck, McKeown, and Kucan, 2013, p. 9). Students are less likely to learn these words independently compared to Tier 1 words. “Students are able to understand and learn Tier 2 words because they have another way to express the word using a different word, usually a Tier 1 word that is similar in meaning” (Beck, McKeown, and Kucan, 2013, p. 25). Finally, Tier 3 words are used less frequently and are “often limited to specific topics and domains” (Beck, McKeown, and Kucan, 2013, p. 9). Some examples of Tier 3 words include hypotenuse, filibuster, and epidermis. A rich understanding of Tier 3 words “would not be of high utility for most learners” (Beck, McKeown, and Kucan, 2013, p. 9). Thus, these words would generally be taught when a specific need arises. Simply, Tier 3 words are “domain-specific academic vocabulary” (Beck, McKeown, and Kucan, 2013, p. 9). In many cases, mathematical vocabulary words are identified as Tier 3 words because “they describe very specific mathematical features and actions” (Beck, McKeown, and Kucan, 2013, p. 9).

According to Beck, McKeown, and Kucan (2013), Tier 2 words are “likely to appear frequently in a wide variety of texts and in the written and oral language of mature language users. When determining whether a word is a Tier 2 word, an educated must think whether learning the word would be beneficial to the students. The educator must also think about whether or not the student already has another word or way to explain and understand the new vocabulary word. Tier 2 words offer students the opportunity to use a “more precise or mature

way of referring to ideas they already know" (Beck, McKeown, & Kucan, 2018). While determining and identifying Tier 2, words educators must take into consideration the specific grade level of the student. One must remember that there is more vocabulary than just Tier 2 words.

According to Beck, McKeown, and Kucan (2013), many mathematical words are considered Tier 3 vocabulary words because "they describe very specific mathematics features and actions. Learning the meaning of the words is not the point. Rather, students need to recognize the concepts and procedures that the words refer to when they encounter them in word problems contexts" (p. 30). The trouble comes when educators are expected to know exactly when and how to introduce vocabulary. In an ideal words teachers would have a list of what grade level each vocabulary word would be introduced. As well as the level of understanding the student must have of this new vocabulary. "The important point that we're getting at here is that teachers need to make decisions about how to deal with the words students are expected to 'learn' in a given time period" (Beck, McKeown, & Kucan, 2013, p. 30). Some words need explicit, extended instruction while other words are to be reviewed just briefly. "There is nothing scientific about the way words are identified for attention in school materials" (Beck, McKeown, & Kucan, 2013, p. ?). Educators must use their own judgement and experience in the selection of Tiered vocabulary words. It is important to remember and consider that "no formula exists for selecting age-appropriate vocabulary words despite lists that identify 'fifth-grade words' or 'seventh-grade words'" (Beck, McKeown, & Kucan). When a word is on one of these word lists, the misconception is that students cannot learn this word before this grade level. However, this is not the case. It means that most student are unfamiliar

with this word before the specified grade level, it does not mean that they are necessarily unable to comprehend and learn this word before that grade level. Selecting and identifying words to instruct come to the judgement of the educators that know the content material and the individual students.

According to Capps and Pickreign (1998), "mathematics can be thought of as a language that must be made meaningful for students adequately to communicate mathematics" (p. 8). Capps and Pickreign (1998) begin their discussion by examining the idea that using language correctly while solving mathematics problems is not an easy task. There is a different set of language that is used to articulate mathematics, in order to show comprehension of concepts. "Understanding language is a prerequisite to solving problems, the communications standards deal with the process of teaching and acquiring the language of mathematics" (Capps & Pickreign, 1998, p. 8-9). According to Capps and Pickreign (1998), mathematical vocabulary needs to be explicitly taught. Capps and Pickreign (1998), suggest that the best ways to teach mathematics vocabulary is to begin by writing down words and then working with students to break apart the vocabulary, helping students use what they already know to make connections to the new vocabulary and concepts. Once explicitly examining the mathematics vocabulary, educators should move on to discussing the vocabulary in context of specific mathematics concepts. Educators must make sure every step includes making connections to prior knowledge and other mathematics concepts. Capps and Pickreign (1998) also examine the importance of students understanding the different grammatical interpretations of vocabulary, which effect understanding within mathematics problem solving. "Rarely, if ever, does one encounter the straightforward operational word *add, multiply,*

subtract, divide, and the like in a problem solving situation" (Capps & Pickreign, 1998, p.11). Capps and Pickreign (1998) stress the importance of understanding mathematics language in order to be successful, understanding the language used in word problems is crucial in determining the right process for obtaining the correct answer. "Thus it is important to note that careful analysis of the language and context of the problem aids in comprehending the problem" (Capps & Pickreign, 1998, p. 12). Capps and Pickreign (1998) state that, "mathematical language is seldom used outside the classroom" (p. 9). Therefore, educators must make sure that they take every opportunity to review and address mathematics vocabulary to ensure understanding.

According to Capps and Pickreign (1998), there are three crucial statements for educators to remember while working with mathematics vocabulary. First, "regardless of students' abilities, the content of mathematics is not taught without language" (Capps & Pickreign, 1998, p. 12). Reading for understanding is different in mathematics than it is in other domains. Second, "one must be aware that mathematical language and symbolism are not reinforced outside the classroom in the same way as the more common language we use to communicate ideas" (Capps & Pickreign, 1998, p. 12). Mathematics vocabulary is not used in daily conversation like other domain vocabulary is, therefore educators need to take every opportunity to reinforce and review mathematical vocabulary. Third, "knowledge of a large vocabulary is related to high comprehension in a subject and that vocabulary should always be learned in a meaningful context" (Capps & Pickreign, 1998, p. 12). In other domains we stress the importance of learning and understanding vocabulary to advance one's knowledge, this must continue into mathematics instruction. When students are able to learn vocabulary in a

meaningful context they are able to gain a deeper understanding of vocabulary which will lead to the ability to answer mathematics problems.

Gap in the Research

New York State has performed extensive evaluations of the mathematics assessments in order to ensure the test is aligned with the specific grade level mathematics standards and content. However, they do not show the same extensive evaluations for the "text complexity" or readability of the questions throughout the mathematics assessment. New York State has released evidence for validity and reliability of the text complexity for the passages on the ELA assessments, however, there is no evidence to support this on the mathematics assessments. New York State has released the checklist used to evaluate the criteria for potential math questions, However, the "clarity" sections address some literary elements but none of them are addressing the readability for the questions and the criteria in this section is subjective. New York State has worked hard to make sure the mathematics tests are addressing the correct standards and content, yet there is a gap in the research on the readability of these mathematics questions. The New York State mathematics assessment is not just about a student's ability to master the math standards and content, it also assesses the student's ability to read and comprehend the maths questions correctly. No research or examination has been released examining whether the New York State mathematics assessments are assessing students on their understanding of mathematics concepts within the standards or on their ability to read and interpret words. Similarly to how New York State does not disclose specific "text complexity" criteria and analysis for the New York State mathematics assessments, no outside research has been found.Specifically, New York State claims that the vocabulary on the mathematics

assessments are at the specific grade levels of the students taking the assessment. However, there is no released evidence or data to support this statement. Along with this, there is no set list or specific criteria one can use to identify what grade level mathematics vocabulary words actually correspond with. While vocabulary across other domains is specifically examined, mathematics is often brushed over or only briefly mentioned for a few sentences at most.

Research Questions

Two research questions were written to focus and drive the discovery of this thesis analysis. The two research questions are: How does vocabulary affect the readability of the New York State Mathematics Assessments? And If there a correlation between the vocabulary difficulty and students performance on the New York State Mathematics Assessments?.

Conclusion

Through the conceptual framework and review of the literature, the researcher discovered the true gap in research for readability levels of mathematics assessments. The researcher developed a conceptual framework in order to discover and examine the history of assessment in the United States and in New York State. This conceptual framework allowed the researcher to understand the process of how the New York State Assessment for 3rd - 8th grade came to be implemented. The review of literature allowed the researcher to gain an understanding of readability, readability of standardized assessments, tiered vocabulary, and mathematics language. The review of literature builds background knowledge for the researcher before moving forward with their research.

Chapter Three: Methodology

Introduction

With the completion of the conceptual framework and review of the literature, the researcher was able to establish background knowledge to support the independent research of the research questions. Through the review of the literature, the researcher discovered a gap in research surrounding the research questions. The review of literature allowed the researcher to examine readability formulas which lead to the discovery of a need for a different form of analysis of the New York State Mathematics constructed response questions in order to successfully reach the intended research question. The methodology below details the researcher discovering and process for collecting data to support or refute the research questions.

Research Design

A comparative study of the vocabulary within the New York State Mathematics constructed response questions was conducted. This comparative study was completed through a vocabulary analysis of the 2017 New York State Mathematics constructed response questions for grades 6 through 8. The vocabulary analysis was completed using tiered vocabulary leveling, which allows for individual words to be "rated" regarding their difficulty based on the age of the students. The New York State Mathematics Standards for 2017 will also be used to help determine the tiered vocabulary levels based on the inclusion of the word within the standard.

The researcher analyzed every constructed response question from the 2017 mathematics assessments for 6th through 8th grade, with a total of 10 questions per grade. The

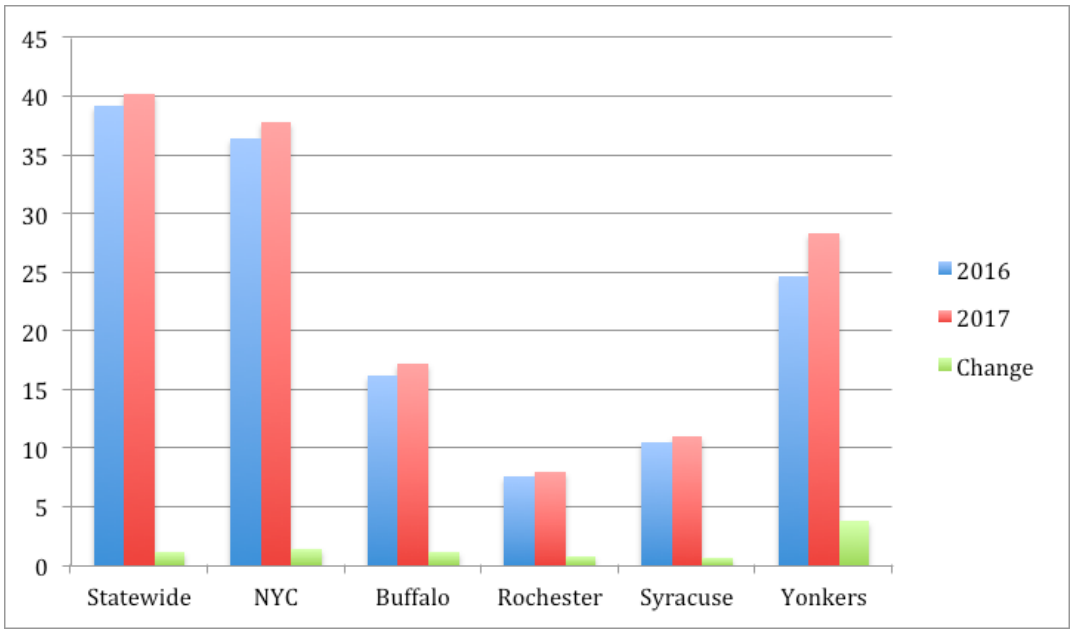
researcher began the vocabulary analysis by selecting domain specific vocabulary within each constructed response question. Once the domain specific vocabulary was selected, the researcher used the standards to identify where the word is used (in the same context) throughout the standards. The researcher recorded each time the word was used up until 8th grade, stating the specific standards or section the vocabulary word is used. Once this was completed for each of the 30 constructed response questions, the researcher used this created documents to determine the Tier for each word in each of the questions (Tier 1, Tier 2, or Tier 3). The researcher then assigned a color to each Tier and highlighted each word with its specific color. Once the color coding analysis was completed for each constructed response question, the researcher determined the percentage of words in each tier for each question and grade level.

Rationale

The New York State mathematics assessments are designed to assess students on their mathematical proficiency, at their grade level. The goal of New York State is to have 100% of students perform at the proficiency level. However, this goal seems distant given that New York State students as a whole are not even performing at 50% proficiency (NYS Education Department, 2017). For the 2017 New York State mathematics assessments across the state, only 40.2% of students received a proficient score. When examining individual cities throughout New York, the percent of students who received a proficient score is even lower. The city of Buffalo performed at 17.2% students proficient, the city of Rochester at 7.9% students proficient, the city of Syracuse at 11.0% students proficient, and New York City at 37.8% students proficient (NYS Education Department, 2017). Comparison of the 2016 and

2017 scores shows a slight increase in the number of students proficient across the state, with a 1.1% increase.

Figure 1: Percentage of Students who scores Proficient on the New York State Mathematics Assessment across grade 3-8



However, the number of students receiving proficiency scores are not where they ideally should be, according to the goals set by New York State. These assessments are intended for students to complete each year from 3rd through 8th grade. With assessments that are completed by students six years in a row, it is important for school districts and teachers to gain an understanding as to why students are not performing at the proficient level set by New York State. Through discussions with fellow education professionals, one possible factor of these low proficiency levels is the readability of the mathematics assessments. While this is not the only possible factor discussed, it is one factor that does not have any research investigating its relevance. Therefore, the issue of standardized test readability is worth studying because the

findings may contribute to further understanding student assessment performance. By understanding and knowing the correlation between the New York State mathematics readability levels at each grade level, teachers will be better equipped to help students perform at a proficient level and to master the Common Core State Standards for each grade level.

Objects of Study

There are no participants in the present study, rather objects of study including the released constructed response questions from the 2017 New York State mathematics assessments. Every constructed response question administered to the students on the 2017 mathematics assessment was released, which means the researcher was able to assess the entire collection of constructed response questions. These assessments are released on the New York State Mathematics Assessment Websites, which is all the researcher has access to. The New York State Mathematics Assessment Website also has the 2015 and 2016 Mathematics Assessments posted, however, the researcher is only able to use the 2017 Mathematics Assessment because it is the only assessment which is aligned with the current, 2017 New York State Standards. The researcher specifically examined the 6th, 7th, and 8th grade assessments for this year. These grades were selected because in New York State, mathematics already is or is becoming departmentalized across these grades and is considered middle school level mathematics. Excluding 3rd, 4th, and 5th grade is ensuring the exclusion of other variables that the upper grades do not have to account for such as mathematics not being departmentalized and the unfamiliarity of the assessment setup. Third grade is the first year students are completing the New York State mathematics assessment which brings a new set of variables to their proficiency score. The New York State mathematics assessments in 2015 to 2017 consist

of two days of multiple choice questions and one day of constructed response questions. The researcher has decided to focus on the vocabulary readability levels of just the constructed response questions, because the multiple choice questions bring a different set of variables. When a student reads and completes a constructed response question, they have to show their work and prove they have a true understanding of the concept as well as the corresponding New York State mathematics standard. When a student reads and completes a multiple choice question, they have a 25% chance of guessing the correct answer based solely on the multiple choice answers provided. These options bring a new variable into account which can influence the readability level on the students' understanding of the concept of any given mathematics standard. New York State does not release every multiple choice or constructed response question that is administered to students each school year. In 2016, New York State began releasing all ten of the constructed response questions that were administered on the 6th, 7th, and 8th grade mathematics assessments. Across each of the three grade levels, there is a total of 10 constructed responses questions on each assessment. Since this is consistent across all the grade levels, the researcher has decided to examine every constructed response question to obtain a true representation of the tiered vocabulary throughout the entire constructed response portion of the assessment.

Data Collection

The researcher began by copying each of the ten constructed response questions from the 2017 New York State Mathematics Assessments for 6th, 7th, and 8th grade. The researcher placed each question with its corresponding test number and grade level in an excel sheet. The researcher began analysis with the grade 8 assessment and worked down to grade 6. The

researcher looked at each constructed response question independently, identifying all vocabulary words that were not Tier 1 words. Each word the researcher identified was listed next to the corresponding constructed response question. Once this was completed for all thirty constructed response questions across each of the three grade levels, the researcher moved on to the next process, determining if the words were Tier 2 or Tier 3 vocabulary words. The researcher used the New York State 2017 Common Core Standards to help with this process. For each word identified from the constructed response questions, the researcher found where and how many times the specific word (in the same context) was used in the standards. For each word, the researcher recorded every time the word was used in the standards, recording each specific standard or section (grade overview or grade introduction).

Once this was completed, the researcher moved to color coding to specifically classify Tier 1, Tier 2, and Tier 3 vocabulary words within each constructed response question. The researcher created two-column tables for each of the three grade levels. For each of the tables, the first column included the constructed response question number and the second column consisted of the specific constructed response question. Once this was completed, the researcher determined the set definition and criteria that would be used throughout in order to consistently classify and color code the Tier 1, Tier 2, and Tier 3 vocabulary words across all constructed response questions and all grade levels.

Before color coding any words in the constructed response questions, the researcher considered the technical definitions for Tier 1, Tier 2, and Tier 3 vocabulary words. According to Beck, McKeown, and Kucan (2013), Tier 1 words “consists of the most basic words: warm, dog, tired, run, talk, party, swim, look. These words typically appear in oral conversations,

children are exposed to them at high frequency from a very early age" (p. 9). Tier 1 words rarely require instructional attention to their meaning in school. Tier 1 words can be described as "everyday words familiar to most students primarily learned through conversation" (Beck, McKeown, & Kucan, 2013, p. 9). Tier 2 words are "high utility for mature language users, found across a variety of domains. Tier 2 words include contradict, circumstance, proceed, auspicious, fervent, and retrospect" (Beck, McKeown, & Kucan, 2013, p. 9). Students are less likely to learn these words independently compared to Tier 1 words. "Students are able to understand and learn Tier 2 words because they have another way to express the word using a different word, usually a Tier 1 word that is similar in meaning" (Beck, McKeown, & Kucan, 2013, p. 25). Finally, Tier 3 words are used less frequently and are "often limited to specific topics and domains" (Beck, McKeown, & Kucan, 2013, p. 9). Some examples of Tier 3 words include hypotenuse, filibuster, and epidermis. A rich understanding of Tier 3 words "would not be of high utility for most learners" (Beck, McKeown, & Kucan, 2013, p. 9). Thus, these words would generally be taught when a specific need arises. Simply, Tier 3 words are "domain-specific academic vocabulary" (Beck, McKeown, & Kucan, 2013, p. 9). In many cases, mathematics vocabulary words are identified as Tier 3 words because "they describe very specific mathematical features and actions" (Beck, McKeown, & Kucan, 2013, p. 9). According to Beck, McKeown, and Kucan (2013), "learning the meaning of the words is not the point. Rather, students need to recognize the concepts and procedures that the words refer to when they encounter them in word problem context" (p. 30).

The researcher began color coding by determining and identifying all Tier 1 words throughout the constructed response questions. Tier 1 vocabulary words were color coded

orange: Tier 1. Judgment of Tier 1 words was based on the grade level of the students that the specific constructed response question was administered to. The researcher asked herself the following questions when selecting Tier 1 words: would a student at this grade level be familiar with this word?; would a student understand this word without the need of specific instruction?; and is this a word a student would hear being used in conversation? The researcher determined that proper nouns would be identified and coded as Tier 1 words. Proper nouns were coded as Tier 1 words because they do not require an understanding of what they mean and students are familiar with proper nouns from a young age through conversation. Once identifying and coding all Tier 1 vocabulary words, the researcher moved on to Tier 2 and Tier 3 words. Tier 2 vocabulary words were color coded green: Tier 2 and Tier 3 vocabulary words were color coded blue: Tier 3. To determine whether a word was a Tier 2 or Tier 3 vocabulary word, the researcher used the Tier level definitions along with the information obtained from the NYS standards. If the word was not a Tier 1 vocabulary word and was used multiple times throughout the standards, throughout multiple age levels, the researcher identified the word as a Tier 2 vocabulary word. These words were still math specific content words, however, they were also used in the standards starting at a low grade level. Since these words were addressed early in the mathematics standards and then in the specific constructed response question, it is assumed that students should be familiar with the vocabulary word. If the word was not a Tier 1 vocabulary word and was not used multiple times throughout the standards or across multiple grade levels, the researcher identified the word as a Tier 3 vocabulary word. These words are also math specific content words but have not been used in the standards starting at low grade levels. Thus, when used in the specific constructed response question, the students would be

less familiar with the word, compared to the identified Tier 2 vocabulary words. These identified Tier 3 words need to be specifically taught when the word arises in context since Tier 3 vocabulary words include "domain-specific academic vocabulary words" (Beck, McKeown, & Kucan, 2013, p. 9).

Data Analysis

Once the color coding for each constructed response question was complete, the researcher counted the number of total words in each individual constructed response question, excluding single letters, numbers, formulas, expressions, and equations. Single letters, numbers, formulas, expressions, and equations were excluded from the word count and color coding because they are not vocabulary words, thus should not contribute to the vocabulary analysis of the constructed response questions. Once the total words for each constructed response question was counted and included on the color coding table, the researcher calculated and wrote down the number of words for each Tier level. The number of vocabulary words in each Tier level within each constructed response question was written under the corresponding constructed response question, alongside the total number of words in each constructed response question. Once these steps were completed for each constructed response question in each of the three grade levels, the researcher calculated the total number of words and total number of words for each Tier level for each of the three grade levels. This information was written on the top of the corresponding grade level table next to the identified grade level.

Once these steps were completed for each of the three grade levels, the researcher took the information from each table and grade level to create an excel sheet of the number of total words and the number of words in each Tier level. The researcher created the excel sheet to

include each of the three grade levels along with the break down of Tier vocabulary levels. For each grade level, the researcher set up five columns which consisted of column 1: test question number, column 2: number of Tier 1 words, column 3: number of Tier 2 words, column 4: number of Tier 3 words, and column 5: total words. The researcher transferred the information for each grade level and constructed response question to the corresponding column, color coding the Tier level columns following the the color coding system used before. Once these steps were completed for each of the three grade levels, the researcher added three more columns, one column after each of the individual Tier level columns, in order to report percentages. The researcher calculated the percentage of Tier 1 words, Tier 2 words, and Tier 3 words within each specific constructed response question, with all three Tier level percentages adding together for a sum of 100%. Next, the total percentage of words in each Tier for each grade level was totaled. This was done by adding the total percent of Tier 1 words across all constructed responses questions on the 6th grade assessment, adding the total percent of Tier 2 words across all constructed responses questions on the 6th grade assessment, adding the total percent of Tier 3 words across all constructed response questions on the 6th grade assessment, etc.

Finally, the researcher had three separate sections within the excel sheet which consisted of the following; column 1: test question number;, column 2: number of Tier 1 words; column 3: percentage of Tier 1 words;, column 4: number of Tier 2 words; column 5: percentage of Tier 2 words column 6: number of Tier 3 words; column 7: percentage of Tier 3 words; and column 8: total number of words. This excel sheet consciously consisted of all data collected in which the researcher will use for analysis.

Conclusion

The methodology chapter was written to outline the researcher's process of collecting data and the researcher process of analyzing the data. Throughout the data collection and data analysis, the researcher will begin to identify finding and connections between the data. With the completion of the data collection and data analysis, the researcher will be one step closer to discover evidence to support or refute the research questions.

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Chapter Four: Results

Introduction

Through data collection and data analysis, the researcher will begin to identify patterns and connection within the data. The researcher complete future analysis of these connection, patterns, and data in order to identify major themes throughout the data collected. Through this process, the researcher will continue to discover evidence to support or refute the research questions. The researcher identified three major themes through the extensive data analysis, which are detailed below.

Theme One: Lack of Test Vocabulary in Instructional Standards

The first theme emerged as the researcher began data collection and identified vocabulary words from the constructed response questions that are also in the New York State Mathematics Standards. While collecting this data (Appendix A, B, C), the researcher noticed that the vocabulary words used throughout the constructed response questions were not all used in the standards. Either the words in the constructed response questions were not found at all within the standards, were not found until high school standards, or were used in early elementary standards yet not again until upper level standards. The researcher examined the first excel sheet (Appendix A, B, C), in which the vocabulary words from the individual constructed response questions were examined through the lense of the 2017 New York State Mathematics Standards. From this examination, the researcher noted all the vocabulary words that were not in the 2017 New York State Mathematics Standards and all the words that were used in one of the lower grade levels yet not again until the higher grades.

After completing this list, the researcher created two tables (Appendix G), one for words not used in the standards at all and one for words used in the lower grades and not again until the higher grades. In these tables, the researcher included the vocabulary word and the grade level of the assessment the word was used in. It was found that the standards lack the specific academic language used in the constructed response questions throughout the assessments. Looking specifically at the words that are not included in the standards or are not included until after 8th grade, the researcher noticed that these words come from each of the three grade levels of assessments analyzed and some of the words are missing across multiple grade levels. Of the 14 words identified from the constructed response questions that are not included in the standards, 13 are Tier 2 words and one is a Tier 3 word. Since these words are Tier 2 and Tier 3 words, they require specific instruction in order for students to understand their meaning. Therefore, teachers need to be aware that these specific mathematical vocabulary words need to be directly taught and used during mathematics instruction, as well as other content areas, in order for students to truly understand their meaning. If this specific vocabulary is not included in the standards, how are teachers expected to know what vocabulary they should be teaching their students in order for them to be successful?

Similarly, the researcher looked at the words that were included in the younger grade level standards and not again until later, or not again at all. Of the 6 words in this category that were identified from the constructed response questions, five are Tier 2 words and one is a Tier 3 word. Thus, these words require specific instruction in order for students to understand their meaning. Again, teachers need to be aware that these specific mathematics vocabulary words need to be taught and used during mathematics, and other content areas, in order for students to

truly understand their meaning. Of these six words, three of the words were used in the younger grade level standards and then again in the standards for the specific grade level of the constructed response question. The other three words were used in the younger grade level standards but are not used again in the later standards, yet they are used in the specific grade level of the constructed response question. If vocabulary is not included in the standards for the specific assessment grade level, how are the teachers supposed to know what vocabulary they should be teaching their students in order for them to be successful on the assessment? For these six specific vocabulary words identified above, teachers teaching 6th through 8th grade mathematics would need to look at all of the mathematics standards for grades kindergarten through their specific grade level to ensure they are able to identify all vocabulary students need to know. Similarly, teachers of younger grade levels need to look at the older grade level mathematic standards. This will help to determine specific vocabulary that may need more explicit instruction in order for it to change from a Tier 3 word to a Tier 2 word. Teachers need to instruct students on specific vocabulary words to provide prior knowledge and exposure for the students' future grade levels. Thus, words become prior knowledge rather than relearned vocabulary.

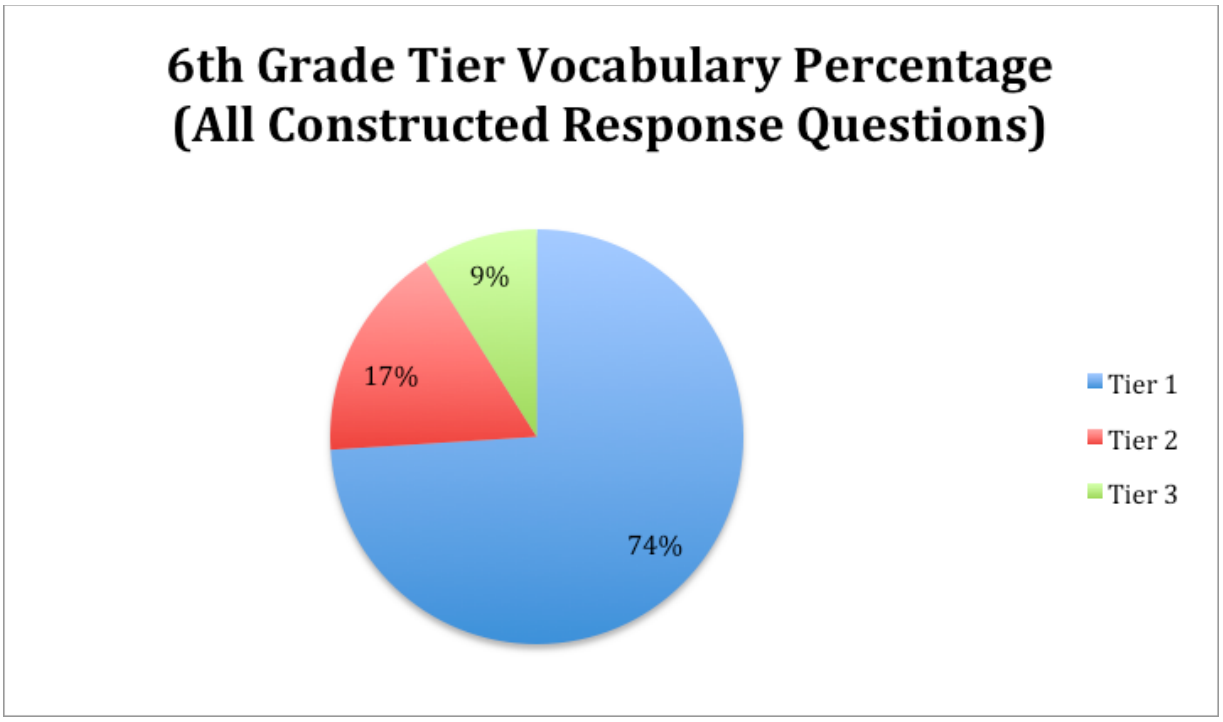
Theme Two: Reading Assessment vs Mathematic Assessment?

The researcher began analysis by looking at the total percentage of Tier vocabulary used for each of the three grade levels. For the 10 constructed response questions in each of the three grade levels, there were 580 words on the 6th grade constructed response questions, 585 words on the 7th grade constructed response questions, and 322 words on the 8th grade constructed response questions. Comparatively, the 6th (580 words) and 7th (585 words) grade

constructed response questions required much more reading, about 260 more words, than the 8th (322 words) grade constructed response questions. On average, the 6th grade questions include 58 words each, the 7th grade questions include 58.5 words each, and the 8th grade questions include 32.2 words each. The 6th and 7th grade questions have on average about 26 more words each compared to the 8th grade constructed response questions. Thus, on average the 8th grade individual questions and entire test is more concise compared to the 6th and 7th grade assessment.

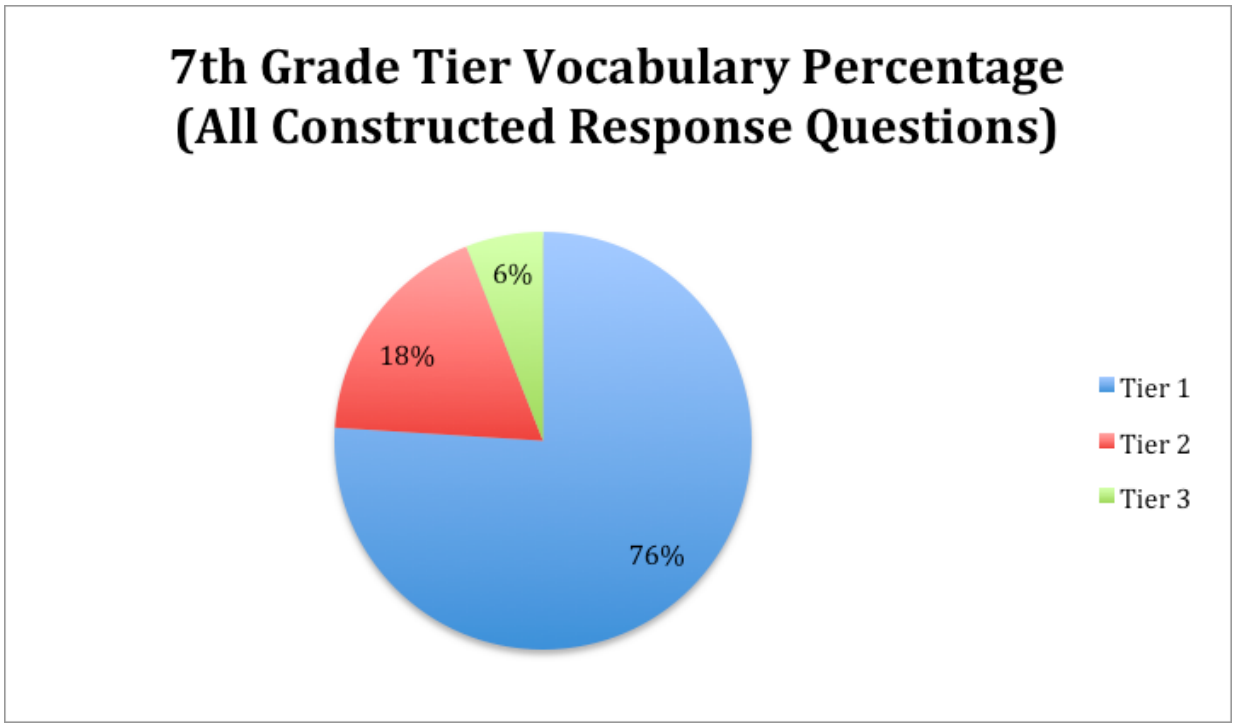
After calculating the total number of words used in the constructed response questions of each grade level, the researcher looked at the total percentage for each Tier vocabulary level. Comparatively, the 6th and 7th grade assessments are similar in their overall percentages of Tier 1, Tier 2, and Tier 3 vocabulary words used. Tier vocabulary words for the 6th grade questions include: 74% Tier 1 words; 17% Tier 2 words; and 9% Tier 3 words.

Figure 2



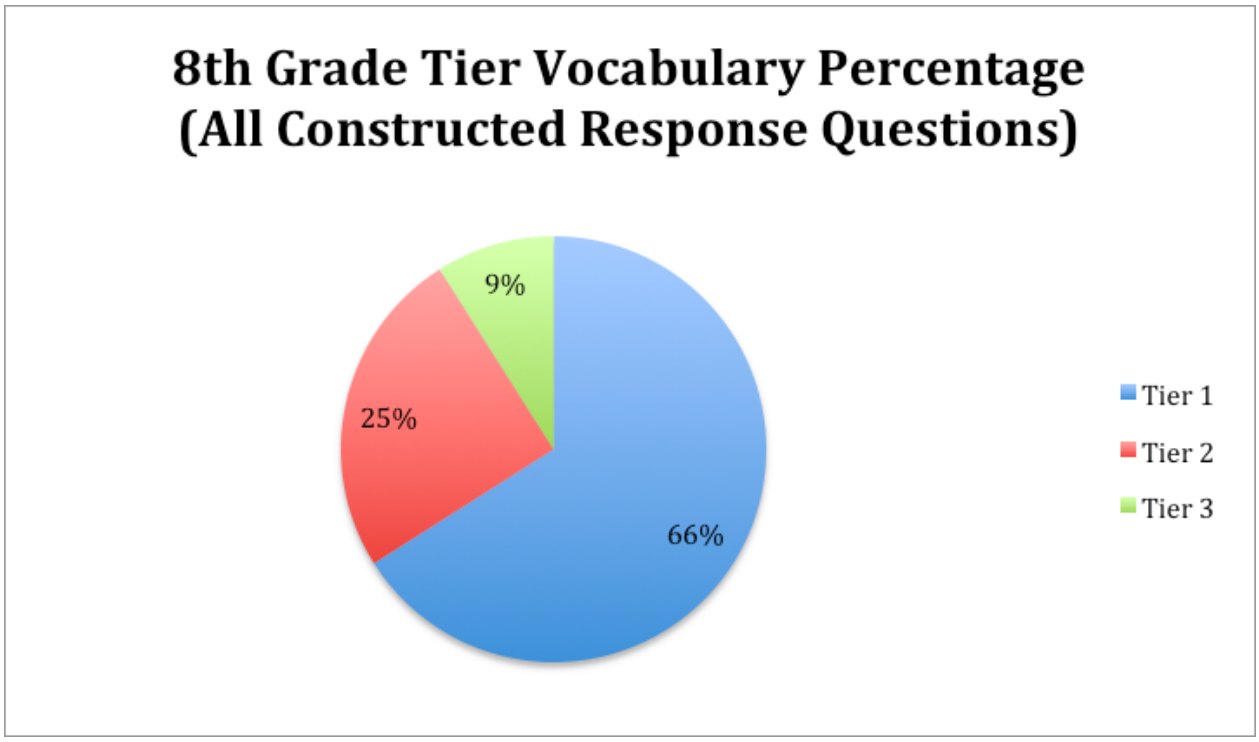
Tier vocabulary words for the 7th grade questions include: 76% Tier 1 words; 18% Tier 2 words; and 6% Tier 3 words.

Figure 3



The 8th grade assessment is similar only in it's Tier 3 vocabulary words used, 9%, however it differs significantly in Tier 1 and Tier 2 percentages of vocabulary words. Tier vocabulary words for the 8th grade questions include: 66% Tier 1 words; and 25% Tier 2 words.

Figure 4



The 8th grade assessment uses less Tier 1 vocabulary words and more Tier 2 vocabulary words, compared to the 6th and 7th grade assessments. Thus, the 8th grade assessments are more concise and focused on specific mathematics concepts, through the use of more Tier 2 vocabulary words and less Tier 1 vocabulary words. Compared to the 6th and 7th grade assessments, the 8th grade assessment has less words to read.Although there are fewer words, the words used are more difficult comparatively.

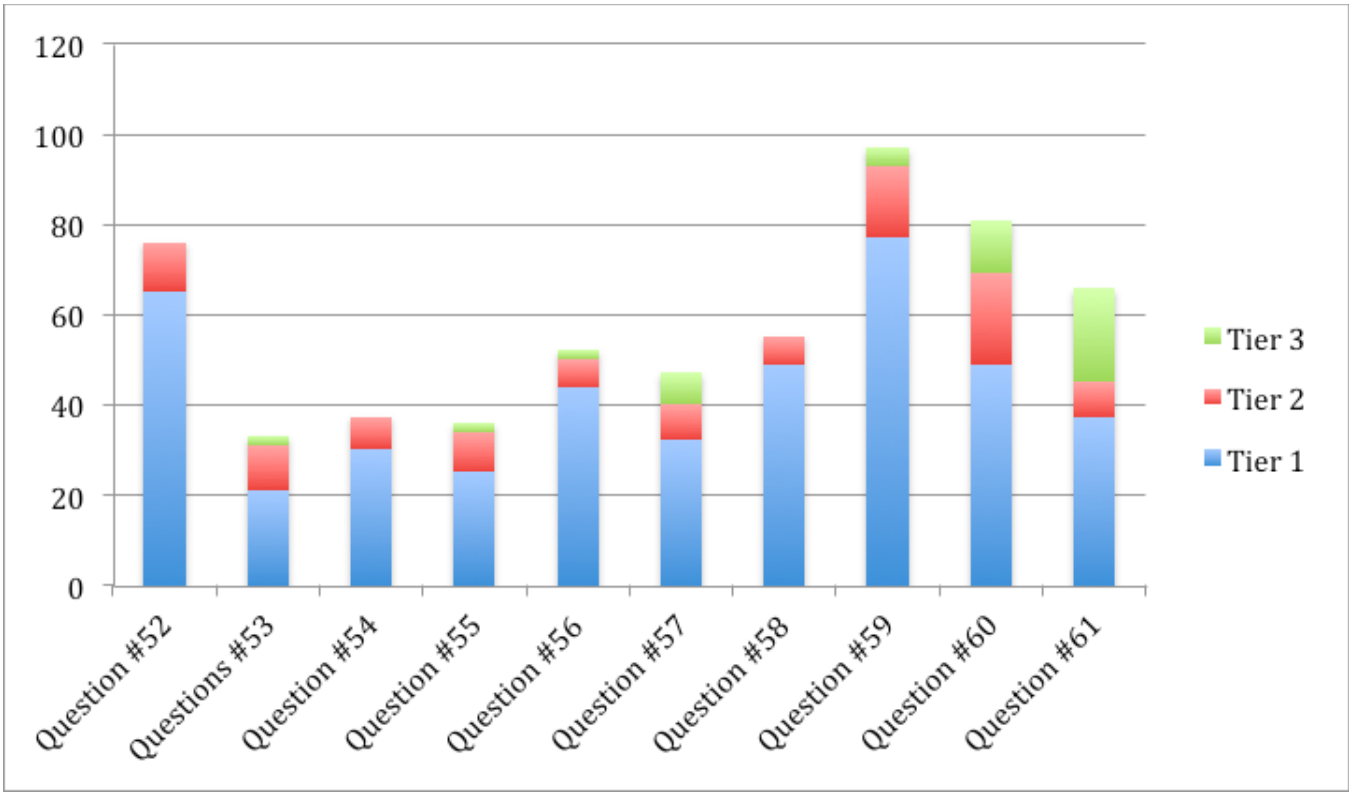
Theme Three: Progression of Vocabulary Difficulty

Next, the researcher looked at the percentages of Tier vocabulary used for individual constructed response questions within a specific grade level. This analysis showed that there are no correlations between the constructed response question number and the vocabulary difficulty. The text vocabulary difficulty does not progressively get more or less difficult as the

assessments go on. The progression of the Tier 1, Tier 2, and Tier 3 vocabulary words within individual constructed response questions and grade levels is not determined by the constructed response questions location within the given assessment. Specifically, for the 6th grade assessment, the first five questions (#52-56) have a low percentage of Tier 3 vocabulary words (6% or less). Then, the next constructed response question (#57) jumps up to 15% of the words being Tier 3 vocabulary. The next two constructed response questions (#58-59) are also at 6% or less Tier 3 words yet the next question (#60) again jumps up to 15% of the words being Tier 3 words. The final question (#61) has 32% Tier 3 words.

Figure 5

2017 Grade 6 Individual Constructed Response Question Vocabulary Tier Breakdown

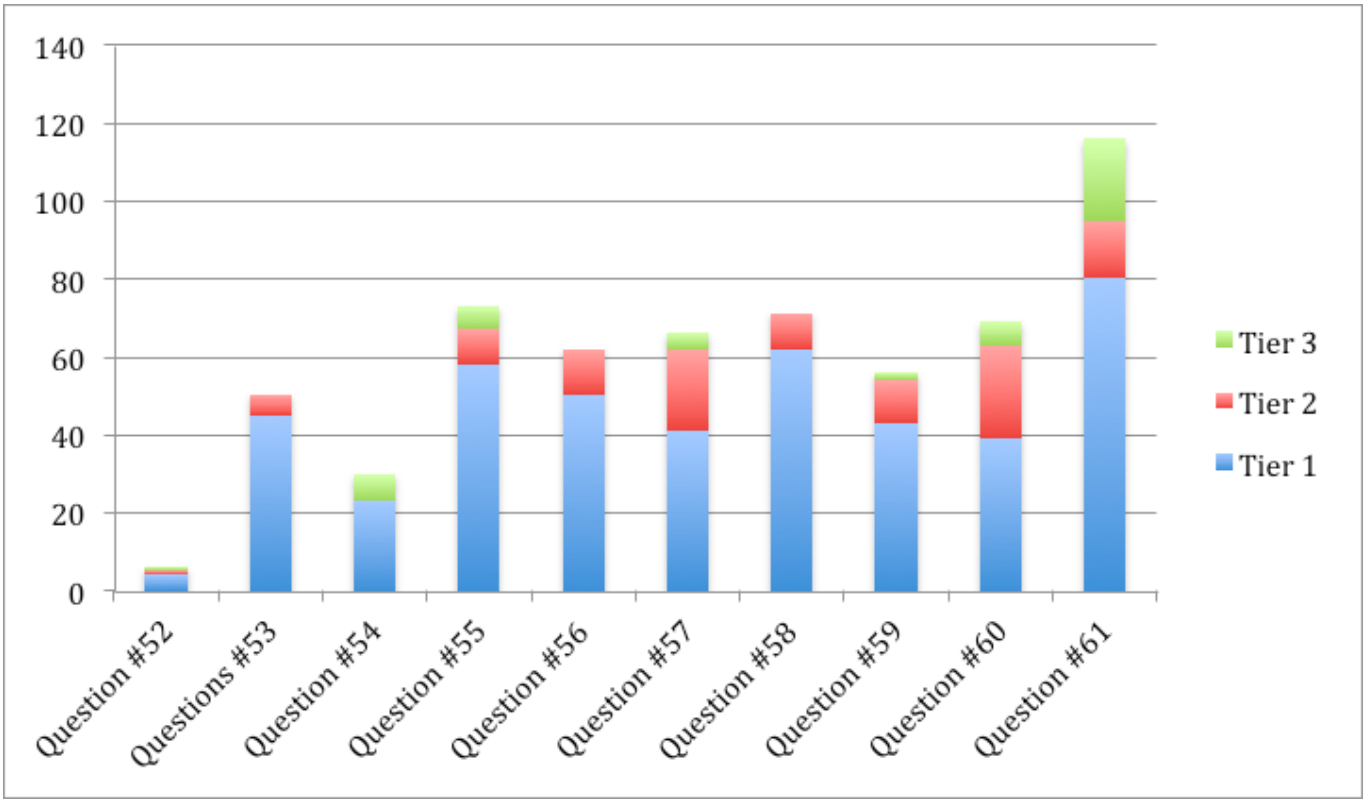


The 6th grade assessment does have its most difficult vocabulary question as its last question, however, there is not a set progression throughout the entirety of the assessment.

The 7th grade assessment only has two constructed response questions that are over 9% Tier 3 vocabulary words, these questions are the second (#53) and third (#54) on the assessment. The first constructed response question (#52) has 17% Tier 3 vocabulary words, and number 3 (#54) had 23% Tier vocabulary words. Like the 6th grade assessment, the 7th grade assessment does not have a set progression of vocabulary difficulty.

Figure 6

2017 Grade 7 Individual Constructed Response Question Vocabulary Tier Breakdown

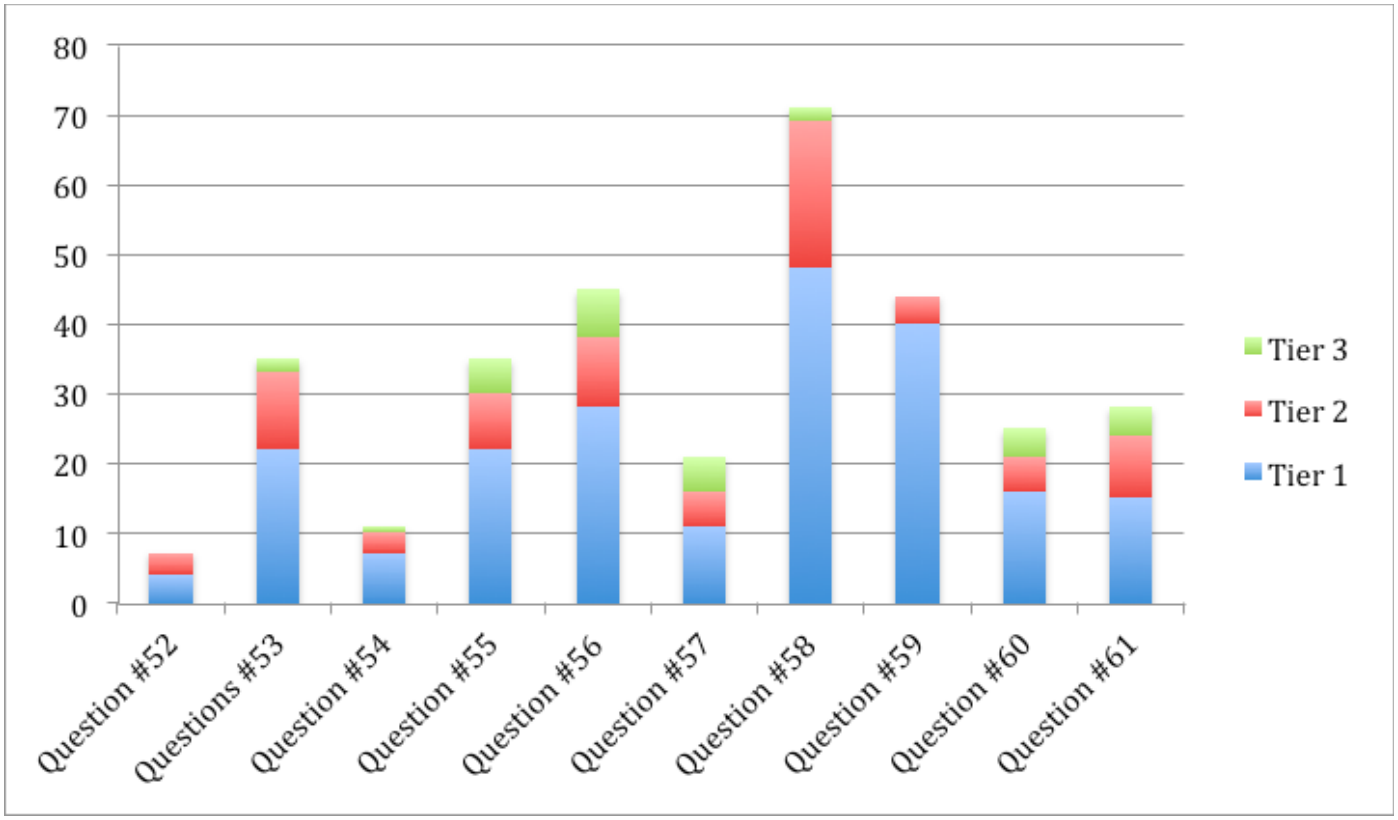


Unlike the 6th grade assessment, the 7th grade assessments most vocabulary difficult questions was the third question instead of the last constructed response question on the assessment.

The 8th grade assessment begins with three constructed response questions (#52-54) that are 9% or less Tier 3 vocabulary. The next two constructed response questions (#55-56) are 14% and 16% Tier 3 vocabulary words. The 6th constructed response question (#57) has the most vocabulary difficulty at 24% Tier 3 vocabulary words. The next two questions (#58-59) are 3% or less of Tier 3 vocabulary and the final two questions (#60-61) are 16% and 14% Tier 3 vocabulary.

Figure 7

2017 Grade 8 Individual Constructed Response Question Vocabulary Tier Breakdown



Similar to the 6th and 7th grade assessments, these constructed response questions also do not have a set progression of vocabulary difficulty. This observation continues for each grade level when looking at the Tier 2 vocabulary included in individual constructed response

questions. For the 6th grade assessment, the constructed response questions range from 12% to 30% Tier 2 vocabulary words, with no progression of vocabulary difficulty. For the 7th grade assessment, the constructed response questions range from 0% to 35% Tier 2 vocabulary words, with no progression of vocabulary difficulty. For the 8th grade assessment, the constructed response questions range from 9% to 43% Tier 2 vocabulary words, with no progression of vocabulary difficulty. Across each grade level, the three different Tier vocabulary levels do not have a set progression of difficulty.

Summary

Assessment vs Mathematics Assessment?, and Progression of Vocabulary Difficulty. The researcher found that mathematical vocabulary and language that was included in the New York State Mathematics assessment were not all found in the New York State Common Core State Standards. The researcher also found that comparatively the 6th and 7th grade New York State Mathematics assessment constructed response questions included about 260 more words than the 8th grade assessment. This brings forward to the discussion of the line between a reading assessment and a mathematics assessment. The final theme the researcher identified was a lack of progression of vocabulary difficulty within the constructed response questions. From the identification and evidence of these themes the researcher now must determine what these themes mean for other educators.

Chapter Five: Discussion

Introduction

With the completion of the data analysis and the identification of major themes, the researcher now must determine what is next. Why are these findings important? What should educators do with these finding? In the results chapter the researcher identified three major themes that emerged during the data analysis; Lack of Test Vocabulary in Instructional Standards, Reading Assessment vs Mathematics Assessment?, and Progression of Vocabulary Difficulty. After discussing the evidence to support these themes the researcher must determine what to do next with this information. In this chapter, the researcher will work to answer the questions what next?.

Significance

Students take the New York State Mathematics assessments each year from 3rd grade to 8th grade. Thus, it is important for teachers and schools to have an understanding and familiarity of what is expected of students in order to be successful on these assessments. It is the responsibility of the schools and teachers to gain the necessary knowledge and understanding in order to prepare their students. With the proper knowledge and understanding of the vocabulary on the New York State Mathematics assessments, teachers are able to adapt and design lessons that will prepare their students. After 8th grade, students begin to take mathematics state Regents exams, which are crucial for graduating from high school and getting into college. When students are prepared and successful in the younger grades on the New York State Mathematics assessments, they will have a strong understanding of the basics of mathematics before moving on to more advanced levels of mathematics. Students will then

be more prepared with the necessary prior knowledge in order to be prepared for upper level mathematics in high school and college. This data collect and analyzed also shows the importance that mathematics is more than numbers, students need to be familiar and prepared to read in order to be successful in mathematics. It is not enough to know the concepts in number form, students must know the corresponding vocabulary to the mathematics concepts.

Limitations

The most significant limitation of this study was time. The researcher would have liked to analyze more grade levels, ideally all 2017 assessments for grades 3 through 8. It would be interesting to see if the findings stayed true for all the grade level assessments. The researcher would also like to have completed the vocabulary analysis on the entire assessment, across all grade levels,looking at both the multiple choice and constructed response questions. Analyzing both types of questions would allow for the researcher to gain a better understanding of the entire assessment vocabulary difficulty. This in return would allow for a better data collection and an understanding on how to prepare students for the entire assessment, not just the constructed response questions. Another limitation of this study is the lack of a set definition and ability to determine the Tier vocabulary levels. While the researcher used a set definition of each Tier level and used the New York State Mathematics standards to determine the levels of each word, the leveling is based on the individual analyzing the vocabulary within each constructed response question. One final limitation while analyzing the data was the proficiency levels. The proficiency levels provided online are based on the entire test, not just the constructed response questions. Ideally, the researcher would have liked to compare the vocabulary difficulty of each question to the number of students who scored proficient on each

question. Thus, this comparison would examine the effect of the vocabulary difficulty on a student's ability to answer the assessment questions fully and accurately.

Implications

Teachers may take the findings and information from this research to help drive their mathematics instruction. Teachers should also consider implementing literacy strategies into their mathematics instruction. Students need to know how to read, approach, and answer mathematical word problems. They need to be able to find the information they need to answer the problem successfully and ignore the other unnecessary information. These are skills and strategies that must be taught to students in order for them to successfully implement. These strategies are not just important for the assessment but for preparing students for upper-level mathematics in their future. Teachers at every grade level should take the time before the beginning of the year to become familiar with mathematics standards of grade levels above and below the level they are teaching. Being familiar with all standards will allow the teacher to have a better understanding of what the students should already know and what they will need to know in order to be successful in future grade levels.

Conclusions

Through the data collection, analysis, and discussion there is a call for teachers to educate themselves about the State Mathematics assessments expectation. Teachers need to be familiar with the New York State Mathematics assessment expectations relating to mathematics concepts as well as the literacy aspects included in the assessments. When teachers have an understanding of these expectations in both mathematics concepts and literacy aspects of mathematics they are better prepared to meet the need of their students. It is not just a call to

prepare students for the New York State Mathematics assessments but also a call to prepare students for the next grade level of mathematics. Mathematics concepts from grade to grade build on one another, the teacher needs to be aware of the expectations of the grade level they teacher as well as the grade level before and the grade level after their own. When a teacher is familiar with the expectation of their grade level, the grade level before their, and the grade level after theirs they are able to continue building on the student prior knowledge. Teachers have the opportunity to not only prepare students for the New York State Mathematics assessment but to also to prepare and set them up for success in all future mathematics instruction. Through this research, the researcher found to need for literacy instruction within mathematics instruction. Teachers need to prepare their student for the specific mathematics vocabulary and language that will be on the New York State Mathematics assessment as well as in upper-level mathematics.

A specific vocabulary analysis of the New York State Mathematics assessments similar to this research completed in this thesis has not be completed before. Therefore, there is a need for the researcher to share their finding with the teaching community. The researcher will work to share these finding with educators of all grade levels who are teaching mathematics, whether it is a school year students will or will not be taking a New York State Mathematics assessment. These findings would be beneficial for any grade level mathematics teacher because mathematics is a building block of knowledge, which teachers should be aware of how to best prepare their student for success in the future. The researcher completed their analysis specifically on the middle school (6th-8th) New York State Mathematics assessments, there is a call for the future researcher to continue this vocabulary analysis with the other lower grade

level (3rd-5th) who also complete the New York State Mathematics assessment each school year. New York State has reworked and rewritten the Common Core State standards to design a next-generation set of standards. These standards will be implemented fully across New York State by the 2020 school year. With the implementation of the next generation standards, there is a call to continued to vocabulary analysis with the new standards.

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Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

52 Dana and Monique are dog groomers. Dana's workday is 10 hours and Monique's workday is 8 hours. Dana and Monique each work 40 hours per week.

On Monday, Dana groomed 15 dogs in 10 hours and Monique groomed 10 dogs in 8 hours. They each earn $12.75 for each dog groomed. Assuming that for the rest of the week Dana and Monique groom the same number of dogs per workday as they did on Monday, what will be the difference between their weekly earnings?

Show your work.

Answer $_____

GO ON

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

53 The formula below is used to convert a temperature in degrees Celsius, C, to a temperature in degrees Fahrenheit, F.

$$F = 1.8C + 32$$

The high temperature in a mountain city was 15°C. What was the high temperature in degrees Fahrenheit?

Show your work.

Answer _____ °F

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

54 A seamstress needs to cut 15-inch pieces of ribbon from a roll of ribbon that is 9 feet in length. What is the greatest number of 15-inch pieces the seamstress can cut from 5 of these rolls of ribbon?

Show your work.

Answer _____ pieces

GO ON

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

55 It is recommended that one fire extinguisher be available for every 6,000 square feet in a building. Write and solve an equation to determine x, the number of fire extinguishers needed for a building that has 135,000 square feet.

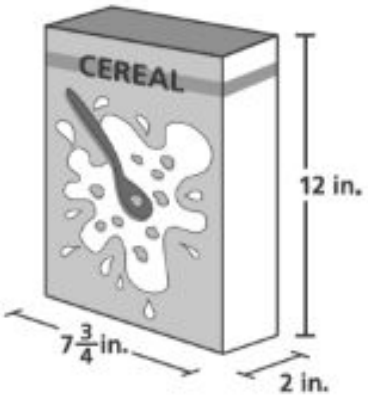
Show your work.

Answer _____ fire extinguishers

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

56 A company sells cereal in two different-sized boxes. The smaller box has the dimensions shown below.

Smaller Cereal Box



The height of the smaller box is 80% of the height of the larger box, while the other two dimensions are the same for both boxes. What is the difference in the volumes of the two boxes?

Show your work.

Answer _____ cubic inches

GO ON

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

57 The area of Brian's rectangular garden, in square feet, can be found by using the expression $6(2x + 5y)$. Use the distributive property to write an equivalent expression for the area of Brian's garden.

Equivalent expression _____

Use your equivalent expression to find the area of Brian's garden, in square feet, if $x = 3$ and $y = 4$.

Show your work.

Area _____ square feet

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

58 A hotel has a number of meeting rooms, m, available for events. Each meeting room has 325 chairs. Write an equation to represent c, the total number of chairs, in all of the meeting rooms at the hotel.

Equation _____

If $m = 7$, use your equation to find the total number of chairs in all of the meeting rooms at the hotel.

Show your work.

Answer _____ chairs

GO ON

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

59 Jimmy and his family are on their way to visit some family friends who live 780 miles away from them. Based on the route they chose, they expect to complete their trip in three days. The distances and average speeds for the first two days driven are shown below.

- First day: 4 hours at an average speed of 60 miles per hour
- Second day: 6 hours at an average speed of 65 miles per hour

If the average speed on the third day is 60 miles per hour, how many more hours will it take for them to reach their family friends' home?

Show your work.

Answer _____ hours

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

60 A right rectangular prism has a length of $2\frac{1}{2}$ feet, a width of 3 feet, and a height of $1\frac{1}{2}$ feet. Unit cubes with side lengths of $\frac{1}{2}$ foot are added to completely fill the prism with no space remaining. What is the volume, in cubic feet, of the right rectangular prism?

Show your work.

Answer _____ cubic feet

How many $\frac{1}{2}$-foot unit cubes can be added to fill the prism completely? Use what you know about unit cubes or the side lengths of prisms to show your work or explain your answer.

Answer _____ unit cubes

GO ON

Appendix A: 2017 Grade 6 Mathematics Released Constructed Response Questions

61 The table below shows the elevations at which different artifacts were found during an archeological dig.

Artifact	Elevation
arrow head	15 feet above sea level
bone	721 feet above sea level
clay bowl	sea level
necklace	462 feet above sea level
woven basket	1,200 feet below sea level

Write the name of each artifact and the elevation at which each artifact was found using a positive integer, zero, or negative integer.

Explain how you determined if an elevation required a positive integer, zero, or negative integer.

STOP

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

52 Find the value of the expression.

$$\frac{5}{(-1.5 + 9.5)} + \frac{0.4(7 + 11)}{-0.2}$$

Show your work.

Answer _____

GO ON

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

53 A museum opened at 8:00 a.m. In the first hour, 350 people purchased admission tickets. In the second hour, 20% more people purchased admission tickets than in the first hour. Each admission ticket cost $17.50.

What was the total amount of money paid for all the tickets purchased in the first two hours?

Show your work.

Answer $_____

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

54 Mick paid $2.94 in sales tax on an item that cost $42.00 before tax. At that rate, how much would he pay in sales tax for an item that costs $58.00 before tax?

Show your work.

Answer $_____

GO ON

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

55 At a store, customers are randomly selected to participate in a survey. On Friday, there were 500 customers at the store. Of those, 90 were selected to participate in the survey. On Saturday, the store manager expects 700 customers in the store. If the probability of being selected to participate in the survey on Saturday is the same as it was on Friday, how many customers will be selected to participate in the survey on Saturday?

Show your work.

Answer _____ customers on Saturday

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

56 A school club needs 300 feet of rope for a project. They have the amounts of rope listed below.

- 2 pieces of rope that are each 16 yards in length
- 1 piece of rope that is 12.5 yards in length
- 1 piece of rope that is 123.25 feet in length

How much additional rope, in feet, does the school club need in order to have enough rope for their project?

Show your work.

Answer _____ additional feet of rope

GO ON

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

57 The table below lists the masses and volumes of several pieces of the same type of metal. There is a proportional relationship between the mass and the volume of the pieces of metal.

PIECES OF METAL

Mass (grams)	Volume (cubic centimeters)
34.932	4.1
47.712	5.6
61.344	7.2
99.684	11.7

Determine the mass, in grams, of a piece of this metal that has a volume of 15.3 cubic centimeters. Round your answer to the nearest tenth of a gram.

Show your work.

Answer _____ grams

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

58 The table below shows the weekly change in the price of one gram of gold for four weeks.

ONE GRAM OF GOLD

Week	Weekly Change in the Price (dollars)
1	+1.25
2	−3.125
3	+0.625
4	+1.5

By how much did the price of one gram of gold change from the beginning of week 1 to the end of week 4? Did the price increase or decrease?

Explain how you found your answer.

At the end of week 4, the price per gram of gold was $39.28. What was the price per gram of gold at the beginning of week 1?

Show your work.

Answer _____ price per gram of gold

GO ON

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

59 Hallum Hardware created flyers to advertise a sale on a certain type of carpet. A portion of the flyer is shown below.

HALLUM HARDWARE
CARPET SALE

Area (square feet)	Cost (dollars)
500	750
1,000	1,500
1,500	2,250
2,000	3,000

Guillen Floors advertises the same type of carpet at a cost of 10% less per square foot than Hallum Hardware. Determine the cost of 700 square feet of the carpet if it is bought from Guillen Floors.

Show your work.

Answer $_____

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

60 A single gram of a certain metallic substance has 0.52 gram of copper and 0.26 gram of zinc. The remaining portion of the substance is nickel. Ben estimated that 0.2 gram of nickel is in 1 gram of the substance. He used this to estimate the amount of nickel in 35 grams of the substance. Find the result of Ben's estimation strategy. Then, find the exact amount of nickel in 35 grams of the substance.

Show your work.

Ben's estimate _____ grams

Exact amount _____ grams

GO ON

Appendix B: 2017 Grade 7 Mathematics Released Constructed Response Questions

61 Last year, a property manager bought five identical snow shovels and six identical bags of salt. The total cost of the snow shovels was $172.50, before tax, and each bag of salt cost $6.20, before tax.

This year, the property manager bought two identical snow shovels and four identical bags of salt. The total cost of the snow shovels was $70.38, before tax, and the total cost of the bags of salt was $26.04, before tax.

Determine the item with the greatest percent increase in the price from last year to this year. Be sure to include the percent increase of this item to the nearest percent.

Show your work.

Answer _____ and _____ %

STOP

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

52 Determine the solution to the equation below.

$$-3.1x + 7 - 7.4x = 1.5x - 6\left(x - \frac{3}{2}\right)$$

Show your work.

Answer _____

GO ON

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

53 A cylinder and a cone have the same volume. The cylinder has a radius of 2 inches and a height of 3 inches. The cone has a radius of 3 inches. What is the height of the cone?

Show your work.

Answer _____ inches

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

54 Determine the solution, if any, to the system of equations below.

$$8x - 2y = 1$$
$$-4x + y = 3$$

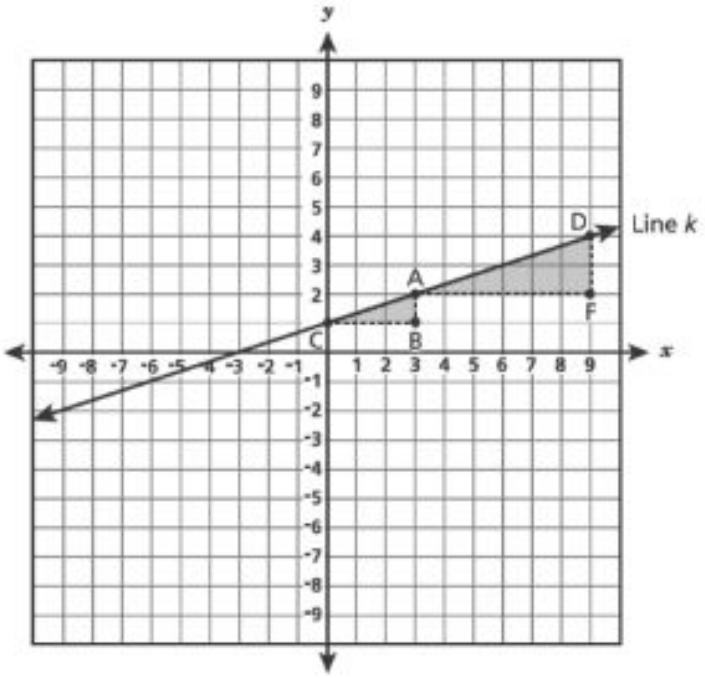
Show your work.

Answer _____

GO ON

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

55 The hypotenuses of similar triangles ABC and DFA both lie on line k, as shown below.



Demonstrate whether the slope of line k is constant between points C and D. Use the leg lengths of triangles ABC and DFA in your answer.

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

56 The values in the table below represent Function B, which is a linear function.

x	y
−3	−7
−1	−1
1	5
3	11

Function L is represented by the equation $y = 6x + 4$. Compare Functions B and L by determining which one has the greater rate of change and which one has the greater y-intercept. Explain why your answers are correct.

Show your work.

GO ON

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

57 The values given in the table below lie on the graph of a linear function.

x	y
0.25	1.00
0.50	1.75
0.75	2.50

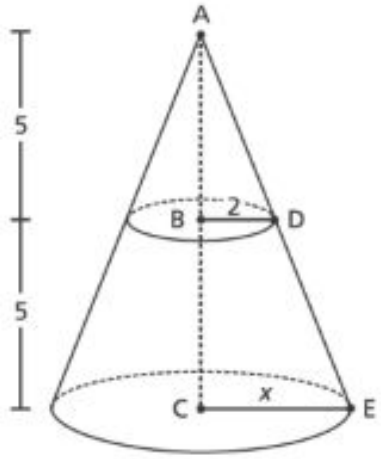
What equation represents this linear function?

Show your work.

Answer _____

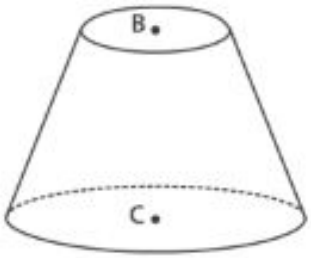
Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

58 The circular base of the cone below has center C. Another circle, with center B, is parallel to the base. This circle is the base of a smaller cone with height AB. The measurements in the diagram are given in inches.



Triangle ABD is similar to triangle ACE.

The smaller cone is removed to create a new object, as shown below.



What is the volume of this new object? Round your answer to the nearest tenth.

Show your work.

Answer _____ cubic inches

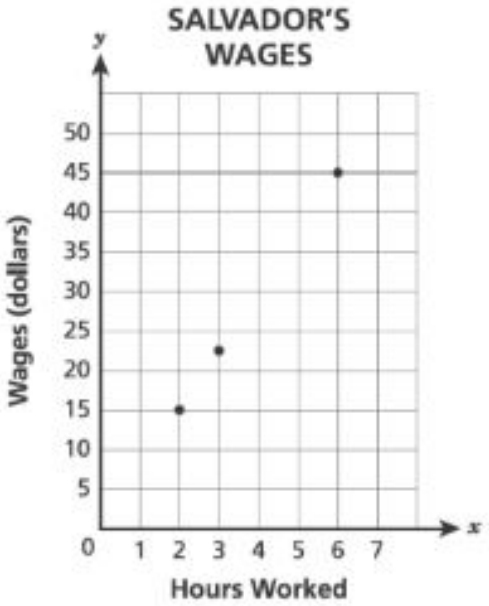
GO ON

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

59 The table and the graph below show Josie's and Salvador's wages, respectively, based on the number of hours worked.

JOSIE'S WAGES

Hours Worked	Wages (dollars)
3	26.25
5	43.75
7	61.25



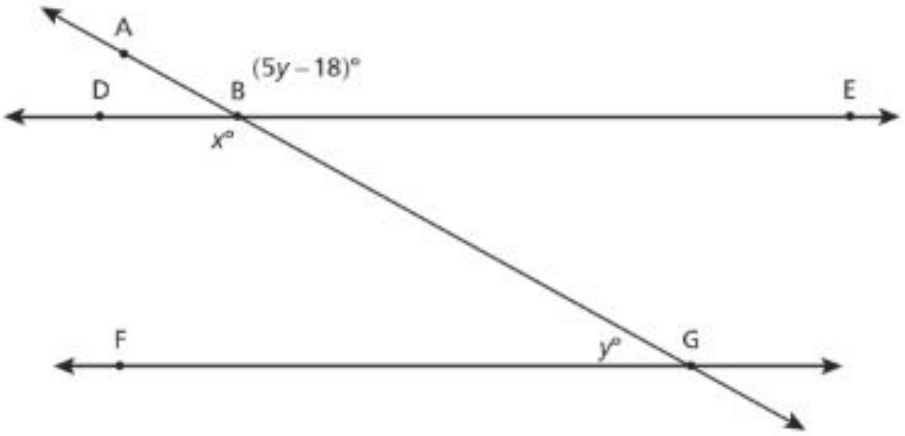
In 2010, Josie and Salvador each worked an eight-hour day for five days each week. How many weeks did it take Josie to earn $1,000 more than Salvador?

Show your work.

Answer _____ weeks

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

60 In the figure below, line DE is parallel to line FG, with transversal AG.



Write and solve a system of linear equations to determine the values of x and y.

Show your work.

Answer $x =$ _____ and $y =$ _____

GO ON

Appendix C: 2017 Grade 8 Mathematics Released Constructed Response Questions

61 Four equations are shown below.

Equation 1: $y = 2^x$

Equation 2: $y = 2x - 5$

Equation 3: $y = x^2 + 6$

Equation 4: $y = \frac{x}{2}$

Identify one linear equation and one nonlinear equation from the list. State a reason why each equation you identified is linear or nonlinear.

Linear equation _____

_____

_____

_____

Nonlinear equation _____

_____

_____

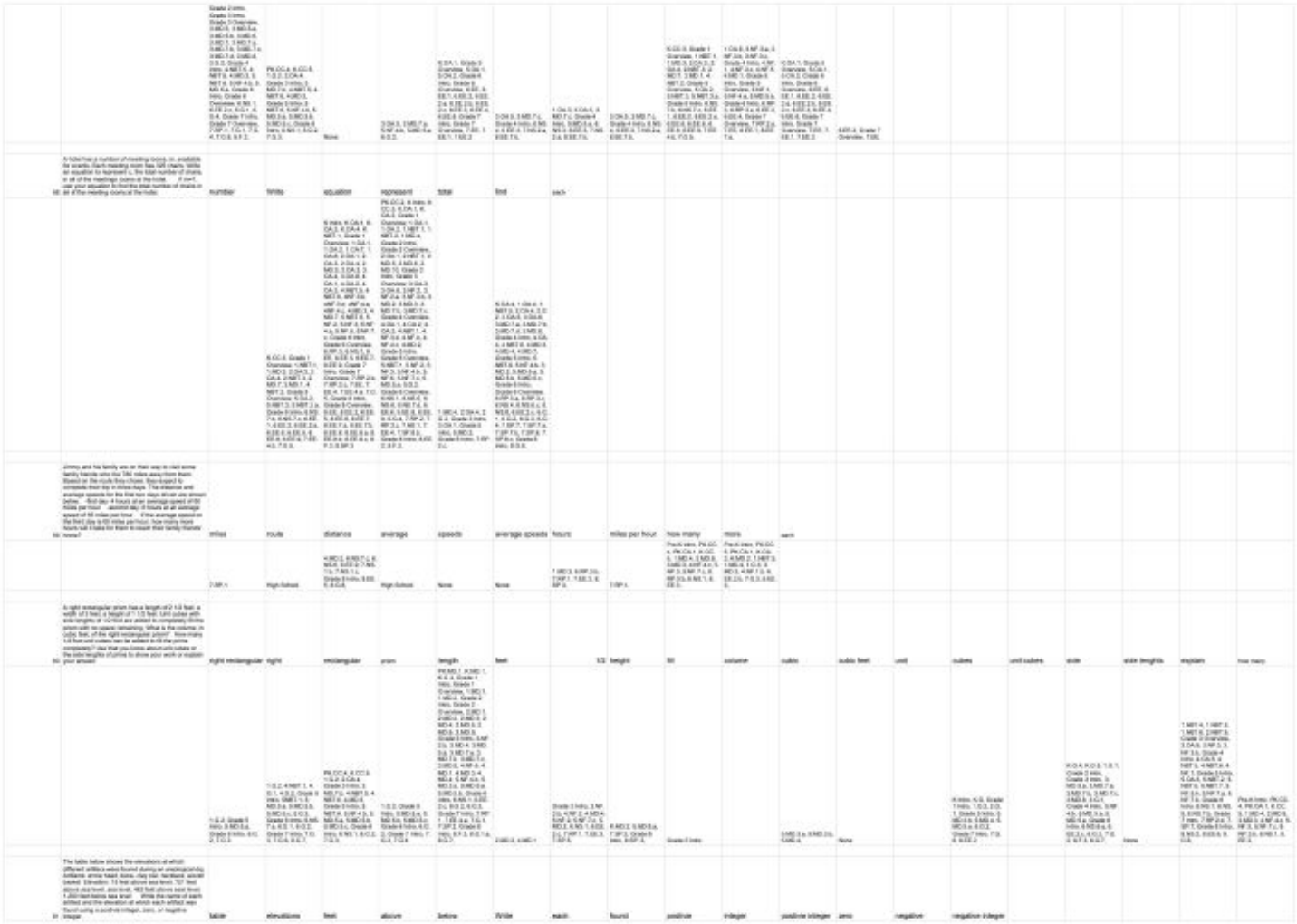
_____

STOP

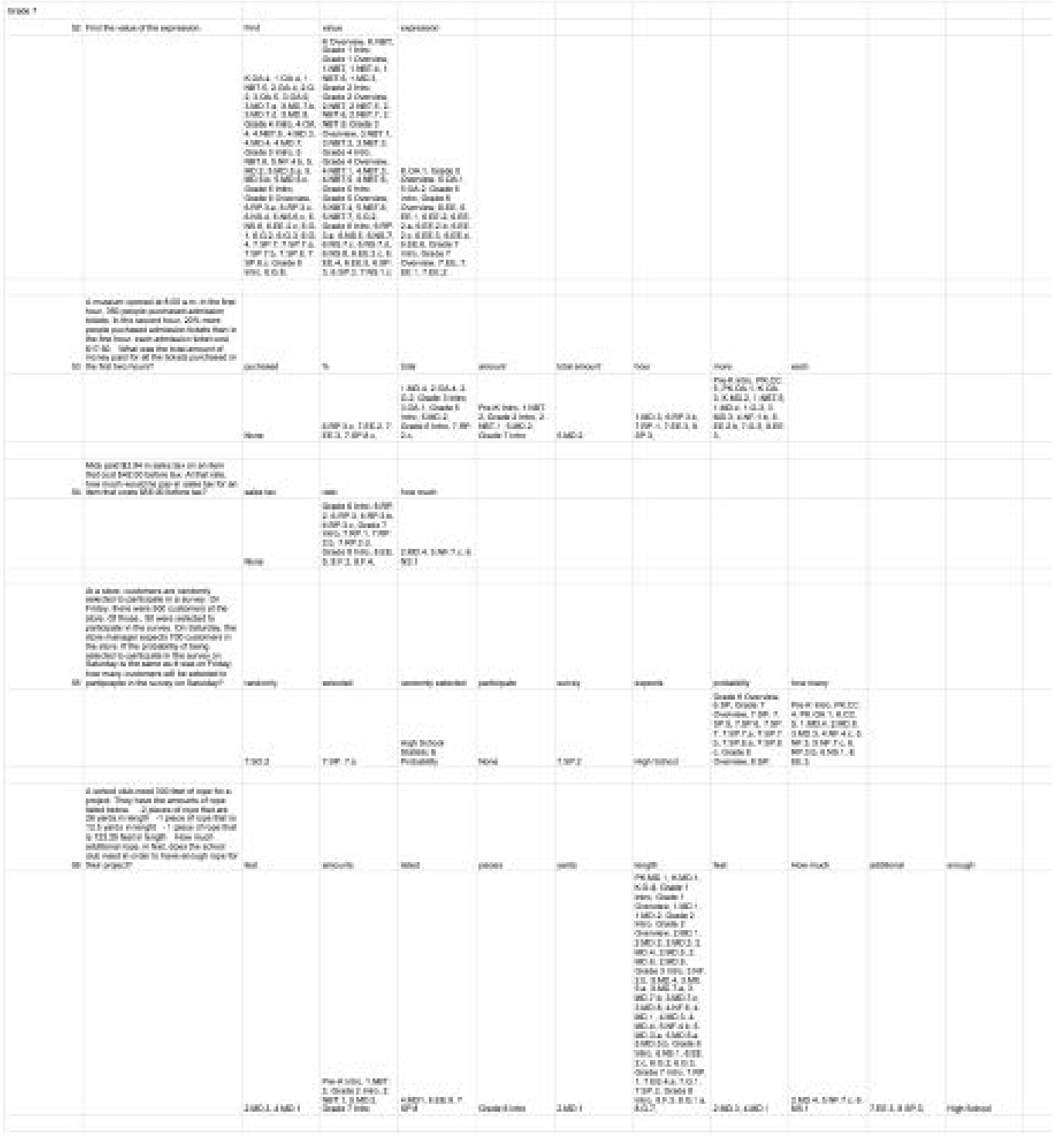
Appendix D: Grade 6 Standards Vocabulary Analysis

Grade 6													
62	Dana and Monique are dog groomers. Dana's workday is 10 hours and Monique's workday is 6 hours. Dana and Monique each work 40 hours per week. On Monday, Dana groomed 15 dogs in 10 hours and Monique groomed 10 dogs in 6 hours. They each earn $12.75 for each dog groomed. Assuming that for the rest of the week Dana and Monique groom the same number of dogs per workday as they did on Monday, what will be the difference between their weekly earnings?	Assuming	difference	hour	each								
		High School	PK.O.3, K.MD.2, K.G.4, 1.NBT.4, Grade 2 Intro, 2.MD.4, 3.MD.6, 4.MD.4, Grade 5 Intro, 5.NF.1, Grade 7 Intro, 7.NS.1.a, 7.RP.3,	1.MD.3, 6.RP.3.b, 7.RP.1, 7.EE.3, 8.RP.3,									
63	The formula below is used to convert a temperature in degree Celsius, C, to temperature in degrees Fahrenheit, F. F=1.8C+32 The high temperature in a mountain city was 15C. What was the high temperature in degrees Fahrenheit?	formula	convert	degree Celsius	degrees Fahrenh	F=1.8C+32	degrees						
		4.MD.3, 6.MD.4.b, Grade 6 Intro, 6.EE.2.b, 6.RP.2.c, 6.G.2, Grade 7 Intro, 7.G.4, Grade 8 Intro, 8.G.9,	Grade 6 Overview, 6.MD.1, 6.NS.4, 7.NS.2.d, 7.EE.3, 8.NS.1,	None	None	None	4.MD.5.a, 4.MD.6, 7.RP.3,						
64	A seamstress needs to cut 15-inch pieces of ribbon from a roll of ribbon that is 8 feet in length. What is the greatest number of 15-inch pieces the seamstress can cut from 5 of these rolls of ribbon?	inch	feet	lenght	greatest	number	piece						
		2.MD.3, 4.MD.1, 7.EE.3,	2.MD.3, 4.MD.1	None	6.NS.4		Grade 6 Intro						
65	It is recommended that one fire extinguisher be available for every 6,000 square feet in a building. Write and solve an equation to determine n, the number of fire extinguishers needed for a building that has 135,000 square feet.	recommended	square feet	Write	solve	equation	determine	number					
		None	None	K.CC.3, Grade 1 Overview, 1.NBT.1, 1.MD.3, 2.OA.3, 2.OA.4, 2.NBT.3, 2.NBT.3.a, Grade 5 Overview, 5.OA.2, 5.NBT.3, 5.NBT.3.a, Grade 6 Intro, 6.NS.7.c, 6.EE.1, 6.RP.3, 6.RP.3.a, 6.EE.6, 6.EE.7, 6.EE.7.a, 7.G.A,	Pre-K Intro, K Intro, K.OA.2, Grade 1 Intro, Grade 1 Overview, 1.OA.1, 1.OA.3, Grade 2 Intro, Grade 2 Overview, 2.OA.1, 2.MD.8, 2.MD.9, 2.MD.10, Grade 3 Intro, Grade 3 Overview, 3.OA.3, 3.OA.8, 3.MD.1, 3.MD.3, 3.MD.7.d, 3.MD.8, Grade 4 Intro, Grade 4 Overview, 4.OA.3, 4.G.A.3, 4.NF.3.d, 4.NF.4.c, 4.MD.2, 4.MD.4, 4.MD.7, Grade 5 Intro, Grade 5 Overview, 5.NF.2, 5.NF.3, 5.NF.4, 5.NF.6, 5.NF.7.c, 5.MD.2, 5.MD.5.b, 5.MD.5.c, 5.MD.5.c, Grade 6 Intro, Grade 6 Overview, 6.RP.3, 6.RP.3.b, 6.RP.3.C, 6.NS.1, 6.NS.4, 6.NS.5, 6.NS.6.c, 6.EE.5, Grade 7 Intro, Grade 7 Overview, 7.RP.3, 7.NS.3, 7.EE.3, 7.EE.4, 7.EE.4.a, 7.G.4.a, 7.G.6, 8.G.9, 7.G.1, 7.G.4, 7.G.5, 7.G.6, Grade 8 Intro, Grade 8 Overview, 8.EE.7, 8.EE.7.b, 8.EE.8, 8.EE.8.b, 8.EE.8.c, 8.G.9, 8.RP.3,	K Intro, K.OA.1, K.OA.3, K.OA.5, K.NBT.1, Grade 1 Overview, 1.OA.1, 1.OA.2, 1.OA.7, 1.OA.8, 2.OA.1, 2.OA.3, 2.OA.4, 2.MD.5, 3.OA.3, 3.OA.5, 3.OA.8, 4.OA.1, 4.OA.2, 4.OA.3, 4.NBT.5, 4.NBT.6, 4.NBT.6, 4NF.3.b, 4NF.3.d, 4NF.4.a, 4NF.4.c, 4.MD.3, 4.MD.7, 5.NBT.6, 5.NF.2, 5.NF.3, 5.NF.4.a, 5.NF.6, 5.NF.7.c, Grade 6 Intro, Grade 6 Overview, 6.RP.3, 6.NS.1, 6.EE.6,6.EE.5, 6.EE.7, 6.FF.5, Grade 7 Intro, Grade 7 Overview, 7.RP.2.b, 7.RP.2.c, 7.EE.3, 7.EE.4, 7.G.6, Grade 8 Intro, Grade 8 Overview, 8.FF, 8.FF.2, 8.FF.5, 8.EE.6, 8.EE.7, 8.FF.7.a, 8.FF.7.b, 8.NS.6, 8.NS.8.a, 8.FF.8.b, 8.FF.8.c, 8.F.2, 8.F.4, 8.G.7	Pre-K Intro, Grade 1 Intro, 1.OA.7, 1.OA.8, 2.OA.3, 2.MD.4, Grade 3 Intro, 3.OA.4, 4.OA.4, Grade 5 Intro, Grade 6 Intro, 6.EE.5, 7.G.2, 7.SP.7.a, Grade 8 Intro, 8.NS.3, 8.NS.6, 8.F.2, 8.F.4, 8.G.7					
66	A company sells cereal in two different-sized boxes. The smaller box has the dimensions shown below. The height of the small box is 80% of the height of the taller box, while the other two dimensions are the same for both boxes. What is the difference in the volumes of the two boxes.	dimensions	height	%	difference	volumes							
		6th Grade	K.MD.2, 5.MD.5.a, 7.RP.3, Grade 8 Intro, 8.RP.3,	6.RP.3.c, 7.EE.3, 7.RP.3, 7.SP.8.c,	PK.O.3, K.MD.2, K.G.4, 1.NBT.4, Grade 2 Intro, 2.MD.4, 2.MD.8, 4.MD.4, Grade 5 Intro, 5.NF.1, Grade 7 Intro, 7.NS.1.a, 7.RP.3,	Grade 2 Intro, Grade 3 Overview, 3.MD.2, 4.MD.2, Grade 5 Intro, Grade 5 Overview, 5.MD.5, 5.MD.5.a, 5.MD.5.b, 5.MD.4, 5.MD.5, 5.MD.5.a, 5.MD.5.b, 5.MD.5.c, Grade 6 Intro, Grade 6 Overview, 6.EE.2.c, 6.G.2, Grade 7 Intro, Grade 7 Overview, 7.G.6, Grade 8 Intro, Grade 8 Overview, 8.G.9,								
67	The area of Brian's rectangular garden, in square feet, can be found by using the expression 8(2m+5). Use the distributive property to write an equivalent expressions for the area of Brian's garden. Use your equivalent expression to find the area of Brians garden, in square feet, if m=3 and y=4.	area	rectangular	square feet	found	expression	distributive	property	distributive propewrite		equivalent	expressions	equivalent expression

Appendix D: Grade 6 Standards Vocabulary Analysis

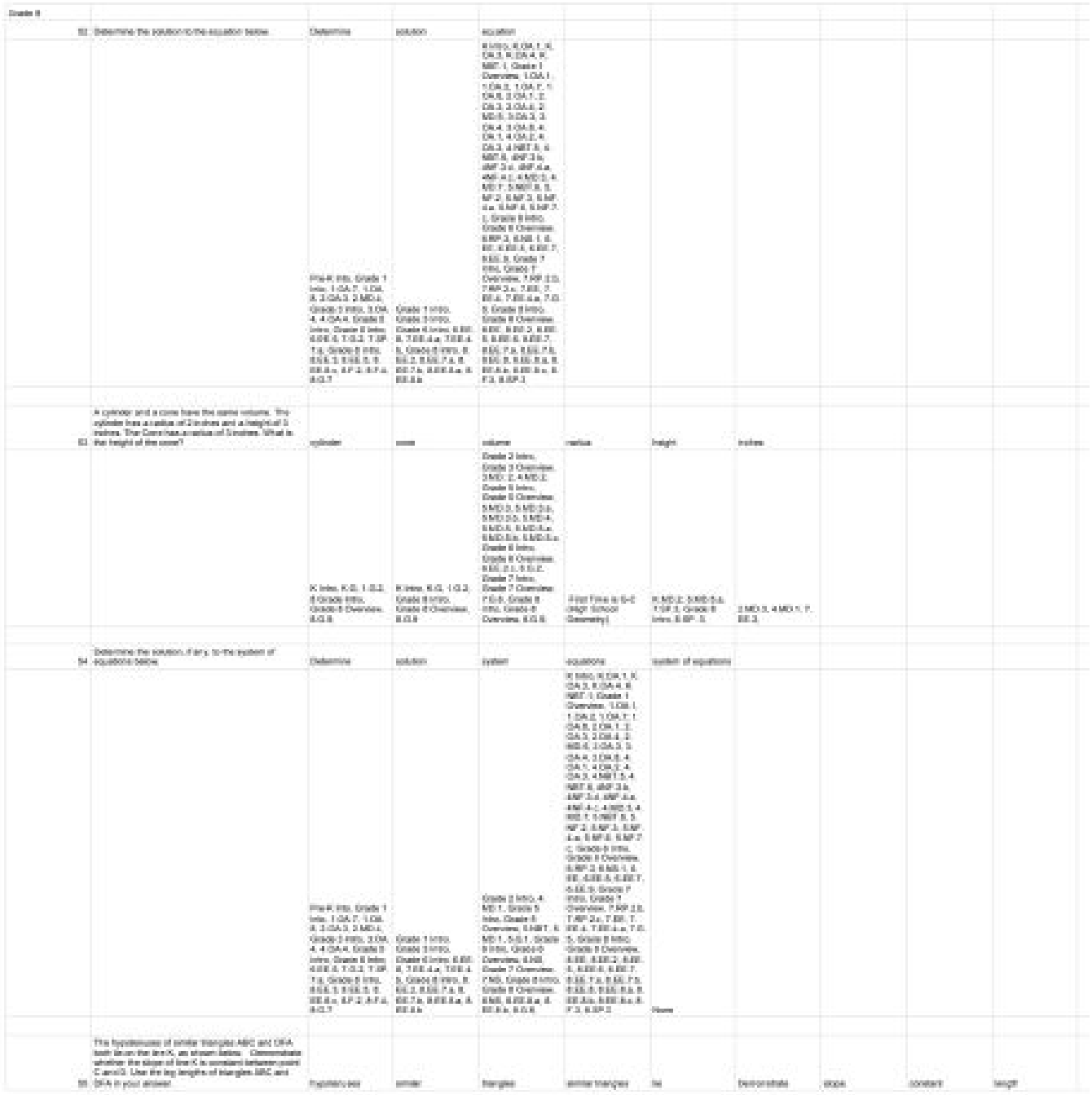


Appendix E: Grade 7 Standards Vocabulary Analysis



Appendix E: Grade 7 Standards Vocabulary Analysis

Appendix F: Grade 8 Standards Vocabulary Analysis



Appendix F: Grade 8 Standards Vocabulary Analysis

		Name	PK-8, K-G, Grade 2 Intro, Grade 7 Intro, 7.SP.3, Grade 8 Intro, Grade 8 Overview, 8.EE.6, 8.G.4, 8.G.5,	Pre-K Intro, PK Overview, PK.G, K Intro, K.G, K.G.6, Grade 1 Intro, 1.G, 1.1.G.2, 2.G.1, 4.G.2, Grade 6 Intro, 6.G.1, 6.G.4, Grade 7 Intro, 7.G.2, 7.G.6, Grade 8 Intro, 8.G.6, 8.G.9, 8.G.5, 8.G.6,	Grade 8 Intro, 8.EE.6	4.NF.4.c, 5.NF.3	PK.CM	Grade 7 Intro, Grade 8 Intro, 8.EE.5, 8.EE.6, 8.SP.3,	8.EE.8, 7.NF.2.a, 7.NF.2.c, Grade 8 Intro	PK.MD.1, K.MD.1, K.G.4, Grade 1 Intro, Grade 1 Overview, 1.MD.1, 1.MD.2, Grade 2 Intro, Grade 2 Overview, 2.MD.1, 2.MD.2, 2.MD.3, 2.MD.4, 2.MD.5, 2.MD.6, 2.MD.8, Grade 3 Intro, 3.NF.3.b, 3.MD.4, 3.MD.5.a, 3.MD.5.b, 3.MD.7.a, 3.MD.7.b, 3.MD.7.c, 3.MD.8, 4.NF.6, 4.MD.1, 4.MD.3, 4.MD.4, 5.NF.4.b, 5.MD.3.a, 5.MD.3.b, 5.MD.5.a, Grade 6 Intro, 6.NS.1, 6.EE.2.c, 6.G.2, 6.G.3, Grade 7 Intro, 7.NS.1, 7.EE.4.a, 7.G.1, 7.SP.2, Grade 8 Intro, 8.F.3, 8.G.1.a, 8.G.1							
56	The value in the table below represents Function B, which is a linear function. Function L is represented by the equation y=8x+4. Compare Functions B and L by determining which one has the greater rate of change and which one has the greater y-intercept. Explain why your answers are correct.	value	table	Function	linear	linear function	equation	Compare	Compare Functions	solve/simplify	rate of change	y-intercept	Explain					
		K Overview, K.NBT, Grade 1 Intro, Grade 1 Overview, 1.NBT.1, NBT.4, 1.NBT.5, 1.MD.3, Grade 2 Intro, Grade 2 Overview, 2.NBT.1, 2.NBT.3, 2.NBT.5, 2.NBT.7, 2.NBT.9, Grade 3 Overview, 3.NBT.1, 3.NBT.2, 3.NBT.3, Grade 4 Intro, Grade 4 Overview, 4.NBT.1, 4.NBT.3, 4.NBT.5, 4.NBT.6, Grade 5 Intro, Grade 5 Overview, 5.NBT.1, 5.NBT.2, 5.NBT.3.a, 5.NBT.3.b, 5.NBT.7, 5.G.2, Grade 6 Intro, 6.NS.2, 6.NS.3, 6.NS.7, 6.NS.7.a, 6.NS.7.b, 6.NS.7.c, 6.NS.7.d, 6.NS.8, 6.EE.2.a, 6.EE.6, 6.EE.8, 6.RP.3.a, 6.NS.5, 6.NS.6.b, 6.NS.6.c, 6.NS.7, 6.NS.7.a, 6.NS.7.b, 6.NS.7.c, 6.NS.7.d, 6.NS.8, 6.EE.2.c, 6.EE.4, 6.G.3, 6.SP.3, 7.NS.1.a, 6.NS.2, 6.F.2, 6.F.4,	3.OA.9, 4.MD.1, Grade 6 Intro, 6.EE.8, 6.G.3, 6.F.2, 6.F.4,	Grade 1 Intro, Grade 2 Intro, Grade 3 Overview, 3.MD, Grade 7 Intro, 7.EE.1, Grade 8 Intro, Grade 8 Overview, 8.EE.6, 8.F.1, 8.F.2, 8.F.3, 8.F.4, 8.F.5, 8.SP.1, 8.SP.2, 8.SP.3,	Overview, 8.EE.6, 8.F.3,	8.EE.8, 7.NS.2.a, 7.EE.3.a, 7.G.6, Grade 8 Intro, Overview, 8.EE.6, 8.EE.8, 8.F.3, 8.F.4, 8.G.6, 8.G.9,	8.EE.5, 8.EE.6, 8.F.3,	K Intro, K.OA.1, K.OA.3, K.OA.4, K.NBT.1, Grade 1 Overview, 1.OA.1, 1.OA.2, 1.OA.7, 1.OA.8, 2.OA.1, 2.OA.2, 2.OA.3, 2.OA.4, 2.MD.5, 3.OA.3, 3.OA.5, 3.OA.7, 3.OA.8, 4.OA.1, 4.OA.2, 4.OA.3, 4.NBT.5, 4.NF.3.a, 4.NF.3.d, 4.NF.4.a, 4.NF.4.c, 4.MD.3, 4.MD.7, 5.NBT.6, 5.NF.2, 5.NF.3, 5.NF.4.a, 5.NF.7.c, Grade 6 Intro, 6.RP.3, 6.NS.1, 6.EE.6, 6.EE.7, 6.EE.9, Grade 7 Intro, Grade 7 Overview, 7.RP.2.a, 7.NS.2.a, 7.EE.1, 7.EE.4.a, 7.G.5, Grade 8 Intro, Grade 8 Overview, 8.EE.6, 8.EE.8.c, 8.EE.8.b, 8.F.3, 8.SP.3	Pre-K Intro, PK Overview, PK.CC, PK.MD, PK.G, K Overview, K.CC.7, K.MD.2, K.G.4, Grade 1 Intro, 1.MD.2, 1.MD.3, Grade 2 Intro, 2.MD.3, Grade 3 Intro, 3.NF.3.c, 3.NF.3.d, 3.MD.3, Grade 4 Overview, 4.NF.2, 4.NF.7.3, 4.MD.2, Grade 5 Intro, 5.NF.1, 5.NF.2.3, 5.MD.2, Grade 6 Intro, 6.NS.3, 6.EE.5, 6.EE.7, 6.EE.8, Grade 7 Intro, Grade 7 Overview, 7.RP.2.b, 7.RP.2.c, 7.EE.1, 7.EE.4.a, 7.G.4, Grade 8 Intro, Grade 8 Overview, 8.EE.6, 8.EE.8.c, 8.EE.8.b, 8.F.3, 8.SP.3	8 Grade Overview, 8.F	High School Function Intro	Grade 8 Intro, 8.F.3, 8.F.4,	Grade 8 Intro	I.MRT.4, I.MRT.6, I.MRT.8, 2.MRT.9, Grade 3 Overview, 3.OA.8, 3.NF.3.3, NF.3.b, Grade 4 Intro, 4.OA.5, 4.MRT.6, 4.MRT.8, 4.NBT.4, NF.1, Grade 5 Intro, 5.OA.3, 5.NBT.2.5, MRT.6, 6.NBT.7, 6, NF.6.a, 6.NF.7.a, 6, NF.7.b, Grade 6 Intro, 6.NS.1, 6.NS.5, 6.SS.5 NS.7.a, Grade 7 Intro, 7.NF.2.a, 7, RP.7, Grade 8 Intro, 8.NS.2, 8.EE.6, 8, 8, 0.S.				
57	The values given in the table below lie on the graph of a linear function. What equation represents this linear function.	values	linear	function	linear function	graph	equation	represents	table									
		K Overview, K.NBT, Grade 1 Intro, Grade 1 Overview, 1.NBT.1, MRT.4, 1.NBT.5, 1.MD.3, Grade 2 Intro, Grade 2 Overview, 2.NBT.1, 2.NBT.5, 2.NBT.6, 2.NBT.7, 3.NBT.1, 3.NBT.2, 3.NBT.9, Grade 3 Overview, 3.NBT.1, 3.NBT.2, 3.NBT.3, Grade 4 Intro, Grade 4 Overview, 4.NBT.1, 4.NBT.3, 4.NBT.5, Grade 5 Intro, Grade 5 Overview, 5.NBT.4, 5.NBT.6, 5.NBT.7, 5.G.2, Grade 6 Intro, 6.RP.3.a, 6.NS.5, 6.NS.7, 6.NS.7.a, 6.NS.7.b, 6.NS.7.c, 6.NS.7.d, 6.NS.8, 6.EE.2.c, 6.EE.4, 6.G.3, 6.SP.3, 7.NS.1.a, 6.NS.2, 6.F.2, 6.F.4,	Grade 1 Intro, Grade 2 Intro, Grade 3 Overview, 3.MD, Grade 7 Intro, 7.EE.1, Grade 8 Intro, Grade 8 Overview, 8.EE.6, 8.F.1, 8.F.2, 8.F.3, 8.F.4, 8.F.5, 8.SP.1, 8.SP.2, 8.SP.3,	Grade 8 Intro, 8.F.2, 8.F.3, 8.F.4,	2.MD.10, 3.MD.3, Grade 5 Overview, 5.OA.3, 5.G.2, 8, MD.6, 6.EE.9, Grade 7 Intro, 7.RP.2.a, 7.RP.2.c, 7.EE.4.a, Grade 8 Intro, Grade 8 Intro, 8.EE.6, 8.F.3, 8.F.4, 8.F.5,	8.EE.6, 8.F.3,	K Intro, K.OA.1, K.OA.3, K.OA.4, K.NBT.1, Grade 1 Overview, 1.OA.1, 1.OA.2, 1.OA.7, 1.OA.8, 2.OA.1, 2.OA.2, MD.5, 3.OA.3, 3.OA.5, OA.4, 3.OA.8, 4.OA.1, 4.OA.2, 4.OA.3, 4.NBT.5, 4.NF.3.a, 4NF.3.d, 4NF.4.a, 4NF.4.c, 4.MD.3, 4.MD.7, 5.NBT.6, 5.NF.2, 5.NF.3, 5.NF.4.a, 5.NF.7.c, Grade 6 Intro, 6.RP.3, 6.NS.1, 6.EE.6, 6.EE.7, 6.EE.9, Grade 7 Intro, Grade 7 Overview, 7.RP.2.a, 7.NS.2.a, 7.EE.1, 7.EE.4.a, 7.G.5, Grade 8 Intro, Grade 8 Overview, 8.EE.6, 8.EE.8.c, 8.EE.8.b, 8.F.3, 8.SP.3	4.MRT.1, 8.NBT.1, 6.NS.7.a	3.OA.8, 4.MD.1, Grade 6 Intro, 6.RP.3.a, 6.NS.5, 7.NP.2.a, 7.NP.2.c, 7.NP.3, 7.SP.3.a, 8, F.2, 8.F.4, 8.SP.4,							
58	The circular base of the cone below has center C. Another circle, with center B, is parallel to the base. This circle is the base of a smaller cone with height AB. The measurements in the diagram are given in inches. Triangle ABD is similar to triangle ACE. The smaller cone is removed to create a new object as shown below. What is the volume of the new object? Round your answer to the nearest tenth.	circular	base (in shape)	cone	circle	parallel	height	measurements	diagram	inches	triangle	similar	volume	Round	nearest	tenth	nearest tenth

Appendix F: Grade 8 Standards Vocabulary Analysis

Appendix G: Missing Assessment Language From Standards Table

Words	Location in Standard	Test
Mass	3rd, 4th	7th
Grams	3rd	7th
Cylinder	K, 1st, 8th	8th
Cone	K, 1st, 8th	8th
Lie	4th	8th
Parallel	4th, 8th	8th

Word	Test
Portion	7th
System of equations	8th
Hypotenuses	8th
Length	6th, 7th, 8th
Square feet	6th, 7th
Cubic feet	6th
Side length	6th
Dimensions	6th
Tax	7th
Cubic centimeter	7th
% less	7th
Per square feet	7th
Exact amount	7th
Nearest tenth	7th, 8th

Appendix H: Grade 6 Color Coded Constructed Response Questions

Grade 6	Tier 1: 429	Tier 2: 101	Tier 3: 50	Total: 580
52	Dana and Monique are dog groomers. Dana's workday is 10 hours and Monique's workday is 8 hours. Dana and Monique each work 40 hours per week. On Monday, Dana groomed 15 dogs in 10 hours and Monique groomed 10 dogs in 8 hours. They each earn $12.75 for each dog groomed. Assuming that for the rest of the week Dana and Monique groom the same number of dogs per workday as they did on Monday, what will be the difference between their weekly earnings?			
	Tier 1: 65	Tier 2: 11	Tier 3: 0	Total: 76
53	The formula below is used to convert a temperature in degree Celsius, C, to temperature in degrees Fahrenheit, F. F=1.8C+32 The high temperature in a mountain city was 15C. What was the high temperature in degrees Fahrenheit?			
	Tier 1: 21	Tier 2: 10	Tier 3: 2	Total: 33
54	A seamstress needs to cut 15-inch pieces of ribbon from a roll of ribbon that is 9 feet in length. What is the greatest number of 15-inch pieces the seamstress can cut from 5 of these rolls of ribbon?			
	Tier 1: 30	Tier 2: 7	Tier 3: 0	Total: 37
55	It is recommended that one fire extinguisher be available for every 6,000 square feet in a building. Write and solve an equation to determine x, the number of fire extinguishers needed for a building that has 135,000 square feet.			
	Tier 1: 25	Tier 2: 9	Tier 3: 2	Total: 36
56	A company sells cereal in two different-sized boxes. The smaller box has the dimensions shown below. The height of the small box is 80% of the height of the larger box, while the other two dimensions are the same for both boxes. What is the difference in the volumes of the two boxes.			
	Tier 1: 44	Tier 2: 6	Tier 3: 2	Total: 52
57	The area of Brian's rectangular garden, in square feet, can be found by using the expression 6(2x+5y). Use the distributive property to write an equivalent expressions for the area of Brian's garden. Use your equivalent expression to find the area of Brian's garden, in square feet, if x=3 and y=4.			
	Tier 1: 32	Tier 2: 8	Tier 3: 7	Total: 47
58	A hotel has a number of meeting rooms, m, available for events. Each meeting room has 325 chairs. Write an equation to represent c, the total number of chairs, in all of the meetings rooms at the hotel. If m=7, use your equation to find the total number of chairs in all of the meeting rooms at the hotel.			

Appendix H: Grade 6 Color Coded Constructed Response Questions

	Tier 1: 49	Tier 2: 6	Tier 3: 0	Total: 55
59	Jimmy and his family are on their way to visit some family friends who live 780 miles away from them. Based on the route they chose, they expect to complete their trip in three days. The distance and average speeds for the first two days driven are shown below. -first day: 4 hours at an average speed of 60 miles per hour -second day: 6 hours at an average speed of 65 miles per hour if the average speed on the third day is 60 miles per hour, how many more hours will it take for them to reach their family friends' home?			
	Tier 1: 77	Tier 2: 16	Tier 3: 4	Total: 97
60	A right rectangular prism has a length of 2 1/2 feet, a width of 3 feet, a height of 1 1/2 feet. Unit cubes with side lengths of 1/2 foot are added to completely fill the prism with no space remaining. What is the volume, in cubic feet, of the right rectangular prism? How many 1/2 foot unit cubes can be added to fill the prims completely? Use what you know about unit cubes or the side lengths of prims to show your work or explain your answer.			
	Tier 1: 49	Tier 2: 20	Tier 3: 12	Total: 81
61	The table below shows the elevations at which different artifacts were found during an archaeological dig. Artifacts: arrowhead, bone, clay owl, necklace, woven basket Elevation: 15 feet above sea level, 721 feet above sea level, sea level, 462 feet above sea level, 1,200 feet below sea level Write the name of each artifact and the elevation at which each artifact was found using a positive integer, zero, or negative integer.			
	Tier 1: 37	Tier 2: 8	Tier 3: 21	Total: 66

Appendix I: Grade 7 Color Coded Constructed Response Questions

Grade 7 Tier 1: 445 Tier 2: 107 Tier 3: 33 Total: 585

52	Find the value of the expression.			
	Tier 1: 4	Tier 2: 1	Tier 3: 1	Total: 6
53	A museum opened at 8:00 a.m. In the first hour, 350 people purchased admission tickets. In the second hour, 20% more people purchase admission tickets than in the first hour. each admission ticket cost $17.50. What was the total amount of money paid for all the tickets purchased in the first two hours?			
	Tier 1: 45	Tier 2: 5	Tier 3: 0	Total: 50
54	Mick paid $2.94 in sales tax on an item that cost $42.00 before tax. At that rate, how much would he pay in sales tax for an item that costs $58.00 before tax?			
	Tier 1: 23	Tier 2: 0	Tier 3: 7	Total: 30
55	At a store, customers are randomly selected to participate in a survey. On Friday, there were 500 customers at the store. Of those, 90 were selected to participate in the survey. On Saturday, the store manager expects 700 customers in the store. If the probability of being selected to participate in the survey on Saturday is the same as it was on Friday, how many customers will be selected to participate in the survey on Saturday?			
	Tier 1: 58	Tier 2: 9	Tier 3: 6	Total: 73
56	A school club need 300 feet of rope for a project. They have the amounts of rope listed below. -2 pieces of rope that are 26 yards in length -1 piece of rope that is 12.5 yards in length - 1 piece of rope that is 123.25 feet in length How much additional rope, in feet, does the school club need in order to have enough rope for their project?			
	Tier 1: 50	Tier 2: 12	Tier 3: 0	Total: 62
57	The table below lists the masses and volumes of several pieces of the same type of metal. There is a proportional relationship between the mass and the volume of the pieces of metal. Mass(grams) Volume(cubic centimeters) Determining the mass, in grams, of a piece of this metal that has a volume of 15.3 cubic centimeters. Round your answer to the nearest tenth of a gram.			
	Tier 1: 41	Tier 2: 21	Tier 3: 4	Total: 66
58	The table below shows the weekly change in the price of one gram of gold for four weeks. By how much did the price of one gram of gold change from the beginning of week 1 to the end of week 4? Did the price increase or decrease? At the end of week 4, the price per gram of gold was $39.28. What was the price per gram of gold at the beginning of week 1?			

Appendix I: Grade 7 Color Coded Constructed Response Questions

	Tier 1: 62	Tier 2: 9	Tier 3: 0	Total: 71
59	Hallum Hardware created flyers to advertise a sale on a certain type of carpet. A portion of the flyer is show below. Guillen Floors advertises the same type of carpet at a cost of 10% less per square foot that Hallum Hardware. Determine the cost of 700 square feet of carpet if it is bought from Guillen Floors.			
	Tier 1: 43	Tier 2: 11	Tier 3: 2	Total: 56
60	A single gram of a certain metallic substance has 0.52 gram of copper and 0.26 gram of zinc. The remaining portion of the substance is nickel. Ben estimated that 0.2 gram of nickel is in 1 gram of the substance. He used this to estimate the amount of nickel in 35 grams of the substance. Find the results of Ben's estimation strategy. Then, find the exact amount of nickel in 35 grams of the substance.			
	Tier 1: 39	Tier 2: 24	Tier 3: 6	Total: 69
61	Last year, a property manager bought five identical snow shovels and six identical bags of salt. The total cost of the snow shovels was $172.50, before tax, and each bag of salt cost $6.20, before tax. This year, the property manager bought two identical snow shovels and four identical bags of salt. The total cost of the snow shovels was $70.38, before tax, and total cost of the bags of salt was $26.04, before tax. Determine the item with the greatest percent increase in the price from last year to this year. Be sure to include the percent increase of this item to the nearest percent.			
	Tier 1: 80	Tier 2: 15	Tier 3: 7	Total: 102

Appendix J: Grade 8 Color Coded Constructed Response Questions

Grade 8	Tier 1: 213	Tier 2: 79	Tier 3: 30	Total: 322
52	Determine the solution to the equation below.			
	Tier 1: 4	Tier 2: 3	Tier 3: 0	Total: 7
53	A cylinder and a cone have the same volume. The cylinder has a radius of 2 inches and a height of 3 inches. The cone has a radius of 3 inches. What is the height of the cone?			
	Tier 1: 22	Tier 2: 11	Tier 3: 2	Total: 35
54	Determine the solution, if any, to the system of equations below.			
	Tier 1: 7	Tier 2: 3	Tier 3: 1	Total: 11
55	The hypotenuses of similar triangles ABC and DFA both lie on the line K, as shown below. Demonstrate whether the slope of line K is constant between point C and D. Use the leg lengths of triangles ABC and DFA in your answer.			
	Tier 1: 22	Tier 2: 8	Tier 3: 5	Total: 35
56	The value in the table below represents Function B, which is a linear function. Function L is represented by the equation y=6x+4. Compare Functions B and L by determining which one has the greater rate of change and which one has the greater y-intercept. Explain why your answers are correct.			
	Tier 1: 28	Tier 2: 10	Tier 3: 7	Total: 45
57	The values given in the table below lie on the graph of a linear function. What equation represents this linear function.			
	Tier 1: 11	Tier 2: 5	Tier 3: 5	Total: 21
58	The circular base of the cone below has center C. Another circle, with center B, is parallel to the base. This circle is the base of a smaller cone with height AB. The measurements in the diagram are given in inches. Triangle ABD is similar to triangle ACE. The smaller cone is removed to create a new object, as shown below. What is the volume of the new object? Round your answer to the nearest tenth.			
	Tier 1: 48	Tier 2: 21	Tier 3: 2	Total: 71
59	The table and graph below show Josie's and Salvador's wages, respectively, based on the number of hours worked. In 2010, Josie and Salvador each worked an eight-hour day for five days each week. How many weeks did it take Joise to earn $1,000 more than Salvador?			
	Tier 1: 40	Tier 2: 4	Tier 3: 0	Total: 44

Appendix J: Grade 8 Color Coded Constructed Response Questions

60	In the figure below, line DE is parallel to line FG, with transversal AG. Write and solve a system of linear equations to determine the value of x and y. Tier 1: 16 Tier 2: 5 Tier 3: 4 Total: 25
61	Four equations are shown below. Identify one linear equation and one nonlinear equations from the list. State a reason why each equation you identify is linear or nonlinear. Tier 1: 14 Tier 2: 9 Tier 3: 4 Total: 28

Appendix K: Grades 6-8 Vocabulary Tier Breakdown - Numbers

Grade 6	Tier 1	Tier 2	Tier 3	Total
52	65	11	0	76
53	21	10	2	33
54	30	7	0	37
55	25	9	2	36
56	44	6	2	52
57	32	8	7	47
58	49	6	0	55
59	77	16	4	97
60	49	20	12	81
61	37	8	21	66
All	429	101	50	580

Grade 7	Tier 1	Tier 2	Tier 3	Total
52	4	1	1	6
53	45	5	0	50
54	23	0	7	30
55	58	9	6	73
56	50	12	0	62
57	41	21	4	66
58	62	9	0	71
59	43	11	2	56
60	39	24	6	69
61	80	15	7	102
All	445	107	33	585

Grade 8	Tier 1	Tier 2	Tier 3	Total
52	4	3	0	7
53	22	11	2	35
54	7	3	1	11
55	22	8	5	35
56	28	10	7	45
57	11	5	5	21
58	48	21	2	71
59	40	4	0	44
60	16	5	4	25
61	15	9	4	28
All	213	79	30	322

Appendix L: Grades 6-8 Vocabulary Tier Breakdown - Numbers and Percentages

Grade 6	Tier 1	Tier 1	Tier 2	Tier 2	Tier 3	Tier 3	Total
52	65	86.00%	11	14%	0	0%	76
53	21	64%	10	30%	2	6%	33
54	30	81%	7	19%	0	0%	37
55	25	69%	9	25%	2	6%	36
56	44	85%	6	12%	2	4%	52
57	32	68%	8	17%	7	15%	47
58	49	89%	6	11%	0	0%	55
59	77	79%	16	16%	4	4%	97
60	49	60%	20	25%	12	15%	81
61	37	56%	8	12%	21	32%	66
All	429	74%	101	17%	50	9%	580

Grade 7	Tier 1	Tier 1	Tier 2	Tier 2	Tier 3	Tier 3	Total
52	4	67%	1	17%	1	17%	6
53	45	90%	5	10%	0	0%	50
54	23	77%	0	0%	7	23%	30
55	58	79%	9	12%	6	8%	73
56	50	81%	12	19%	0	0%	62
57	41	62%	21	32%	4	6%	66
58	62	87%	9	13%	0	0%	71
59	43	77%	11	20%	2	4%	56
60	39	57%	24	35%	6	9%	69
61	80	78%	15	15%	7	7%	102
All	445	76%	107	18%	33	6%	585

Grade 8	Tier 1	Tier 1	Tier 2	Tier 2	Tier 3	Tier 3	Total
52	4	57%	3	43%	0	0%	7
53	22	63%	11	31%	2	6%	35
54	7	64%	3	27%	1	9%	11
55	22	63%	8	23%	5	14%	35
56	28	62%	10	22%	7	16%	45
57	11	52%	5	24%	5	24%	21
58	48	68%	21	30%	2	3%	71
59	40	91%	4	9%	0	0%	44
60	16	64%	5	20%	4	16%	25
61	15	54%	9	32%	4	14%	28
All	213	66%	79	25%	30	9%	322