

Comprehension of Mathematic Readings:
Preparing Vocabulary Skills for the Transition to High School
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Abstract

This paper describes the process of assessing the comprehension skills of a student between her eighth and ninth grade years of school as they pertain to mathematics. Celia, the student in the study, has been identified as being below grade level in comprehension though she meets grade level expectations for her reading fluency. In the past, this deficit has been known to cause her hardship in math class when asked to read and interpret informational text that explains how to perform calculations or describes a mathematical process. Following the initial assessment of skills, Celia participated in two lessons designed to help her build her skills, particularly focusing on growing her vocabulary decoding skills. These lessons were found to not only help her grow these abilities but also to instill greater confidence within Celia to focus more closely at the pieces within the text and how they come together to form a main idea and series of points. This paper will address not only the multiple parts of the lessons but how the lessons will influence Celia in the future as she reads for understanding.

Keywords: comprehension, informational text, vocabulary study

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Background Information

The student worked with through this study, referred to throughout as Celia, will be a coming ninth grader this coming fall. After having her as a student last year for Math 8, I will again be teaching her for math in Algebra I. Celia will also be enrolled in Algebra I Lab, which is another class I teach for students who tend to struggle with math for various reasons and will benefit from having a second hour of class designed to support their learning from the core class through different activities and practices relevant to what is being learned in Algebra I. According to her MAZE reading comprehension scores from seventh and eighth grade, Celia is categorized as comprehending somewhat below grade level but her scores on other tests for fluency are at grade level. Celia recently turned fifteen at the beginning of this summer and somewhat older than many of her peers due to the way she has progressed through her schooling so far.

Celia's reason for being older is due to her nontraditional path through schooling that unfortunately is not uncommon of several students in her district. She is an outgoing student who enjoys working with her peers and is friendly towards teachers and other students alike. Her life at home, however, has included many instances of unsettledness, with a lot of inconsistency when it comes to her mother's approach to her schooling. Although Celia has lived in the rural area near the school her entire life, she has attended two other districts and been homeschooled two different times for at least parts of two different school years. Her family is similar to many in the area with its brokenness, and she claims ties to a handful of other students in the district

and surrounding area as estranged relations. She has six siblings, none of which are actually full siblings, and this year she will be living with her former step mom, as her mother has moved to another country to remarry. Although Celia has never known the challenge of learning another language or being the minority race or ethnicity, her life has been full of diverse circumstances and uncontrollable change in every area, including school. Somehow, in the midst of it all, she has maintained her average grades with enough learning to move on with her classes.

The hardest transition for this bubbly, relational teen has been the shift between home school and regular school. In the seventh grade, which I did not teach her for but interacted a few times with early in the year as part of our middle school team, Celia began the year about a week late for unknown reasons and tried her best to catch up after moving districts from where she attended sixth grade. She was with us for around three months of first semester and then was pulled before Christmastime to be homeschooled—only to return again at the end of May. She was clearly behind in several areas, one of which that was noted at her end of year benchmarking by our reading specialist in terms of her reading comprehension. Celia was reading fluently for her age but had trouble understanding what she just finished reading. The difference was not one that warranted her any type of special services, but her teachers did need to be aware going into eighth grade that we wanted Celia to be able to catch up in reading, as well as the other subject areas she was now behind in.

As many studies have shown and all educators know, reading comprehension is vitally important for success in all areas of school, as well as life. Celia's struggle is a rather invisible one to most, as when listening to her read aloud a person would never guess it. In fact, Celia volunteers often to read for the class and helps her classmates when they do by providing words when someone gets stuck. She can pronounce and likely even define or describe most of the

words if asked, but when putting the words together in strings of sentences she describes her feelings as overwhelmed or lost within the text. As far as math goes, I have noticed this in her inability to recall information without the text right in front of her; she struggles most with tests and quizzes when her notes are in front of her as she cannot remember the information without re-reading line by line. She also has trouble interpreting information in the textbook excerpts that we read as a class and understanding the goal when working on story problems.

A lot of what I try to do in my classroom is geared more towards the story aspect of math; the application of what we are learning is worked towards at the same time new material is being learned in attempt to help students see the connections of their skills to their everyday lives. My eighth grade classroom is also heavily group focused, with students learning material together and sharing their findings with the class. The environment Celia worked in last year required her to use technology often and to read and interpret directions in an exploratory fashion that required a lot of interpretation of the written and spoken word. One thing that helped Celia succeed in Math 8 was having elements of choice within most projects so that she could choose that which gave more partner work to help her with understanding and interpretation of project instructions. Also, she is one student I always tried to check in with often to make sure that she had clear understanding of the direction she was going, especially if the day's assignment was a reading assignment where she would be required to share with others what she learned from reading about how to work through a problem—a format I try to use periodically to promote more autonomy and confidence in my students' ability to learn on their own when needed.

In this upcoming year that I will have Celia in class again, I will have her in two classes, and one of them will be very small, comprised of a handful of students from the other, all of whom I have had in class as eighth graders. This is one of the benefits of a small rural district for

a student like Celia: she will gain understanding of the strengths and weaknesses of her peers if she watches for them, and can know better how to work around her own weaknesses and use her strengths as a team member among them. By choosing to use Celia as my student for this research, however, I was choosing to remove her from this climate and instead as her to work semi-independently, with only me there as teacher. My hope was to stretch Celia and help her gain more confidence her ability to decode what she reads for meaning at least somewhat on her own and help her see that she can find meaning through the challenge. This would involve some element of risk for sure and likely some amount of discomfort on her part, as I know very well the way that nerves can attack this student when she feels she is noticeably behind the curve.

Preparing for the Lessons

Going into the project I told her to feel free to ask any questions she might have and to remember that the results of activities we would be doing were meant to help her with her comprehension and that any exercises I asked her to work on independently would be shared with her so she knew how she did. Being a fun, interested individual who knows me well as teacher, she was comfortable and willing with this. Both lessons that I taught had large sections where she would be working with me, to help her gain a feeling of safety within the challenge. We worked in my classroom because it is close to her home, and I think helped her feel like there was some amount of normalcy even though there were few other people in the building at the time.

After my initial meeting with Celia to conduct the pre-assessments, I spaced out my two lessons and the post-assessment over the course of a week and a half to allow Celia time to hopefully process in-between and practice some of the strategies we worked on in her pleasure

reading. One issue I have always felt has hindered Celia's academic career is the times she was homeschooled with very little structure or support from anyone in regards to her learning.

Homeschooling can happen in a variety of very positive ways, but for Celia this looked like working independently on a computer-based school program where she and her mom chose the classes she would participate in and when she would work on them. According to Celia, she did not take much math during her stints with homeschooling. When she began eighth grade with me I could definitely see that she was behind, and this constant game of catch up with the moving around between curriculums (or lack thereof) apparently makes it more difficult to understand math at the level she needs to at times.

Every teacher and student (if they are really honest with themselves) is aware of the fact that some amount of material learned previously will be lost over a long break from studying it such as summer break. In reality, this break is less than three months long yet much has to be reviewed afterwards before moving on. For Celia, she's fallen behind the most when she lost a couple of four to five month periods during the "homeschooling without math" phase as it happened at a very detrimental time. When looking at what she knows and really understands mathematically it is quite obvious that her basic skills from elementary are there, but that her middle years of moving around mentally between schooling systems has left some gaps of understanding. This fact, combined with her difficulty with comprehending what she reads on her own very easily, has made her almost completely reliant only on learning when she is right with the teacher—when really what she needs is the ability to learn more on her own to catch up too.

Being that I worked with Celia in the middle of summer break, I wanted to gain an accurate perspective of where her comprehension was at before working with her, both in

relation to fictional writing and informational math text. I chose to administer two MAZE readings that were at or slightly below grade level. For the first three minute test I had Celia read independently a middle school fictional story and for the second, a middle school grade text about a math concept she should already be familiar with (Appendix A). I wanted to take a look at the difference between her comprehension scores without her feeling threatened by needing to understand anything new mathematically since that is her weaker subject area. By conducting the MAZE assessments, I was able to get an accurate picture of Celia's ability to understand the holistic meaning of the text as she chose the right words for each blank as well as assure myself that results would not be skewed by the assessment itself being confusing (MAZE assessments are conducted three times each year at our district so Celia was very familiar with the process, look, and feel of taking the assessments).

What I found was that Celia was able to decode meaning fairly well in both texts and really wasn't that far off in choosing correctly for either the fiction or the math piece. One difference to note was that Celia finished the fiction piece with time to spare, whereas she did not quite finish the math text. Knowing this, I decided that one need that I wanted develop into a goal would be to address her lack of confidence in even attempting to understand a math piece, as she was noticeably more unsure of herself during the math part of the testing. Secondly, the flow of the text didn't seem to be a problem; Celia could read each sentence and move on from it comfortably once she chose a word. However, the words that she struggled with generally were words that had multiple meanings both in math and non-math settings. It seemed to throw her understanding each time she would come to one and think only of the definition for the word that she knew outside of the math classroom. Realizing this, I recognized her need for recalling

vocabulary words and for linking her understandings of words with their mathematical meanings so that she could better decode even new words in the math world more accurately.

Celia's Lessons

After assessing Celia's skills I designed two lessons that would target her ability to use pre-reading strategies to break apart the text and identify words she may struggle with beforehand. In doing so, my hope would be that Celia would be able to begin the selection more prepared for either already knowing what to expect better—and thus easing some anxiety which distracts her from meaning—and also to have skills for remembering more of her basic math vocabulary words and not having to relearn them each time. Being that she is about to begin ninth grade and I know that many of these terms will appear again in her Algebra I textbook, it will be completely necessary that she gain as many as possible to her math repertoire before starting school (Standard II).

In high school mathematics, and especially in the way I design my classroom, students are expected to become more independent in how they approach new concepts. For a struggling student, getting behind is not an option as math continuously builds and requires the use of virtually every skill previously addressed. Celia will need skills for this next year that will help her not fall behind and give her the tools needed to practice and prepare outside the classroom to keep up with the growing pace of the course. Algebra I uses a variety of new vocabulary words as well as terms from back in her schooling, and I am not yet certain if there are other gaps from her switching of schools or her first home school experience (where she said she also did not work on math at all) in earlier grades that may rise up unexpectedly and cause her to struggle (Standard II).

In attempts to help her recognize her need for more independent comprehension strategies, she and I talked after her pre-assessment about when she feels the most lost in learning new material in math. Surprisingly, she was quite aware of the fact that a lot of her struggle came from terminology and her inability to look back at her math text for help because she didn't understand what she read. When I asked her how she usually goes about trying to read the book or even her notes, she said that she hadn't really tried in a while but that when she did, she just sat down like it was any other book and read the words. But, not surprisingly, she didn't understand any of it when she got done any better than when she began. We began a conversation about how reading an informational text is so much different than reading a fiction story and I decided to design my first lesson (Appendix B) around this idea: reading the text using specific strategies that we could apply to the math book and finding a way to break it down into more of a study than just reading the sentences on the page (Standard VI).

Naturally, when talking about reading informational texts, vocabulary came up, and seemed like a bit of a touchy subject with Celia. She was embarrassed to admit that she wasn't getting all of the words, because she always did when it came to English classes and the books she had to read in those classes. We continued talking and I pointed out to her that she had a very natural aptitude for reading the words—pronouncing them—but that it was the meaning of the words and how they fit into the sentence that she was missing. I planned to make my second lesson provide Celia with at least one method of coping with missing terminology that she came across, something that she could work on at her own pace outside of school so that she would feel more prepared when she read along with others or worked on assignments with the new words included in them. The second lesson (Appendix C) we worked on together, practicing a strategy called LINCIS that allows students to make connections between new vocabulary and

familiar words (Standard VI). This strategy is one that I know our high school English teacher actually uses with her students, so it is one that Celia will come in contact with next year in that class too, and she will have that additional support for practicing the strategy should she decide to continue using it.

The Results

From looking at the work that Celia produced, it seems that both strategies we worked on for the study fit her needs and personality. Going into the study, Celia let me know she was somewhat nervous about having to read about math. It isn't that she hates the subject or anything, but she is an outspoken girl with a good perspective about her own abilities. She knows where she struggles, and she is used to needing help when it comes to these kinds of independent projects. After we finished the second lesson—before any formal post-assessments were done—I felt the reading instruction did in fact make a meaningful contribution to Celia's confidence at the very least. After scoring the post-assessment (Appendix D), her actual score improvement was slight, and likely the result of this reading including many of the same terms that we studied just a day earlier. Regardless, what I am most pleased with is the way she was able to work independently on some of the LINCS cards herself and that she now has a few extra strategies to bring with her to class in the fall.

When it comes to school, Celia is generally excited about learning and about working with others, but this idea of confidence in what she is working towards is extremely important for her success. Because I know this and we were working during the summer without other students working with her to provide that collaborative atmosphere, most of my lesson was geared toward strategy instruction. I felt this would be most interesting and useful for Celia also because I know that the strategies were things she may have never seen before but can actually

use. Like most students her age, she enjoys knowing things because she enjoys sharing her knowledge with others (Standard III). This way, when we address these same strategies through different means during her Algebra I class and the second lesson's strategy shows up during her freshman English class too, Celia will not have to focus as much on learning how to do the technique but instead on the material at hand (Standard II). These strategies are simple enough that she can remember them or be reminded of them quickly if needed.

During the first lesson, I gathered together simple note cards on which we would record what we studied. For the first part of that lesson, I wanted Celia to be able to skim material for what is important and coming up in material to help her learn to keep focused on the text and already understanding a general gist of what was to come before she got started reading. As with many students who struggle with comprehension, Celia often gets stuck in how much reading there is as an entire text and does not know how to break things down on her own easily (Standard III). I demonstrated the skimming by modeling with my pencil as I hovered over the lines looking for terms that stuck out at me. Each time I came to one and circled it, I also shared with her why specifically I was selecting it so she would start to make note of how some words appeared repeatedly in the text or were words that I already knew but didn't understand mathematically (Standard I). After we finished the process with the reading and defining of terms, we answered the questions at the end of the text together and talked about answers. I let Celia answer first each time and either affirmed her or asked her more about her answer to guide her towards the correct answer. In this way, I tried to give her independence within a very safe space so she would feel able to work on her own on the next reading.

For the second lesson, I not only walked Celia through the LINCS strategy part by part, but I gave her an example of a completed table and explained to her how I chose my linking

word and wrote my story. As we worked through the first couple of words together from there, I allowed her to do as much as she wanted on the first one and came up with everything else for her. After she worked with me just the one time I could see that she liked it enough to try one on her own so I just watched and answered questions—which were really just focused on “Is this ok?”—and provided encouragement. There was only one word on the list that Celia grew frustrated with herself for not being able to come up with a linking word, but once I gave her a few suggestions she chose one and came up with her own linking story without problems (Standard IV).

With each of the lessons I gave Celia time to try enough of the strategy on her own that she could internalize it and personalize it some, making it more likely that the technique will stick. Also, I encouraged her to keep the cards and notes we’d made for use in the fall. At the end of the first lesson, we talked about what exactly she liked and didn’t like about doing the pre-reading exercises and came to the conclusion that although it took much longer than just trying to read through quickly like she normally would have, she did feel more prepared than usual to answer the questions that followed. That being said, we also talked about how she could apply the same technique to other classes that include informational readings and that seemed to make her happy to know that she would use it in more than just math class. In regards to the second lesson, I applauded her good work and even told her that we’d be practicing the strategy this year in my class and in her English class, and that it was just one of many good vocabulary strategies that could help her comprehension (Standard IV). Overall, I felt she finished both lessons at least understanding how the techniques could be helpful and being open to trying them again, which I consider a success.

Although I planned the lessons out before hand, there was some adjustment made throughout teaching them. I planned the general format for what I wanted to accomplish and how I thought it would be best to get there, but left room for flexing in the amount of material we would cover during each lesson (how many readings or words we might get through) and how many examples I would go through or how I might address those exactly. Seeing that we were working on math and reading skills during the summer, I tried to treat the beginning of each lesson critically to help interest Celia and grab a hold of the goals for the day. It was important to me that she see the lessons as useful to her rather than just that she was helping me by working through the lessons—and I think she understood this.

As far as the first lesson went, I found that I needed to assist a lot more than I expected to and learned a lot more about how Celia's struggles actually affect her. While I had always assumed her comprehension problems were linked only to her inability to construct meaning from having many sentences strung together and not taking the time to slow down within them, I found during the word circling and defining discussion that she also really did not know the words that she needed to in terms of basic math vocabulary. Some of her questions I definitely thought she would have known. This helped me greatly in deciding on what the second lesson would be exactly, though I ended up deciding to use a different bank of words for great variety (Standard III). During the second lesson I had far more words planned for than we actually had time to cover in the time we planned to work. Rather than extending the time or trying to rush, I decided to focus instead on getting as many done as we comfortably could while still working carefully and completely. I think this was smart move as it allowed Celia to really see what the process of doing the strategy felt like and will encourage her to take her time when she uses it in the future. Furthermore, when she completed the post assessment, Celia still knew the words and

her linking words with them and could use the strategy to help her even without having her note cards to help.

Concluding Thoughts

In designing the lessons, I tried to keep my goals as simple as possible. For the first, I wanted Celia to know a few basic pre-reading strategies for informational texts and to be able to identify the main ideas of the writing after reading through and understanding all of the words and sentences within it. For the second, I expanded on the term comprehension part by Celia being able to use each part of a specific vocabulary strategy with several words independently. Although I needed to talk through and practice a lot more of the reading with her during the first lesson, Celia was able to answer most of the questions on the reading independently and answered all of the correctly with some assistance. She also completed multiple examples of the LINC'S table on her own and came up with every part of it including the linking word (which is usually the hardest part) on her own. When we talked after her post-assessment, which was several days after the first lesson and a full day after the second, she spoke logically about how each strategy was useful for learning new material (Standard IV). At first she was a little disappointed when she asked me about her numerical results for the assessment compared with the pre-assessment, but as we were talking about the strategies themselves she came up with on her own the idea of doing LINC'S tables during her pre-reading rather than simply seeking to define those words (Standard V). This level of increased self-assessment and prescription demonstrated to me that she did understand the goals of the lessons and how they applied to her learning.

Although the lesson felt completely beneficial for me as a teacher looking to understand better the process Celia was going through in working to understand a passage, I wonder at what else may have been brought to the lesson had I chose to involve another student. I would have wanted to choose that student carefully as someone who Celia already works well with, but who perhaps could have done some of the modeling during the first lesson but then learned from Celia's creativity in the second. In this way, the lesson would have been more geared towards the peer learning that I try to instill in my students on a regular basis in my classroom. This would have been beneficial for both students in that they would be finding a classmate who each was understood by and could continue working together with in the coming year.

The materials I chose seemed to work well for each lesson independently, but I also acknowledge that by making the decision to not link the list of words together between the two lessons, I chose to only really help prepare Celia for the post-assessment with the second lesson. In regards to the data collected, although it does not show a great deal of change in scores between the two assessments, it did serve to give me an accurate picture of the pace Celia needed to read at to get correct answers for as many as she did and what kinds of words she struggled with the most. In the future I would like to find time to work more with Celia on more of those words specifically that she did not understand as well so that she will not be stuck by them again (Standard V).

By finding a creative way to introduce and study vocabulary with Celia, I interested her and allowed her to have fun within the lesson. I also made sure to always encourage Celia and make the lesson feel applicable to what she is about to be doing this coming school year. Knowing that she does not like others to see that she is behind in anything helped me find ways to encourage her forward in this. Being that there were just the two of us working the twenty or

thirty minutes spent on each lesson was put to good use; at the same time, Celia realistically could have spent longer without much problem on the second lesson. Also, I would have been interested in seeing what she could have come up with had I sent some of it home with her for homework—which she definitely is capable of doing on her own. The real test will be this fall as she tries to tackle informational reading on her own and has to put these skills into practice on her own. Because she struggles so much with comprehension related to longer texts, I will need to watch for what might still be out of her limits at first to ensure she gains confidence through initial success, as this confidence is so key with a student like her.

Through the integration of vocabulary within both of my lessons, I attempted to work with Celia at least in part on a core issue for many students: the lack of phonological awareness and its debilitation on students when they cannot decipher parts of words to help them find meaning. This lack of understanding of phonemes is one that causes the struggles of many students who have problems with comprehension (Bhat, 2003). In the first lesson, looking at the word itself was where we started each time as we tried to think about the word in any other context that we knew it from and I helped Celia leaf through the definition of the word and put it in her own words. In doing this, she naturally gravitated towards defining the word by using the meanings of parts of the words. This occurred in the second lesson as well, as Celia and I chose linking words carefully that sounded like the word, and thus often had part of the word embedded in them. Also, by reading through the text in the first lesson and trying to understand each word we circled in context, we effectively decoded new words while keeping them in context, which has proven to be infinitely important in other studies (Moats, 1998) (Standard I).

By balancing the two lessons against one another I was able to help Celia study vocabulary extensively in both sessions, with applied meaning of the words in at least the first

lesson. Being able to help students study language in a focused fashion like this has proven to be most effective and important for those who are behind in their comprehension and understanding (August, 2006). By considering what I already knew about the skills and struggles of the student I was working with, taking this seriously in my design of the two lessons, and considering the need for comprehension of certain vocabulary words in my subject matter, accomplishing the lessons with Celia allowed us both to understand this process moreover (Standard I).

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Appendix A

Pre-Assessment Results

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The Prince and the Pea

In the ancient city of London, at / so / on an autumn day a boy was born / were / last to a poor family of the / (port) / tank / name of Canty, who did not want / has / too / get. On the same day another English / flake / whips / child was born to a rich family as / (of) / to the name of Tudor, who did / lags / trot / want him. All England wanted him too. England / had / the / I can so longed for him, and hoped the / for / slip him that, now that he was habits / really / cranky come, the people went nearly mad for / now / she joy. Mere acquaintances hugged and kissed more / each / turn other and cried. Everybody took a holiday / winding / plastics, and high and low, rich and trip / poor / came, feasted and danced and sang, and got / let / saw very mellow, and they kept this / up / in / as for days and nights together. By big / let / day, London was a sight to see, with / fuss / then gay banners waving from every balcony / met / and / fig housetop, and splendid pageants marching along.

Games / There / Snake was no talk in all England but / and / nip of the new baby. Edward Tudor, Prince of / to / as Wales, who lay in silks and mother / plank / satins, unconscious of all this fuss, and not / two / set knowing that great lords and ladies four / tank / were watching over him—and not caring, school / braked / either. But there was no talk about / son / the / now other baby, Tom Canty, in his cuff / poor / milk rags, except among the family he had / sow / not just come to trouble with his athlete / bananas / presence.

London was fifteen hundred years old. The / Pea / Hit streets were very narrow, and crooked, the / rim / and dirty, especially in the part where Tom Canty faint / lived / chirp, which was not far from London Bridge. The / Was / Put houses were of wood, with the second / mixers / trapper story projecting over the first, and the / see / pit third sticking its elbows out beyond the / net / lob second. The higher the houses grew, cut / the / sea broader they grew.

The house which Tom's jacket / larger / father lived in was called Offal Court, put / can / out of Pudding Lane. It was small, decayed / shadowy / plants, and rickety, but it was

quiet / blimp, lovely road, past the great cardinal's stately / planned / tampers palace, toward a far more mighty the / now / and majestic palace—Westminster.

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8

Working with Interest Rates

A formula is an equation that contains more than one variable. It can be thought of as (a, you, it) "recipe" for solving a particular type (that, on, of) problem. Remember, that several steps will (number, do, often) be required to solve a particular (problems, equation, in) and that several mathematical properties might (will, need, is) to be used. You will need (to, the, at) always use the rules for the (order, calculator, and) of operations and work through the (formula, money, equation) one step at a time. There (by, are, is) many standard formulas that we can (isolate, access, that) to help us solve problems. A (equation, model, formula) can be used as a model (for, in, by) problems in the areas of geometry, (medical, banking, driving), and finance, and science.

When you (earn, pdt, enter) money in a bank account, your (finance, bank, money) earns interest. This interest is payment (from, in, by) the bank for the use of (my, your, its) money. The bank may pay you (a, any, every) interest rate it desires; these days (a, every, the) usual rate is around 5 percent. The (money, easy, basic) formula for figuring out how much (interest, formula, equation) you will earn on an investment (be, is, are) fairly simple. To figure the interest, (multiply, simplify, take) three things: the principle (or amount (might, you, they) invest), the interest rate put into (other, function, decimal) form (5 percent would be written .05), and (through, the, will) time in years. The formula can (if, be, is) written as $i = prt$.

The formula $(m, b, i) = prt$ is for simple interest. It (does, might, is) not help you find interest that (is, has, by) compounded. Compounding occurs when you leave (your, some, self) money alone. Then every so often (the, has, its) interest is computed again using a (new, brand, multiply) principle. The formula for compound interest (lets, has, must) you find the value of an (uphill, savings, investment) after some number of years. However, (it, if, be) is a fairly complex formula. If (they, you, it) want to work with it, you (it, ve, d) need a scientific calculator with an (multiply, solve, exponent) key. When you do so, do (don't, so, not) round

Appendix B

Lesson 1 Lesson Plans and Student Samples

Lesson Title: Reading an Informational Text in Math

Subject: Algebra I

Grade Level: Ninth Grade

Date: July 19, 2011

Duration: 20-30 minutes

Lesson Objectives: The student will demonstrate pre-reading strategies for reading an informational text. The student will identify the main concept of a selected math text and be able to summarize the main idea of the reading.

Standards Addressed:

CE 2.1.1 Use a variety of pre-reading and previewing strategies (e.g., acknowledge own prior knowledge, make connections, generate questions, make predictions, scan a text for a particular purpose or audience, analyze text structure and features) to make conscious choices about how to approach the reading based on purpose, genre, level of difficulty, text demands and features.

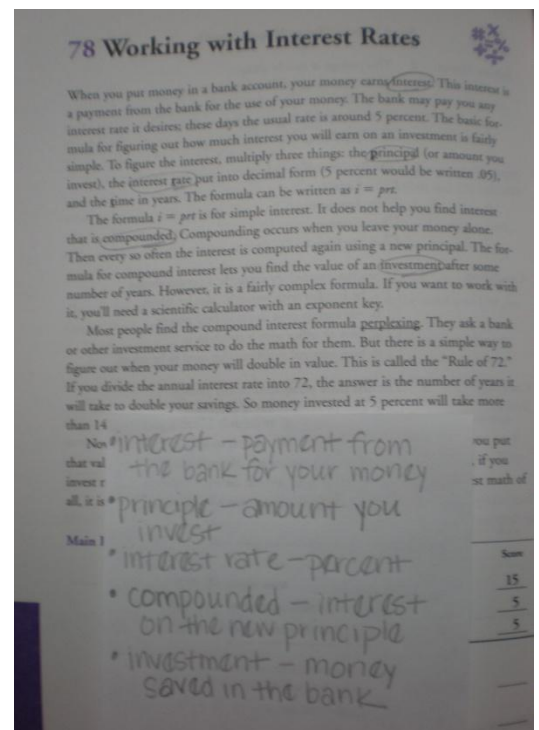
CE 2.1.3 Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

CE 2.1.4 Identify and evaluate the primary focus, logical argument, structure, and style of a text or speech and the ways in which these elements support or confound meaning or purpose.

Materials: Math text, note cards for student; informational passage familiar to student such as “Working with Interest Rates” from *Six-Way Paragraphs in the Content Areas*

Resources: Math Study Skills Workbook, Third Edition, by Paul Nolting.

Rationale/ Background: Students often struggle with understanding the more sophisticated language of nonfiction writing and have more trouble with comprehension when they do not understand the vocabulary as it is put together for independent reading and learning. Students who miss understanding in pieces of math struggle more overall as it is important to have all the building blocks understood to allow the information to build upon itself throughout.



Opening: The teacher brainstorms a list of differences between reading fiction and nonfiction with the student. From this list, some of the challenges in reading for information are identified: new vocabulary, understanding examples given, recognizing the main idea, interpreting style. A piece of informational text that the student has not seen before will be used today as pre-reading and during reading strategies are discussed.

Middle: The teacher guides the student through a reading the student has seen before. For this lesson, a simplified version of the “Working with Interest Rates” selection from the pre-assessment will be used. The teacher will ask the student to recall anything the student remembers from reading the piece before and write it with the title of the piece on one side of a note card. Then, the student will skim the words of the text again and circle (with a pencil) any new words that were not readily understood or that had new context in the reading. The teacher will then check the circled words to make sure there is a manageable amount (no more than 5-6 for a short reading) and have the student put all of their concentration into reading the text aloud to the first circled word. When the student arrives there she will stop, and discuss the reading so far with the teacher. Together, they will define the circled word and summarize its importance to the topic. The student will write a short definition with the word on the back of the note card and continue reading to the next word, repeating the process through to the end. If there are any written or numeric math examples in the reading, the student will write each step and discuss on a separate piece of paper, copying at least one example to the note card to save for later reference.

Conclusion: The teacher and student will discuss the importance of understanding each word in an informational text in the context in which it is being used in the reading. The teacher will ask the student to describe the importance of each of the new terms that were identified on the note card verbally, and if desired, in writing. The teacher may ask the student to walk verbally through another example problem that goes with what was read and to apply the skills learned from the reading at each step, showing that the process is understood from the reading.

Adaptations and Extensions: For students who have difficulty skimming, the teacher may choose to do so with the student. To do this, the teacher can sit next to the student and demonstrate the process by sweeping their own pencil over the lines of text and moving across each line, stopping at any words known to be important to the text. When arriving there, the teacher can prompt the student briefly to notice that the word seems to be out of place or is repeated often or otherwise seems important, and circle it for the student. For students who are more advanced or independent, or once a student has worked through the process with a student multiple times, the teacher may choose to demonstrate the process or outline it for students and then allow students to try the process either with a partner or on their own.

Assessment: After finishing the note card and walking verbally through a problem, the student should be able to answer the comprehension check questions following the reading (see the following page). Once the student has answered the six questions, the teacher and student will go back through the answers and discuss each one. If needed, any new information or ideas gathered from the discussion can be added to the student’s note card. These cards can also be collected and checked over by the teacher if more readings are assigned, and discussed verbally to ensure the student understands each one.

Appendix C

Lesson 2 Lesson Plans and Student Samples

Lesson Title: Making Connections with Vocabulary

Subject: Algebra I

Grade Level: Ninth Grade

Date: July 22, 2011

Duration: 20-30 minutes

Lesson Objectives: The student will define and describe a list of vocabulary words using pictures and stories to make connections to other, more familiar words. The student will identify and demonstrate each part of the process in creating a LINCS table for a vocabulary term.

Standards Addressed:

CE 2.1.3 Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

CE 2.2.3 Interpret the meaning of written, spoken, and visual texts by drawing on different cultural, theoretical, and critical perspectives.

Materials: Any Algebra I text (can be adapted to any math or subject-area text useful to student); copies of at least one form of a LINCS vocabulary table

Resources: LINCS vocabulary study from professional development in district

Rationale/ Background: Students often struggle with remembering new terms in math that don't always have a definition elsewhere in their lives. It is also difficult to find ways to remember those new terms and use them in daily conversations as needed in the material to come, as the word might be remembered but the definition is not. For the student studied, having a handful of new vocabulary all at once was difficult to work with because the student did not have an effective way of practicing those new words or mastering the definitions, thus making the use of them in successive lessons equally difficult to understand each time.

Opening: The teacher provides a list of vocabulary words needed for an upcoming section of reading or set of math problems. Together, the student and teacher discover or read the definition for each one and discuss the context of them all together if they are at all connected.

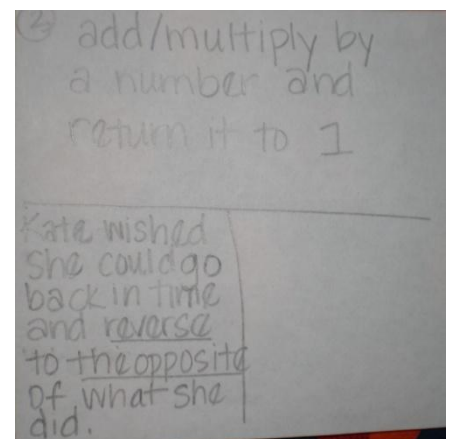
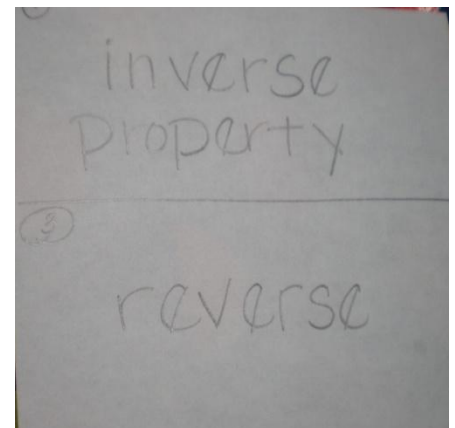
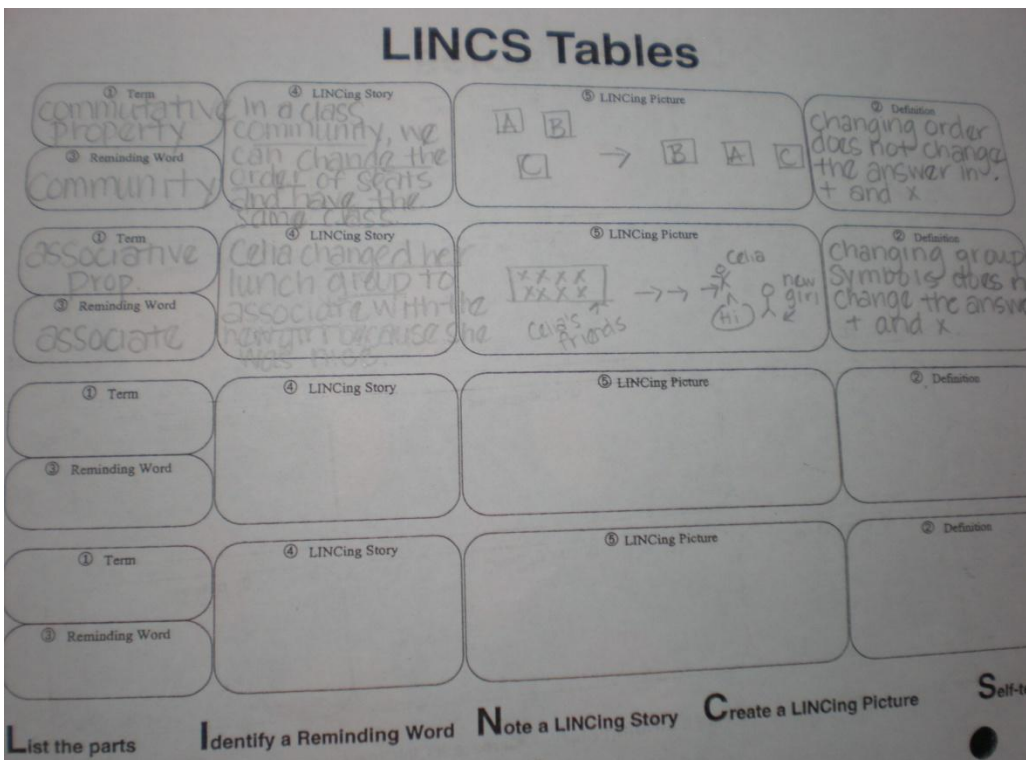
Middle: The teacher shares the LINCS vocabulary chart with the student. Using another word that is not connected to the material or other words on the list but is also unlikely to be familiar to the student already, the teacher goes verbally demonstrates the creation of each part of the

LINCS table, actually making the table on a note card or piece of paper as she goes. Then, the teacher chooses a word from the list and the student and teacher will follow the same process for that word together, each making their own table using the same pieces of LINCS. The teacher and student should create at least two tables together before allowing the student to try some or all of the steps independently.

Conclusion: The student will read through each card and explain her connections verbally to the teacher. The student will also write a summarizing paragraph of each of the steps in LINCS to have for further use.

Adaptations and Extensions: For students who have difficulty with organization or need more direction, copies of the LINCS tables can be made to provide the student with more structure for recording the words and their connections. The actual style of the table can also be adapted to provide more space wherever it might be needed. For students who really struggle with the connection part, the teacher may choose to provide the Linking Word and its definition for the student. Once students understand the process and can correctly fill out a LINCS chart for several words, students can be shown how to do this same process in an organized way on a note card instead of a LINCS table, so they can do so as often as they like with any new readings and words in the future.

Assessment: The student will read through a text that contains each of the words identified as vocabulary words out loud with the teacher. Each time a word is reached in the reading, the student will pause and describe its meaning by going through their connection process as much from memory as possible, or using the LINCS table as needed. The teacher will formatively assess with the student how each connection was helpful and adjust the tables with the student as needed to make them more effective for learning the information.



Appendix D

Post-Assessment Results

6/6/18

Using the Properties of Real Numbers

Prior to learning to solve equations we learn first to recognize and use the properties of real numbers. The commutative property of addition says (to, that, the) we can add numbers in any (says, order, parentheses). The commutative property of multiplication is (both, solving, very) similar. It says that we can (multiply, identity, name) numbers in any order we want (process, that, without) changing the result. Both addition and (variable, multiplication, they) can actually be done with two (numbers, coefficients, work) at a time. So if there (group, first, are) more numbers in the expression, how (do, is, of) we decide which two to "associate" (prior, first, its)? The associative property of addition tells (us, removed, that) that we can group numbers in (is, original, a) sum in any way we want (and, using, equating) still get the same answer. The (number, commutative, associative) property of multiplication tells us that (we, new, itself) can group numbers in a product (by, in, a) any way we want and still (need, prior, get) the same answer.

The identity property (us, for, the) addition tells us that zero added (to, says, are) any number is the number itself. (Way, Sum, Zero) is called the "additive identity." The (identity, commutative, particular) property for multiplication tells us that (want, find, the) number 1 multiplied times any number gives (a, the, in) number itself. The number 1 is called (how, the, integer) "multiplicative identity." In the inverse property (done, applied, of) addition, a number added to its (so, opposite, it) integer will always equal zero. All (zero, if, four) of these properties are applied to (this, addition, a) and multiplication, but not to subtraction (or, easiest, decide) division. This is because they do (inverse, not, is) work backwards as these operations work (least, opposite, with) of addition and multiplication.

The principles (of, an, its) equation-solving procedures are designed to result (learning, in, sides) what are called equivalent equations. The (properties, while, play) of equality that we study in (multiplying, steps, algebra) are very important in the process (of, but, for)

It is important to (review, subtraction, common) these properties prior to (into) create equivalent equations while solving (quite, addition) property of equality simply says that (both, the, us) same (ided to, be, or, multiply) subtracted from both sides of an (equation, more, new equation will be (solution, all, equivalent) to the original equation. The (efficient, one, property) of equating says that if we (multiply, two, zero) both (on by (we, the, procedures) same number, the new equation will (show, be, to the original one. One (use, can, because) of this property is to change (coefficient of the variable to a 2 (add, in, when) solving an equation. (e might (be, real, must) the elimination of fractions from an (relation,) by multiplying the entire equation by (same, the, which) least common (fractions (equal, prior, in) the equation. (ditive) to first multiply the entire equation (a, in, by) the least common (coefficients, fractions, original) in the equation. This will result (in, be, nt equation with only integer (algebraic, coefficients, distributive). Often (be required (entire, without, to) solve a particular equation. Several (remove, may) be used. Remember that parentheses must (be, might, times) (properties, tells, distributive) of real numbers that is quite (useful, candid, the distributive property. (This, Called, Of) property allows us to remove (parentheses (very, in, order) an equation so the properties of (equation, one, equability) can (be applied to find the (solution, may, changing). The distributive property comes into play (study, when, equivalent) an expression involves both addition and (commutative, there, multiplication). A longer name for it is, "(the, a, often) distributive property of multiplication over addition."