Building & Developing Quantitative Literacy

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This curriculum unit is recommended for: Common Core Math 1

Keywords: quadratics, factoring,

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: This unit is designed to be taught in common core math 1, and the focus is on quadratics. In this unit, the students will start with an activity playing corn hole. After they play the game, they will begin to think about the mathematics behind the game, focusing on the motion of the bean bag. As we study the other concepts in the quadratics unit, we will frequently make references to the corn hole game, as well as make connections to other games and activities that have a similar motion.

I plan to teach this unit during the coming year to 70 students in common core math 1

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Introduction

I am currently a math teacher at Performance Learning Center High School in the Charlotte-Mecklenburg School District. This is my second year at Performance Learning Center, before that I was at West Mecklenburg High School for two years. This current year is my seventh year teaching, and in my experience as an educator I have taught middle school (6^{th} grade) and a variety of courses in the high school setting, ranging from algebra 1/math 1 to honors pre-calculus. In my teaching experience, I have found myself working mostly with lower level students. These are students who have significant deficits in their mathematical skills and abilities for the grade level that they are in currently. Most of these deficits go back a year or two, sometimes more depending on the student. With that in mind, I have experience in teaching inclusion classes and working with students who have documented learning disabilities and other conditions that make learning mathematically more difficult than the average child. I started my work with lower level students when I was teaching middle school in High Point, North Carolina. I worked with a special education teacher and planned and co-taught the class. As I worked with these students, I begin to see that my best teaching was when I worked with lower level students. I also began to realize that I like working with lower level students. I appreciate the work ethic and perseverance that some of them displayed in class, and I enjoy seeing each student grow in them mathematics skills and in their confidence levels.

Rationale

My reasons for choosing this topic is two-fold. First, I have an interest in reading and problem solving techniques and strategies in mathematics. As I worked with students in the past teaching them and preparing them for the End of Grade or End of Course exams, I began to realize that my students were able to learn and accurately execute the mathematics in the curriculum, but when I presented them with a word problem or task, they begin to struggle. The first time I really noticed this phenomenon was when I was teaching sixth grade math my second year teaching. When I gave my students a straight forward computation problem, they were able to arrive to the correct solution. When I gave them a word problem or task on the same concept, the majority could not come up with a solution without me or my co-teacher's assistance. It was at that moment that I realized just how critical reading skills are in the mathematics classroom. My students could not get to the mathematics in the problem because they could not comprehend the

problem. At the point I began to consult with other teachers and research reading and problem solving strategies.

Secondly, I chose this topic and this seminar because I want to see my students learn and grow into productive citizens. The more time I spent researching reading and problem solving, the more I realized that my students could not think through the problem. I am persuaded that in a world that is filled with data and information, our students need quantitative literacy skills so that they can process the information around them. I want to be able to teach my students mathematics in way the build these quantitative literacy skills. I want them to be able to think critically about the numbers and data they see around them. Many of my students currently claim that they will never use half the mathematics that I am teaching them, but I want them to realize that it is the thought pattern and thinking skills that they take with them into whatever career field they choose to go to. At the end of the day, I want my students to be able to see numbers in the real world and know that these numbers carry meaning and significance. They need to be able to process what those numbers mean and how they connect to the situation being presented. I believe that knowledge is power, and I want my students to be empowered individuals who are able to make sense of the information that comes their way so that they can react appropriately.

School/Student Demographics

This year I am teaching Math 1 and Advanced Functions and Modeling Performance Learning Center High School. Performance Learning Center High School is a small non-traditional high school. We have about 250 students this year in grades nine to twelve. Many of the students in the school come to Performance Learning Center because, for one reason or another, they were struggling academically and/or socially in the standard comprehensive high school. With that in mind, we have some students who have anxiety issues around learning, especially math. Since my time here, I have seen students who have a history of struggling in mathematics. Many of the students have had difficulty with mathematics since late elementary and middle school. Their difficulty over the years have lead them to a fixed mindset that mathematics is difficult and they will never learn it. My class size varies, with 5 being my smallest and 30 being the biggest. We have five seventy minute blocks in a school day.

Unit Goals

As stated above, my goal with this unit is to see my students become creative, critical thinkers. I want them to be able to process and interpret information given to them. From a mathematics perspective, I want them to be able to read, analyze, and successfully communicate information given to them in words, charts/tables, graphs and other diagrams. My goal is to help them take numbers and data make it make sense in

the context of the problem. In our curriculum, we have several standards that speak to these types of skills, as well as our standards or mathematical practice that were created by the common core. The appropriate common core standards and mathematical practices are listed in appendix section.

Content Research

Most people hear the term literacy and initially think of it unilaterally. We think of it in its most basic definition: the ability to read and write (1). Given this definition, people naturally think that it primarily concerns younger children and the professionals who work with these younger children, teaching them to read and write. My experiences as a mathematics teacher, and more recently being a part of this seminar I am in now, allow me to see that literacy is much more complex that my original assumption. I see now that literacy is a multi-faceted concept, and within this large concept (literacy) there are skills that we need to instill in our students at every level. As educators, we start in the early grades (teaching and assessing literacy skills) and continue to reinforce and cultivate those skills as each student matriculates through school. With this in mind, one of the dimensions of literacy that I chose to focus on was quantitative literacy.

The natural question that comes to most people's mind is: what is quantitative literacy? This is a question that is not easy to answer. There are other terms that are used by different authors and their research. Some of the terms that are commonly used interchangeably with quantitative literacy are numeracy, mathematics, mathematical literacy, or even just basic arithmetic (2). For some professionals in the mathematics community, all these terms listed above can represent the same ideas, thus allowing them to either use them interchangeably. The other viewpoint is that that each of these terms are closely related but there are distinct differences between each term above that makes them unique and separate from each. For instance, one could view mathematical literacy and quantitative literacy as being one and same whereas another may look at mathematical literacy as a literacy that is based more on mathematical content and quantitative literacy is deals with mathematics and content knowledge, but goes beyond just the content to include attitudes and dispositions about mathematics (3). With this in mind, many professionals and organizations have different ideas and approaches when it comes to defining quantitative literacy. For the purpose of this unit plan, the definition for quantitative literacy is:

> an aggregation of skills, knowledge, beliefs, dispositions, habits of mind, communication capabilities and problem solving skills that people need to

> autonomously engage in and effectively manage situations at life and at work that involve numbers quantitative or quantifiable information, or textual information that is based on or has embedded in it some mathematical elements (4)

The above definition gives light to the complexity and multi-dimensional nature of quantitative literacy. From reading this definition, you can see that it is more than just having a working knowledge of mathematical content and procedures; but it implies that quantitative literacy is more of a habit of mind characterized by a person's motivation to use quantitative information, and it is shaped by that person's beliefs, values and attitudes towards mathematics (5). Defining quantitative literacy this way allows one to see that there is a need for mathematical content knowledge, but the notion of this literacy is how to take that knowledge and apply it in everyday life. It transcends the notion of just learning mathematical content and begins to look at how a person perceives mathematics as a discipline, and based on those perceptions, how does that person use mathematics to help them navigate and live a productive life. To simplify this, quantitative literacy is not about how much mathematics a person knows, but more about how well a person is able use the mathematics that they understand and have truly mastered, which implies that they have to have a solid understanding of some mathematics (6). Whether it is basic arithmetic, algebra, or more advance topics, knowing how to take what you know and apply it effectively is the key to be a quantitatively literate person. That person should be

> Capable of using written, spoken, or graphic sources dealing with number, spatial, or data information in achieving goals and functioning in everyday life. In short, quantitatively literate people are capable of manipulating aspects of mathematical knowledge to understand, predict, and control situations important to their lives. Such people have the ability to reason in numerical, data, spatial, and chance settings; to integrate and apply mathematical concepts and procedural skills; and develop and interpret models related to the problems they encounter (7).

Taking what we now know about quantitative literacy we can begin to design our instructional practices and assessments to not only teach our content, but to build and develop some quantitative literacy skills within our students. One practical way for teachers to do this is by focusing on word problems and problem based tasks that are connected to the reality. To develop quantitative literacy, our students have to begin to process real world problems (8). For example, looking at quadratics, the unit we will be working on in class, I will have the students begin to read and dissect word problems that discuss projectile motion. As we read and study these problems, we will actively discuss how we use quadratics to describe the projectile motion we see all the time in nature. The goal for my students is to make sure they are able to shift between the "real-world context of the problem and the mathematical world needed to solve it." (9) Students have to be able to access the mathematics learned in school and through life experiences, and

then be able to reason and use critical thinking skills to determine how to apply the mathematics concepts to their current problem. Revisiting the concept of quadratics, students need to be able to make a connection between an object going through the air and the fact that it create a curve that can be modeled by a quadratic function; and from there further analyzed so that we can fully describe the motion. In order to successfully implement such a process, there are two big ideas to consider: the mathematical content knowledge that they student possesses and the level of reasoning and/or problem solving skills they have.

Content Knowledge

This refers to the mathematics discipline from which we pull out topics and organize them to create our curriculum for school mathematics. As curriculum leaders pull and organize information to create curriculum guides, the goal is to convey the idea of what math is, which in its most basic form, is "a language that describes patterns: patterns in nature and patterns invented by the human mind." (10) Common Core is an example of curriculum leaders who look at the mathematics discipline and organized into a curriculum to be taught in kindergarten to grade twelve. As we organize curriculum, we do sometimes distort the basic idea of mathematics. Because of the way we organize topics, students have a difficult time seeing math as a discipline that is growing and spreading; instead, they see it as fragmented pieces of information that makes no sense to them (11).

Reasoning

This addresses the critical thinking component of quantitative literacy. As our students progress through school, we want them to become creative critical thinkers. In mathematics, this means taking a real world scenario and translating it to an abstract representation using numbers, symbols, equations, diagrams, or manipulatives (12) and vice versa. For instance, being able to look at a football game, see the football flying through the air and first understanding that there is a way to mathematically describe the football, and then gathering all the pertinent information needed to create a model to describe the motion of the football in multiple representations. Being able to change from a real world scenario to an abstract representation is not an easy task. This is a skill that takes time and practice to develop and master. Many times, it requires students to take on new and, many times, difficult problems and tasks (13).

Importance of Quantitative Literacy

Something that is of great importance is the significance of this form of literacy in our society. Quantitative literacy is and "artifact of our culture," it is a skill that appears and is utilized in multiple settings (14) For example, when people watch sports, there are so

many different numbers and statistics being used in the various conversations about that particular sport. Another instance in when you go to work, most people in their respective careers will find themselves in a scenario in which they will have to deal with numbers and quantities, and make sense out of it. Quantitative literacy is a literacy that both shapes and is shaped by our society (15). As we moved forward and progress in our society, this literacy will evolve and change with us. For example, by World War II, quantitative literacy was basic arithmetic, now in today's time, it has grown into a collection of skills that promote higher order thinking – open-ended problems, communication and cooperative learning (16). This a skill that is fundamental for our student's success in the future.

General Teaching Strategies

In order to develop the quantitative literacy skills in students, we as teachers have to be very intentional in planning our classroom activities and instruction. As we plan our lessons it is important that we keep our classroom culture in mind. We have to create an environment in which students feel safe and the fear of looking or feeling belittled is gone. We must take time to know our students and their backgrounds and let them learn who we are and how we ended up in this profession. There are a variety of icebreaker and team building activities that are designed to build these crucial relationships. One that I like to use is icebreaker bingo. The student get a bingo sheet with various statements on them that pertain to characteristics, experiences, hobbies or interest that may or may not apply to them. The students go around and have students initial the square that they relate to. Afterwards, you can have a class discussion about each item on the bingo sheet and let the students respond about what they can relate to. I have a list of some that I have seen and used in appendix B. Once we have assured our students that we are here for their success, we can begin to push and motivate them to learn the new concepts that are in the curriculum. For many students, this will be a challenge and a stretch for many students. No one wants to feel as if they know nothing, but we have to remind and encourage our students that we learn from our mistakes and that the more they communicate with myself and with each other, the better off they will be when it comes to learning the concepts in this class. This tends to be difficult because most students have a negative view of mathematics, and when they engage with mathematical content they put energy into creating a barrier between themselves and the mathematical concept (17). They want very little to do with the mathematics because most of their past experiences with mathematics have be bad, and they leave feeling as if they cannot be successful. As we organize and plan, we really need to create an environment in which students can begin to shift the way they view mathematics. The way we do this is by

engaging in meaningful tasks, activities, and assessments that allow them to face their fear and/or anxiety of mathematics in a safe and productive way.

Academic Conversations

I want to teach my students how to engage in meaningful conversations about the mathematics they are learning. There are many benefits that come from having students talk with each other about the mathematics they are working on. By having students engage in a conversation about mathematics, they have direct access to the ideas, strategies, procedures, and facts about the concept. Additionally, the students are also building up their own social skills and consequently, developing a classroom environment that values and encourages learning (18). My plan is to put the students into small groups of 2-3 students and give them scripts with questions stems and advice about how to engage in academic discourse. I will form heterogeneous or mixed ability groups so that as the students engage in conversation, they can all learn from the experiences and perspectives of their peers.

Writing

Another general strategy I will use is that of writing. My goal for implementing writing in the classroom is to have them write reflection based on the concepts by utilizing discussion boards online and by having them write out the reflection on paper. The first piece is to have them do discussion boards. Currently we are using Canvas (an online learning management system) and I have them do answer questions that either deal with the prior knowledge needed for the topic of the day; or I will have them post their thoughts and insights on the discussion board as they work on a problem or task during the class. Then, I will have the students respond to each other on the discussion board, allowing them to critique each other and create a conversation in a different medium.

The second piece is having them write out their reflections on paper. These are more personal thoughts and opinions about the concept. I want them to communicate their honest thoughts and feeling about how they are doing with the mathematics concepts that we discuss. This is an opportunity for me to assess how confident each student feels about the mathematics we discuss over the unit. As they write, I will be looking for Standard English grammar to make sure that they know how to write complete sentences.

Reading

I want to stress to the students how to read in mathematics. I will be using a problem solving strategy to show them how to read to learn. We will be using close reading strategies as we work on word problems and tasks in mathematics. As we build and develop their reading skills, I want to make sure that they can read the objects like

graphs, tables/charts, and other representations that are used to convey mathematical ideas.

Blended Learning & Instruction

As we learn new concepts in math, we will come to a point in which I will give some direct instruction on some of the newer concepts in the unit. We will most likely be doing this every day. I am at blended learning school, so we look for ways to merge technology resources with our curriculum. As we move through the curriculum, I will have the students watch videos on a variety of concepts. The videos will either be created by me (I will discuss the concept) or they will come from a website that I have reviewed and deemed appropriate. As the students watch the instructional videos, I will have the students take Cornell notes. Cornell notes are a way to write notes so that you can write questions as you read through the notes. More information about them will in in appendix B. As they write these notes, they can organize the information I am giving them, as well as write down any questions they may have about the topic we are discussing. From there, we can review their notes, address any concern and formally assess them.

Inquiry – Based Learning

I will do a major project with my students that will utilize all of the above strategies. The project will be on quadratics. Before we engage in any direct instruction about quadratics, we will do a project in which the student have to play corn hole. After we play a game, I will have a coaching document for them to fill out about why they think we played this game and how it connects to some of the math they have already seen. At this point, the students will essentially be guessing, however, the goal is to see what connections they can make before we formally introduce the topic. As we progress through the unit, I will add on to the coaching document and monitor how their thoughts and conceptual knowledge is changing over time. As we discuss the different lesson topics, we will frequently make connections to the corn hole activity and how we were experiencing mathematics as we played the game.

Instructional Implementation

For this unit, the timeline given by the district is 15 days. Within this time period, we will discuss the idea of quadratics as well as an introduction to operating with polynomials. We will begin discussing how to operate with polynomials, which are separate from the concept of quadratics. Therefore, for the purposes of this unit, we will spend 8 days on the concept of quadratics:

- Day 1: Introduction to quadratics and analyzing quadratics
- Day 2: Solving quadratic equations (square roots)
- Day 3: Solving quadratic equations (factoring)
- Day 4: Analyzing and graphing quadratics
- Day 5: Comparing linear, exponential and quadratic functions
- Day 6: Word problems & review
- Day 7: Review
- Day 8: Formal assessment

Day 1:

- Warm up: 10 minutes
- Corn hole game: 30 minutes
- Critique corn hole video: 10 minutes
- Discussion board: 8 minutes
- Ticket out the door (closing assessment): 6 minutes
- Homework: 4 square vocabulary graphic organizer

We will start by doing a warm up on a factoring polynomials (a previous topic that will be used in a later lesson). From there, I will introduce the next activity, which will be to play a game of corn hole. I will go over the directions for the game and explain that I will record them playing the game and when we are done, we will go inside, watch the recording and begin to make the connection between the game and the mathematics we will discuss. Note that nothing has been said about why we are playing corn hole up to this point. I want to make the connection between the game and the mathematics concept after they have already played. I want this activity to be more discovery based. I want the students to gradually see and discover the connection between the corn hole game and quadratics. At this point in the class, we are now watching and analyzing the video of the corn hole game. As they watch, I am going to give each student a coaching document to help them process the connection between the video and the quadratics that we will be discussing momentarily. This document will have questions for them to answer and help them make the connection between a game of corn hole and quadratic functions. After they have completed their document individually, we will have a group conversation about the activity and the video. The goal is for the students to notice the motion of the bean bag each time it is thrown in the air. I want them to notice that every time one of them throws the bean bag, it goes up, reaches a climax, and comes back down. After our group discussion, I will have them go online and answer a discussion board prompt that will ask them to think of other real world examples that have this type of motion. The closing assessment will be a critique of the activity, asking them how they felt about it,

was it effective in introducing the concept and any suggestions for the future. Homework will be to create a 4 square graphic organizer for the following terms: quadratic function, vertex, maximum, minimum, increasing, decreasing, axis of symmetry, standard form of a quadratic function, vertex form of a quadratic function.

Days 2- 5

- Warm up: 10 minutes
- Vocabulary review conversation: 5 minutes
- Instructional video: 15 minutes
- Mini assessment: 10 minutes
- Walch task/word problems: 20 minutes
- Discussion board reflection on the task: 5 minutes
- Ticket out the door: 5 minutes
- Homework

For days 2 through 5 we will dive into the mathematics behind the motion we discussed in the video. We will go in the order listed above and we will be doing what is outlined directly above. We will start each day with a warm up. The warm ups will be a reinforcement of topics from the past few days. So for these days, the warm up will consist of problems that deal with the various aspects of quadratic functions. As they work on the warm up problem(s), I will check homework from the previous night, looking to make sure that the solutions make sense and go over the answers with each student. From there, we will review the warm up, and discuss some vocabulary. To start of the unit, I will be doing the four square graphic organizer. This is a graphic organizer that is good for synthesizing the vocabulary used in mathematics. There is more information about this organizer (and others) in the appendix section. We will compile the work they did individually into one four square organizer and discuss it, then print it out and hang it on the wall in the classroom for future reference. Next, the students will watch the instructional videos. These are videos that I will make myself and post online in the Canvas learning management system. I have found over time that the best video are the ones that I create myself, keeping my students in mind as I create the videos so that they make sense. The goal of these videos is to be short and to the point. I will be using the promethean software to create my notes and later record my voice and actual movements as I write the notes for the students. I will say that at this point my students have already been doing this, so they will be familiar with this activity. As they watch the video, I will have them take Cornell notes so that they will actually begin to internalize the concepts in the video and not just literally watch it. I will walk around and monitor the students and address any concerns or technical issues they may have.

After the videos, the students will take a short five to six question mini assessment to see how they are doing after watching the video. The assessment will be basic computation problems that are related to the video that they just watched. Once they are done with the assessment, the student and myself will review the scores, discuss any issues and have them reassess until they reach a point of mastery (eighty percent or higher). Once they have mastery the computational skill, they will move into some word problem and/or task. Our resources for these word problems and task is currently through Walch Education. We will use the workbooks provided for us by the district to practice word problems and tasks in order to further develop each student's problem solving skill set. These problems will be all words, but may include graphs, chart, diagrams, and other visuals that they students can expect to see for their final exam. The students will attempt these problems and I will closely monitor them to see how they are processing the problem at hand. Once they finish the task, I will have them go online to the discussion board and post a reflection about the task they just completed, then I will have them comment on another student's post the next day. At this point, we are moving towards the end of class and we will do a closing assessment, reflecting on the major topic for the day and whether or not it made sense for each student. The homework will be more vocabulary and some computational practice problems to further reinforce the skills discussed that day.

Day 10: Word problem & review

On this day, we will explicitly focus on processing and understanding word problems and tasks, making sure that each students is approaching and processing the problem correctly. We will make any corrections and/or finish to the previous tasks from the earlier lessons. Once that is complete, I will hand them their formal performance task. This task will use the corn hole activity as the context for the problem, and will include several key topics from the unit. This task will be due the day of the test.

Day 11: Review

For our review, we will start by having each student complete a KWL, which is a graphic organizer that has the students share what they know (K), what they still want to know (W) and what they have learned (L). For the warm up, we will focus on the K and W parts. Next, each student will randomly pick a topic from the unit and they will create a mini study guide for the test based on that topic that they picked. Along with the study guide, they need to have some examples of EOC like problems for that topic. Then we will have the students do a gallery walk activity where they pair up with each other and explain their topic to another student. By the end of the class, each student should have a complete study guide for their assessment. The ticket out the door will be to finish the KWL chart.

Day 12: Formal assessment

The students will come in and take the quadratics exam on our online testing program (school net). When the students are done, they can complete the performance task and submit for review and grading.

Conclusion

This lesson has many different components designed to enhance the experience for my students. I want them to understand that math is more than just some strange collection of numbers and letters, but that it is a collection of ideas and concepts that transcend the books or worksheets that most students see in school. These ideas and concepts exist because they were discovered by various mathematicians in the past who were attentive to the world around them. These mathematicians noticed, discovered, and quantified various patterns in nature and consequently created the ideas and concepts that we now study in the K-12 school and beyond. With this in mind, these mathematicians had to have been quantitatively literate to recognize these complex patterns in nature. Now that we are in the 21st century, these patterns are no longer a problem to be discovered to some of us in society. However, we still have many people who are perplexed by mathematics and the patterns that it contains. My goal for this unit to help my students discover and appreciate the central notions of mathematics and help them extend these notions beyond a book or a worksheet. I want my students to become more like some of the past mathematicians, who noticed patterns and phenomenon in nature and were able to make sense out of these phenomenon and live as an empowered and productive citizen.

Appendix 1: North Carolina Math 1 Standards

NC.M1.F-IF.4: Interpret key features of graphs, tables, and verbal descriptions in context to describe functions that arise in applications relating two quantities, including: intercepts; intervals where the function is increasing, decreasing, positive, or negative; and maximums and minimums.

NC.M1.F-IF.5: Interpret a function in terms of the context by relating its domain and range to its graph and, where applicable, to the quantitative relationship it describes.

NC.M1.F-IF-6: Calculate and interpret the average rate of change over a specified interval for a function presented numerically, graphically, and/or symbolically.

NC.M1.F.IF.7: Analyze linear, exponential, and quadratic functions by generating different representations, by hand in simple cases and using technology for more complicated cases, to show key features, including: domain and range; rate of change; intercepts; intervals where the function is increasing, decreasing, positive, or negative; maximums and minimums; and end behavior.

NC.M1.F.IF.8: Use equivalent expressions to reveal and explain different properties of a function.

NC.M1.F-IF.8a: a. Rewrite a quadratic function to reveal and explain different key features of the function

NC.M1.F.IF.9: Compare key features of two functions (linear, quadratic, or exponential) each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions).

NC.M1.A-SSE.1: Interpret expressions that represent a quantity in terms of its context.
NC.M1.A-SSE.1a: Identify and interpret parts of a linear, exponential, or quadratic expression, including terms, factors, coefficients, and exponents.

NC.M1.A-SSE.1b: Interpret a linear, exponential, or quadratic expression made of multiple parts as a combination of entities to give meaning to an expression.
NC.M1.A-APR.3: Understand the relationships among the factors of a quadratic expression, the solutions of a quadratic equation, and the zeros of a quadratic function.

NC.M1.F.BF.1: Write a function that describes a relationship between two quantities.

NC.M1.F.BF.1b: Build a function that models a relationship between two quantities by combining linear, exponential, or quadratic functions with addition and subtraction or two linear functions with multiplication.

NC.M1.F-LE.3: Compare the end behavior of linear, exponential, and quadratic functions using graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.

Appendix B – Teacher Resources

1. Web links to instructional videos: these are instructional videos from YouTube that discuss the unit concept.
2. Coaching Document for the corn hole game: these are some reflective follow questions for the students to complete as they watch the video of them playing corn hole.
3. Math Talks document: this a document that I found online that I use in my classroom to help with the academic conversations we have.
4. Problem Based Task: this the assessment that will use at the end of the unit. The document you see will have everything included, but the student will only need the second page to complete in class.
5. Khan academy quadratics: this is just a link to the quadratics section on khan academy, it includes videos and practice problems that you can use at your discretion.
6. Complete list of North Carolina Math 1 Standards: all of the revised standards for the North Carolina Department of Public Instruction.
7. Quizlet: this is a link to the quizlet that I created for the quadratics vocabulary. It also included vocabulary terms concerning polynomials because those are typically grouped with quadratics in our unit plans from the district.
8. Corn hole directions: this is a website with directions about how to play corn hole
9. Cornell notes: this is a website about what Cornell notes are and how they are used in the classroom.
10. Cornell Note Document: a blank document for you to print and copy to use in class.
11. KWL chart: this is a KWL template that we will use on the review day. The students will type in what they know (K), what they want to know (W) and what they have learned (L)
12. NCTM Vocabulary Article: this is an article from the National Council of the Teachers of Mathematics that discussing math vocabulary instruction.
13. 4 square vocabulary document: this is a blank document that you can use in class to reinforce vocabulary. It is pretty much self-explanatory, with the exception of the light bulb word, which is something that will help the student remember the definition for the term. There is more information about this in the NCTM article.
14. Icebreaker activities: this is a list of 40 icebreakers that can be used in the classroom.

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1. Lesson links
    a. Graphing quadratics: https://www.youtube.com/watch?v=mDwN1SqnMRU

b. Graphing quadratics on calculator google document: https://docs.google.com/a/cms.k12.nc.us/presentation/d/12hhSfk9n0l-aiZSB2_NrGdxCddPHYJjjcHm5GCEOzis/edit?usp=sharing
c. Comparing linear, exponential, quadratic functions https://www.youtube.com/watch?v=CxEFOozrMSE
d. Solving quadratics with square roots: https://www.youtube.com/watch?v=T5HsXihtkO8
e. Solving quadratics by factoring: https://www.youtube.com/watch?v=SDe-1lGeS0U
f. Solving quadratics by graphing (no solution): https://www.youtube.com/watch?v=8Pk2VN6wzqU
g. Solving quadratics by graphing (2 solutions): https://www.youtube.com/watch?v=vIXuqhBI2iM

2.

Corn Hole Quadratics Activity

Directions: The video is a recording of us playing the corn hole game. As you watch the video, answer the following questions listed below.

Pre discussion

1. Was playing this game a new experience for you (have you played this game before)?
2. Did you enjoy playing the game, why or why not?
3. As you watch the video, describe the motion of the bean bag.
4. Why does the bean bag have this type of motion?
5. Does the angle at which you throw the bean bag affect your accuracy? Explain your reasoning.
6. Looking at the video, was there a difference between the throws that made it in the hole versus the throws that landed on the board versus the throws that did not make it on the board at all? Explain your reasoning?
7. Thinking about the motion of the bean bag, are there games or activities in which an object follows the same motion? If so, what are they?
8. Using what you already know about mathematics, create an equation that you think would describe the motion you are seeing.

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3. https://drive.google.com/a/cms.k12.nc.us/file/d/0B67aIrJaZWJDZkp3RjFxSjYzX1U/view?usp=sharing

4. https://drive.google.com/a/cms.k12.nc.us/file/d/0B67aIrJaZWJDT182OVJOZGk3SFU/view?usp=sharing
5. https://www.khanacademy.org/math/algebra/quadratics
6. http://maccss.ncdpi.wikispaces.net/file/view/Math%201_REVISED_6-62016.pdf/584880511/Math%201_REVISED_6-62016.pdf
7. https://quizlet.com/128041867/math-1-unit-4-vocabulary-quadratics-polynomials-flash-cards/
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9. http://www.uwec.edu/ASC/resources/upload/Cornell-Note-Taking-System.pdf
10. https://drive.google.com/a/cms.k12.nc.us/file/d/0B0u3QDF6iPNJQ2dWTEt1OE5ob1E/view?usp=sharing
11. http://www.readwritethink.org/files/resources/printouts/KWL%20Chart.pdf
12. file:///C:/Users/leroyd.santos/Downloads/mtms2013-08-38a%20(2).pdf
13. https://docs.google.com/a/cms.k12.nc.us/document/d/1yWJ1fPExtHao-QmX5F2A33y8Sai52JU_Sh5_uzYFv-c/edit?usp=sharing
14. https://drive.google.com/a/cms.k12.nc.us/file/d/0B67aIrJaZWJDRjhDNmh1VlM3bVU/view?usp=sharing

Notes

1. Scherba De Valenzuela, *"Definitions of Literacy."* Pg. 1
2. Steen, *Why Numbers Count: Quantitative Literacy for Tomorrow's America*, Pg. xx
3. Wilkins, *Modeling Quantitative Literacy*, Pg. 268
4. Wilkins, *Modeling Quantitative Literacy*, Pg. 268
5. Wilkins, *Modeling Quantitative Literacy*, Pg. 268
6. Hallett, *The role of mathematics courses in the development of quantitative literacy*, Pg. 91
7. Steen, *Why Numbers Count: Quantitative Literacy for Tomorrow's America*, Pg. 48
8. O'Connell and SanGiovanni, Putting *Practices into Action*. Pg. 30
9. OECD (2010), *Learning Mathematics for Life: A Perspective from PISA*, Pg. 20
10. OECD (2010), *Learning Mathematics for Life: A Perspective from PISA*, Pg. 21
11. Brendefur, *High school mathematics teachers' beliefs about learning, pedagogy, and mathematics, and their relationship to teaching authentically*. Pg. 252
12. Epler, *Examining Response to Intervention (RTI) Models in Secondary Education*. Pg. 143
13. Ferrini-Mundy and Martin, *Principles and Standards for School Mathematics*, Pg. 334
14. Steen, *Why Numbers Count: Quantitative Literacy for Tomorrow's America*, Pg. xvi
15. Steen, *Why Numbers Count: Quantitative Literacy for Tomorrow's America* Pg. xvi
16. Steen, *Why Numbers Count: Quantitative Literacy for Tomorrow's America*, Pg. xviii
17. Appelbaum and Allen, Embracing *Mathematics: On Becoming a Teacher and Changing with Mathematics*, Pg. 73
18. Chapin, O'Connor, and Anderson. *Classroom Discussions: Using Math to Help Students Learn*, Pg. 6

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Appelbaum, Peter, and David Scott Allen. *Embracing Mathematics: On Becoming a Teacher and Changing with Mathematics*. New York, NY: Routledge, 2008.

This is an east to read book that describes the different aspects of becoming and being a mathematics teachers. The authors were both teachers themselves and in the text they share experiences from teaching and from researching the teaching and learning of mathematics. In the text include student work samples and some math activities throughout the book to help illustrate their point.

Hallett, Deborah Hughes. "The role of mathematics courses in the development of quantitative literacy." *Quantitative Literacy: Why Numeracy Matters for Schools and Colleges, edited by Bernard L. Madison and Lynn Arthur Steen* (2003): 91-98.

This is an article that discusses what quantitative literacy is and the different roles that high school and college math courses have in helping people develop quantitative literacy. The author discusses the current nature of education and testing and then begins to briefly discuss teaching and learning strategies that will help develop quantitative literacy skills.

O'Connell, Susan, and John SanGiovanni. *Putting Practices into Action*. Portsmouth, NH: Heinemann, 2010.

This book going into a great amount of detail as they discuss the 8 mathematical practices that accompany the common core standards. They briefly discuss the history and purpose of the standards, and from there they give very clear and detailed descriptions of each mathematical practice. They include examples and rubrics throughout the text.

OECD (2010), *Learning Mathematics for Life: A Perspective from PISA*, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264075009-en

This is a huge research document perform by an international group that measures and discussing the current state of mathematics and mathematical literacy of students based on the mathematics instruction the students received. The book starts by describing the organization and their goals, then moves into the very detailed research results.

Steen, Lynn Arthur, ed. *Why Numbers Count: Quantitative Literacy for Tomorrow's America*. College Entrance Examination Board, 1997.

This is a collection of articles written by math and math education professionals about quantitative literacy. Each author discusses their view of quantitative literacy and its implications in our society today.

Wilkins, Jesse L.M. "Modeling Quantitative Literacy." Educational and Psychological Measurements 70, no. 2, 267-90. Accessed October 27, 2016. doi:10.1177/0013164409344506.

This article is a research articles discussing how to measure an individual's quantitative literacy skills. In the beginning of the article, the author discusses the definition of quantitative literacy. From there he goes into the research design, implementation, and results.

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