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Authentic Montessori Math Assessment and Common Core

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An Action Research Report

By Melanie Driskill

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In fulfillment of final requirements for the MAED degree

St. Catherine University

St. Paul, Minnesota

Advisor: __________________________________ Date:_________________________

Abstract

The intent of my project was to examine the way I assess my students' math in my 9-12 Montessori classroom given the new Common Core standards. The study involved six students, varying ages 9-11, in a public school setting. Data collection methods included pre- and post- assessments, observations, written responses to Webb's Depth of Knowledge (DOK), and a brief questionnaire about the attitudes toward the various types of assessment (See Appendix A). The results of the data analysis showed an average increase of 84% in grade level achievement after practicing with the DOK, as well as an improved student enjoyment and enthusiasm for learning when compared to traditional lessons. The results of this action research investigation indicate that students perform better on Common Core math assessments after practicing with the DOK, as the DOK provides an outline to enable students to think critically.

Countless teachers, both Montessori and traditional, are working hard to find ways to get their students to record their thought processes in math. Montessori students are known to work with material that generates higher-level thinking; however, with the new Common Core State Standards, students need to begin recording those procedures. Many Montessori students are not able to articulate their thought processes and need stimulating questions to begin demonstrating higher order thinking skills. The education system is being revolutionized with the implementation of these Common Core State Standards. Teachers are learning new techniques and philosophy as they process the improved and robust standards for teaching. The new standards are designed to help students become prepared for the future by learning real-life skills. They provide a consistent, clear understanding of what students are expected to learn, so teachers and parents have tools to help them. With our students falling behind in mathematics, most teachers are open to new ways to reach students and to help them meet their fullest potential (The Times Editorial Board, 2013). We, as educators, need to improve assessment processes.

Montessori schools—both public and private—have followed the state standards for decades. Montessorians have strived to sustain quality curriculum that adheres and often exceeds the state standards while maintaining an authentic Montessori program. Many Montessori schools have created their own curriculum maps that coincide with the state standards to show its commitment to excellence. The 2012-13 school year marked the end of California Standards test—STAR test—since the adoption of the Common Core Standards testing is being implemented in the near future. This exciting time provides a new challenge for Montessorians—to develop Montessori assessments that meet the Common Core Standards. It is essential to maintain an authentic Montessori program that is genuine to its roots while responsible for the Common Core Standards. Many Montessorians are researching this task; however, the 9-12 level is often overlooked, as this level is not as common as the others.

"One hallmark of mathematical understanding is the ability to justify, in a way appropriate to the student's mathematical maturity, why a particular mathematical statement is true or where a mathematical rule comes from" (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010 ¶ 3). The Montessori math materials provide students with the necessary tools to remember, understand, apply, analyze, evaluate, and create concepts. The Montessori Method supports the Common Core State Standards (CCSS) by providing extended thinking opportunities with the freedom of choice incorporated in the classrooms. For example, when 9-12 year olds are working with the peg board material, they have the opportunity to reorganize elements into new patterns by choosing their own numbers to carry out a squaring problem. They analyze the size of the squares and rectangles and how place value affects them.

From my literature review, I found that many Montessori teachers assess student learning by conducting the three-period lesson. Research by Seldin and Epstein (2006) indicates "Montessori teachers will use the Three-Period Lesson to help children" (p. 36). Montessori teachers have used this form of assessment since the inception of the method. The teacher will present the lesson and have students name what they are learning (introduction), recognize what they are learning (identification), and remember what they have learned (cognition). This last period is the testing period, where the teacher evaluates the child's learning. This form of assessment is still relevant to student learning; however, it needs to be advanced to meet the demands of twenty-first century standards.

Traditional Montessori teachers take part in alternative methods of assessment—forms that adhere to the child's natural functions and desires. They keep daily observational records on every student that reflect student achievement and social growth. Furthermore, checklists are developed—to show what lessons have been presented, practiced, and mastered—to assess each child based on observations (Olaf, 2013). Teachers use their anecdotal notes to guide instruction. "Observing what the student is learning; examining their projects and products; by questioning students; by having conversations with students; or, by testing their knowledge and skills" are all forms of authentic assessment (Roemer, p. 8, 1999). Roemer's literature further indicates "assessment does not drive instruction, but follows naturally from particular arrangements of curriculum and teaching" (p. 11). These articles indicate that Montessori-style of assessment proves to be authentic. Although these genuine assessments provide benefits to students, the observations need to reflect Common Core State Standards by using the DOK to demonstrate where the students use their higher order level of thinking.

Various alternative methods used by Montessori teachers are a useful tool when adhering to the CCSS. Student and teacher-created rubrics help develop high expectations that are made with a common language. These traditional methods of assessment are reflected in the CCSS; however, alternate vocabulary is used, and

Montessorians need to develop a common language that is seamless with the new traditional educational methods. This can be done by utilizing the DOK to show where Common Core State Standards are being met.

The Common Core State Standards and Montessori standards both strive to achieve a child-centered environment that prepares the students for the real world. The Smarter Balanced Test—which assesses Common Core Standards—uses stimulating and directive questioning that mirrors student-generated ideas during Montessori lessons. This is apparent in the "Webb's Depth of Knowledge" matrix (DOK), which provides a vocabulary and a frame of reference when thinking about our students and how they engage with the content (Hess, 2009). DOK offers a common language to understand "rigor," or cognitive demand, in assessments, as well as curricular units, lessons, and tasks. Webb developed four DOK levels that grow in cognitive complexity and provide educators a lens on creating more cognitively engaging and challenging tasks. The Montessori math assessment practices need to be advanced to encourage students to record their thought process that, according to CCSS, needs to be verbalized so fluently during lessons because of the rigor of the standards. This needs to be a part of the three-period lesson, where students demonstrate cognition using the DOK. Given stimulating and directive questions, students are able to justify, in a way appropriate to the student's mathematical maturity, why a particular mathematical statement is true or where a mathematical rule comes from. Montessori teachers all around the world are contemplating "How do I assess my 9-12 students in math given the new Common Core standards while maintaining authentic Montessori practices?"

My students have inspired me to look deeper into how I assess them in math. They demonstrate high-level thinking when using the peg board material and are able to conceptualize key ideas. My class is composed of twenty-nine 9-12-year-olds, in a charter school setting that has been established for twelve years. I have a clear California Teaching Credential and am certified as a 6-12 Montessori Teacher. I have a credentialed teaching assistant who assists me by providing classroom overview and one-on-one help with students. I chose a group of six students to focus on—three boys, three girls—who work proficiently but all are somewhat reluctant to write out and explain their thinking in math. One of these students is new to Montessori as a sixth grader, while the other five have been in the program for three or more years. They are currently working on squaring trinomials with the peg board material, while hypothesizing different ideas. My work will include math pre-tests and post-tests, which will focus on assessing Montessori math with the Common Core State Standards using the Webb's Depth of Knowledge Matrix.

Description of Research Process

I teach multiple subjects in a 9-12 class at an established public Montessori school. My class of twenty-nine fourth, fifth, and 6th graders is composed of children with Montessori experience and children who are new to Montessori. I am the leader of a four-teacher grade level team, where we meet weekly to discuss curriculum. Currently in my sixteenth year of teaching, I am working with other educators to blend Montessori and the new standards. My goal is to keep Montessori authentic by demonstrating its adherence to the Common Core State Standards. Although I teach multiple subjects, I am targeting Montessori math and Common Core State Standards for my research.

With my class of ten fourth graders, nine fifth graders, and ten 6th graders, I have five math groups, where I present formal lessons to them every Monday. Throughout the week, I provide follow up presentations either individually or with the group, as needed. The group I targeted is comprised of fifth and sixth graders, both Montessori experienced and new to Montessori.

My data was generated by multiple sources. First, I used my students' pre- (beginning of the year) and post-tests (at the end of my study) using Renaissance Learning's STAR Math test (See Appendix B). During their time in between the test, I used Webb's Depth of Knowledge (DOK) math matrix to assess their progress. In addition, I used the students' portfolios to monitor growth. The STAR math tests are computer-generated and measure overall skills according to grade level standards; this test is meant to help students prepare for the Common Core State Standards standardized test. The DOK measures higher order level thinking as expressed with student writing. I did not include a pre-assessment using the DOK, as the student performance using this was so low it was not measurable. The portfolios consist of daily work recorded in a composition book. Collecting data from three sources allowed for triangulation of the findings in this study. Data triangulation helped reduce the likelihood of error in the findings when similar results are reported from two or more of the sources.

I chose to focus on a fundamental Montessori math material—the peg board. My 9-12 students work on squaring binomial numbers, using the hierarchical material. They perform this work independently, in small groups, and with the teacher. They choose their numbers to square and record their work in their composition books. Their profound discussions can be observed as I perform my classroom overview, but they struggle with recording their thoughts that the Common Core State Standards demand. I have the students complete one binomial square problem a day on top of their abstract practice work.

During the first part of my study, I observed students working during the three-hour uninterrupted work cycle. I used the DOK to observe and record their conversations and measure the level of thinking. At this point, I had already conducted the beginning of the year STAR math tests (See Appendix B). I listened to their conversations and wrote on the DOK matrix what levels of thinking I observed. I had a separate matrix printed for each child. On other days, I reviewed their portfolio performance in their composition books and charted them on the DOK as well. It is important to "analyze a pattern of performance observed and documented over time in natural settings," (Kohn, pg. 44, 2000).

For the next step, I introduced the students to probing questions that enhanced their depth of knowledge. This was presented as a matching job with a control of error on the back. (See appendix B.) The students worked on this job for multiple days and continued the rubber stamps activity several times. This work was recorded in their portfolios. Students worked alone, in small groups, and with the teacher.

The next portion of my study consisted on having the students record more of their thought processes in math. I introduced them to a teacher-created "Assessment Test" that I generated. This test was performed and recorded in their portfolios as a rough draft. Students were allowed to discuss the questions with each other during its application. The control of error for this activity was the teacher. (See Appendix C.)

After the students spent multiple days completing this test by using the materials, they entered their answers in a Google Form (See Appendix E). This enabled them to rethink their answers in a more abstract form and graphed their responses to give me formal information to evaluate. From this, I was able to see what questions were most difficult for students and what questions were more obvious. I was also able to review their level of proficiency in writing out their thought process in math. The students then completed the Renaissance Place STAR Math test and I compared the results from the beginning of the year to the present.

Analysis of Data

In order to answer my action research question, "How do I assess my 9-12 students in math given the new Common Core standards while maintaining authentic Montessori practices?" I collected data from three sources: pre- and post-assessments, observations using the Webb's Depth of Knowledge, and a teacher-made assessment in a Google Form where students could write out answers in paragraph form—also assessed using the Webb's Depth of Knowledge Matrix.

The first data I collected and reviewed was the Renaissance Place STAR Math test's State Standards report. I analyzed the data by looking at their estimated mastery range according to the Common Core State Standards. The results for the beginning-of-the-year assessment test are analyzed on two different graphs and are labeled 4th Grade STAR Test (see Figure 1) and 5th Grade STAR Test (see Figure 2). They show my nine focus students' results. The test consisted of 40 questions, varying in difficulty level that adjusted as the student answered questions. Students were provided a computer and scratch paper to solve the mathematical problems. The mean for 4th grade was 4.85, and the mean for 5th grade was 4.62.

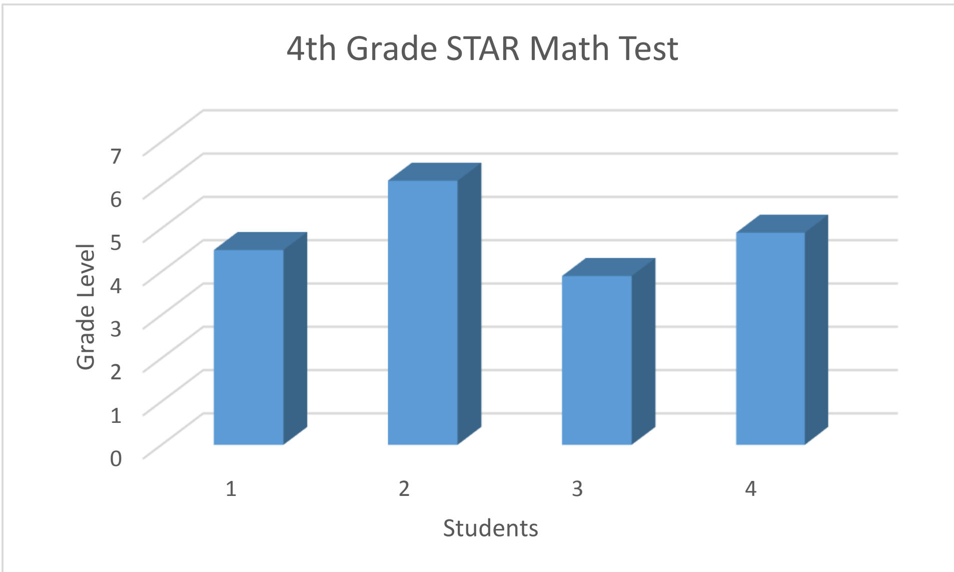

Figure 1. 4th Grade STAR Math Test

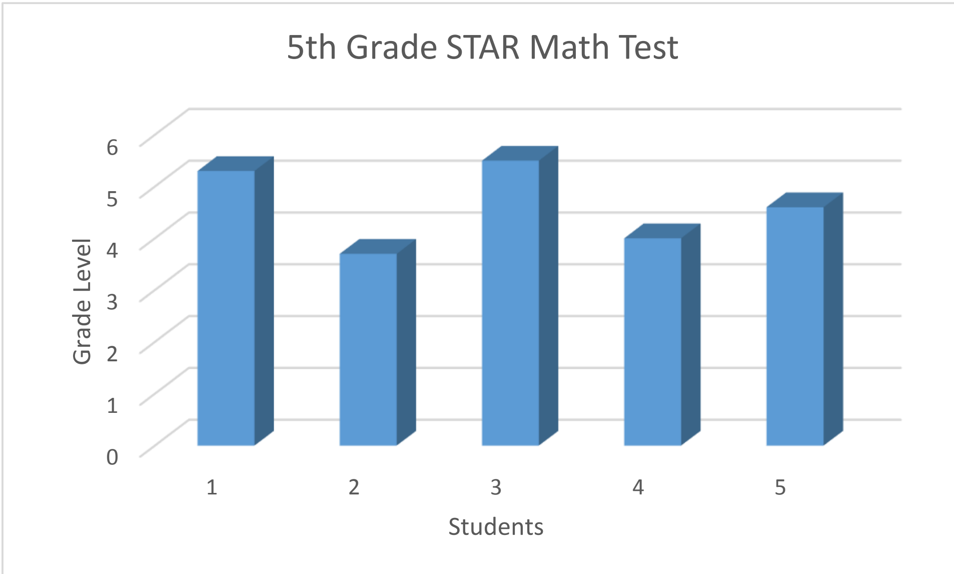

Figure 2. 5th Grade STAR Math Test

Additionally, the students completed a teacher-made assessment over two different days in which they used the pegboard material to answer critical thinking questions. This served a rough draft to the Google Form responses. This was meant to assess the students' ability to answer math questions in a written form—a crucial Common Core State Standard. As the pre-assessment provided for no data (students gave up), it seems that students need to be prompted with appropriate questions to stimulate their thinking. For the post-Binomial Square Assessment data collected with the DOK, I recorded the number of answers from the students that demonstrated higher-level thinking (see Figure 3). With the prompts, the students were able to answer a measurable amount of questions. This data suggests that given the right prompts, students can perform critical thinking skills in math and write out their answers in paragraph form.

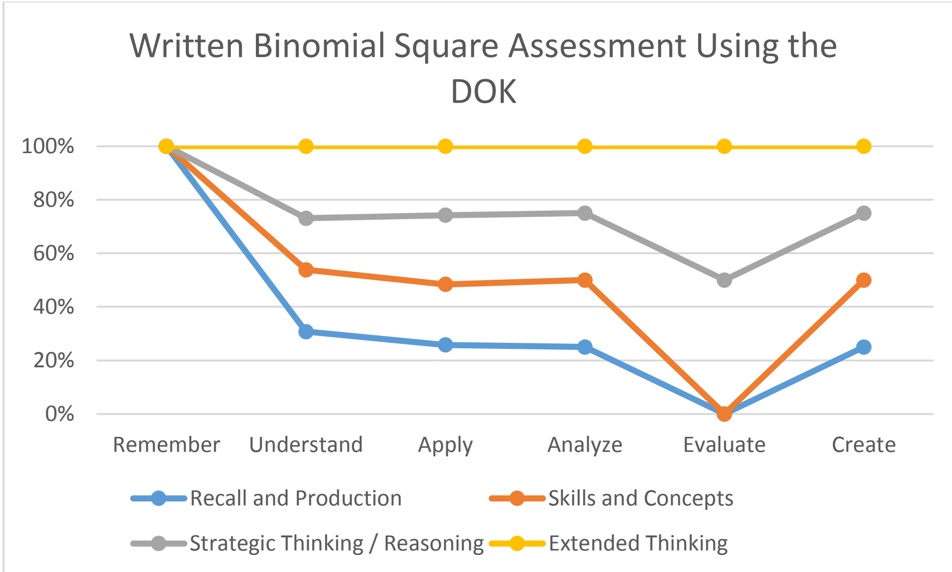

Figure 3. Written Binomial Square Assessment Using the DOK.

While working on the material, I performed observations and listened to students' conversations with each other. I again used Webb's Depth of Knowledge Matrix to assess their discussions. I observed them over a 3-hour, uninterrupted work cycle, where I allowed them to discuss their answers with each other. I carefully guided them by assuring them it was satisfactory to have different ideas and answers. Most were on-task and completing the work, while one was off-task and focused on non-academic work with friends. Using the DOK, many of the students' "Remember" level of knowledge appeared to be the weakest while speaking, while the "Analysis" seems to be the strongest. The "Evaluate" level of knowledge took more stimulation. The students needed more guidance in this area (See Figure 4). I also provided a Google Form for the students to have a chance to rethink their ideas and to type up their paragraph answers.

The students were completely independent at this time. The varying completion rate depended on the effort exerted.

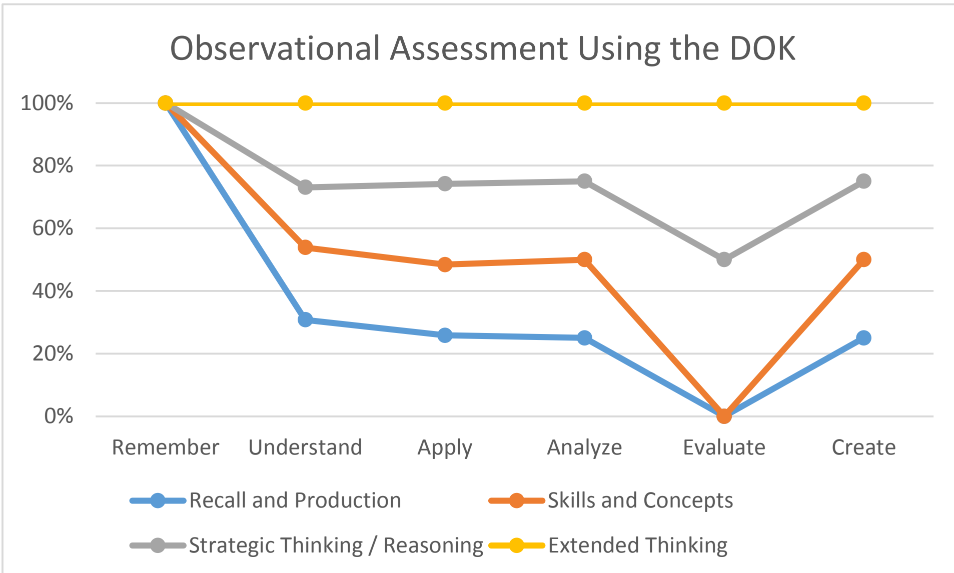

Figure 4. Observational Assessment Using the DOK

The final STAR Test results indicated high growth after performing more critical thinking skills in math. With the conversion to Common Core State Standards, students must cite evidence in their thinking. This requires written explanations in math. As compared to the period where they were recording their work in the portfolios to the period where they were required to write out their thoughts, their STAR Math test results increased (See Figure 5).

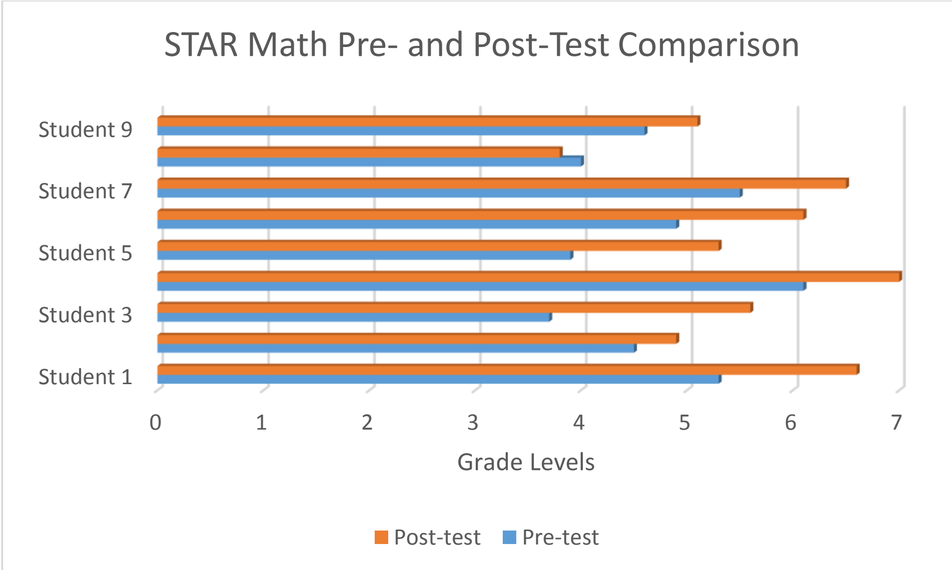

Figure 5. Pre- and Post STAR Test Results

After analyzing and reviewing all three data sources, I can conclude that I need to assess my students thinking in math by providing them multiple ways to show their thinking. Most importantly, I need to provide them with developmentally appropriate questions that are stimulating and get them to discuss their thoughts. The pre- and post-assessments showed significant growth, my observations using the Webb's Depth of Knowledge showed an initial progress of zero to noticeable increase, and my teacher-made assessment in the Google Form presented progression. At times, my data produced contradictory results for the student who was off-task. However, in general, the students had a higher test scores after being introduced to an assessment that required critical thinking skills. In the next section, I will describe how I plan to implement this form of assessment in going forward with my action research plan.

Action Plan

My action research study generated data that generally indicated that students are able to think on a higher level—based on the DOK—when prompted with appropriate questions; furthermore, they are able to use authentic Montessori materials to reach Common Core standards. Overall, my students' scores based on the DOK increase from 0% to 60% (this includes a student's score who did not complete the assignments). Besides increasing critical thinking skills, the students' STAR Math scores, which are compatible with Common Core State Standards the scores increased from 4.6 to 5.5 grade level. In addition, the students showed enthusiasm in their discussions about their observations.

My data provided some insights toward informing my teaching practices and pedagogy. My results suggest that students will perform better on Common Core State Standards tests given the appropriate tools along with their traditional Montessori math work. My data further indicates the importance of observational assessment, using a scoring guide such as the DOK. It is invaluable for the teacher to listen to the students' conversations regarding material, as it provides assessment data on their critical thinking skills.

During this study, I found that my students knew more than they were able to articulate during lessons. They appeared to be withholding information because they thought it was not the correct answer. After I explained that there are different ways to respond to the prompts, they were more forthcoming with their answers. I also found that the students were able to make observations that I had not yet discovered in regard to the size of the shapes in the binomial square. Their absorbent minds captured a visualization that I was not able to see at first.

My next step is going to be to develop more probing questions to guide my students' thinking. I can see using the DOK to write these questions, and then using the matrix as an assessment tool with a defined scoring rubric. This would support their written work as well as the teacher's observational assessment. I think my research will impact my teaching practice by allowing my students the environment in which to think deeply about math—a subject they are required to perform. Furthermore, I hope it would alleviate students' fear about math and relieve anxiety. This type of work might even create students' love for math, as they will understand it on a deeper level and see its connections to the real world.

As Montessori teachers are often challenged by traditional-school-style-thinking, math textbooks are often presented as a solution to the Common Core era. Public school Montessorians are scrambling to find out how they are going to adhere to the new standards. With so many math textbook companies creating inviting and promising curriculum to fix this challenge, many are feeling that their authentic Montessori roots are being compromised. However, Montessori continues to be timeless, as its pedagogy applies to all. Dr. Montessori was truly ahead of her time—her work encompassed Common Core all along. The only difference is that we, as twenty-first century Montessorians, need to provide that classroom atmosphere that supports the recording of high-level thinking. We can do this by using DOK question stems (see appendix F). Our students have had the capabilities all along; we just need probe them to record those thoughts and connections to the real world. Using the authentic Montessori materials to solve complex math problems is Common Core, and we do not need to change our curriculum.

With this study, I have found how to assess my 9-12 students in math given the new Common Core standards while maintaining authentic Montessori practices. Students need probing questions to guide their thoughts. I need to have these prepared for them and reiterate that there is not necessarily one right answer. I do not need to change what I am teaching; rather, I need to use a tool such as the DOK to report my data in a way that can be understood by administrators of Montessori and traditional schools alike. I would potentially conduct research in the future by seeing how I assess my 9-12 students in reading using the DOK that supports Reading and Language Arts.

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Appendix A

Revised Bloom's Taxonomy	Webb's DOK Level 1 Recall & Reproduction	Webb's DOK Level 2 Skills & Concepts	Webb's DOK Level 3 Strategic Thinking/ Reasoning	Webb's DOK Level 4 Extended Thinking
Remember Retrieve knowledge from long-term memory, recognize, recall, locate, identify	○ Recall, observe, & recognize facts, principles, properties ○ Recall/ identify conversions among representations or numbers (e.g., customary and metric measures)			
Understand Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion (such as from examples given), predict, compare/contrast, match like ideas, explain, construct models	○ Evaluate an expression ○ Locate points on a grid or number on number line ○ Solve a one-step problem ○ Represent math relationships in words, pictures, or symbols ○ Read, write, compare decimals in scientific notation	○ Specify and explain relationships (e.g., non-examples/examples; cause-effect) ○ Make and record observations ○ Explain steps followed ○ Summarize results or concepts ○ Make basic inferences or logical predictions from data/observations ○ Use models /diagrams to represent or explain mathematical concepts ○ Make and explain estimates	○ Use concepts to solve non-routine problems ○ Explain, generalize, or connect ideas using supporting evidence ○ Make and justify conjectures ○ Explain thinking when more than one response is possible ○ Explain phenomena in terms of concepts	○ Relate mathematical or scientific concepts to other content areas, other domains, or other concepts ○ Develop generalizations of the results obtained and the strategies used (from investigation or readings) and apply them to new problem situations
Apply Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task	○ Follow simple procedures (recipe-type directions) ○ Calculate, measure, apply a rule (e.g., rounding) ○ Apply algorithm or formula (e.g., area, perimeter) ○ Solve linear equations ○ Make conversions among representations or numbers, or within and between customary and metric measures	○ Select a procedure according to criteria and perform it ○ Solve routine problem applying multiple concepts or decision points ○ Retrieve information from a table, graph, or figure and use it solve a problem requiring multiple steps ○ Translate between tables, graphs, words, and symbolic notations (e.g., graph data from a table) ○ Construct models given criteria	○ Design investigation for a specific purpose or research question ○ Conduct a designed investigation ○ Use concepts to solve non-routine problems ○ Use & show reasoning, planning, and evidence ○ Translate between problem & symbolic notation when not a direct translation	○ Select or devise approach among many alternatives to solve a problem ○ Conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results
Analyze Break into constituent parts, determine how parts relate, differentiate between relevant-irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct	○ Retrieve information from a table or graph to answer a question ○ Identify whether specific information is contained in graphic representations (e.g., table, graph, T-chart, diagram) ○ Identify a pattern/trend	○ Categorize, classify materials, data, figures based on characteristics ○ Organize or order data ○ Compare/ contrast figures or data ○ Select appropriate graph and organize & display data ○ Interpret data from a simple graph ○ Extend a pattern	○ Compare information within or across data sets or texts ○ Analyze and draw conclusions from data, citing evidence ○ Generalize a pattern ○ Interpret data from complex graph ○ Analyze similarities/differences between procedures or solutions	○ Analyze multiple sources of evidence ○ analyze complex/abstract themes ○ Gather, analyze, and evaluate information
Evaluate Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique			○ Cite evidence and develop a logical argument for concepts or solutions ○ Describe, compare, and contrast solution methods ○ Verify reasonableness of results	○ Gather, analyze, & evaluate information to draw conclusions ○ Apply understanding in a novel way, provide argument or justification for the application
Create Reorganize elements into new patterns/structures, generate, hypothesize, design, plan, construct, produce	○ Brainstorm ideas, concepts, or perspectives related to a topic	○ Generate conjectures or hypotheses based on observations or prior knowledge and experience	○ Synthesize information within one data set, source, or text ○ Formulate an original problem given a situation ○ Develop a scientific/mathematical model for a complex situation	○ Synthesize information across multiple sources or texts ○ Design a mathematical model to inform and solve a practical or abstract situation

Appendix B

[redacted]

A bookstore received a shipment of seven different books to put in the new books display. The prices of the books are $29, $17, $31, $18, $26, $18, and $33. What is the median price of the books received in the shipment?

Ⓐ $25

Ⓑ $18

Ⓒ $16

Ⓓ $26

Appendix C

The Binomial Square

How many terms?

The binomial square has two terms.

How many squares?

The binomial square has two squares.

How many rectangles?

The binomial square has two rectangles.

Write an algebraic expression for the binomial square?

$$a^2 + 2(a \times b) + b^2$$

Write an algebraic expression using different terms?

$$\_\_^2 + 2(\_\_ \times \_\_) + \_\_^2$$

What is the etymology of the word binomial?

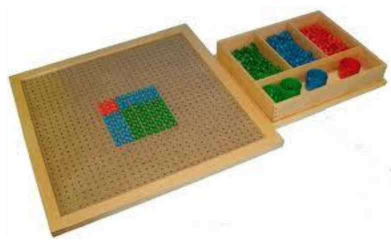
Use the Dictionary of Etymology for this.

Draw the binomial square in your book and color.

Bonus: Use stamps to create an algebraic expression for the binomial square and have your teacher check it

Appendix D

Binomial Square Assessment



The binomial square is a

______________________________________.

Steps

1. First

____

2. Second

____

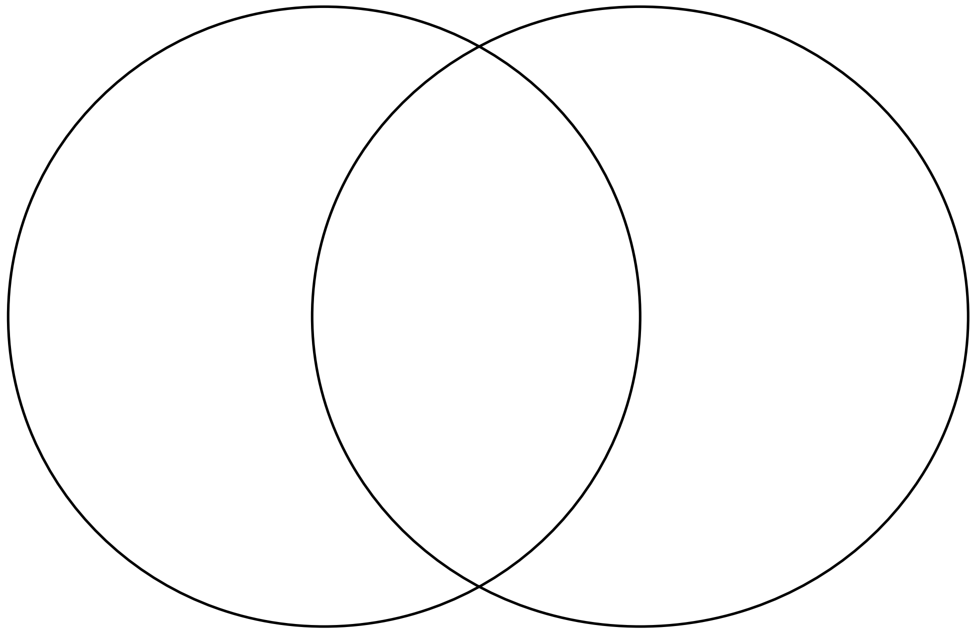
3. Third

____

4. Fourth

____

The shapes in this problem, _____ are similar and different from ______.



The hundreds square is related to the blue rectangles because

____

____

The tens rectangles lead you to the answer in the units square because

____

____

____

If the tens place and the units place values were reversed, the rectangles would be ___________ and the units square would be ______________.

It is necessary to have then tens rectangles because

____

____

Name________________________ Grade________

Date____________________

Appendix E

Google Doc Binomial Square Assessment

What shape do the hundreds make?

- Square
- Rectangle
- Triangle
- Circle
- Other

What shape do the tens make?

- Square
- Rectangle
- Triangle
- Circle
- Other

What shape do the units make?

- Square
- Rectangle
- Triangle
- Circle
- Other

What is a binomial square?

What are the four steps for creating a binomial square?

Write a paragraph comparing and contrasting 23 squared and 12 squared.

How is the hundreds square related to the tens rectangle?

What would happen to the size of the tens rectangles if the tens place and units place were reversed?

Why is it necessary to have the rectangles?

How many squares are in the binomial square?

Google Drive

Appendix F

DOK 1

(Recall and Production: Remember, Understand, Apply, Analyze, Create)

Can you recall _______________?

When did ____________ happen?

Who was ____________________?

How can you recognize ______________________________?

What is______________________?

How can you find the meaning of____________________________?

Can you recall _______________?

Can you select_______________?

How would you write ________________________?

What might you include on a list about __________________?

Who discovered____________?

What is the formula for ___________________________?

Can you identify___________?

How would you describe ___________________________?

DOK 2

(Skills and Concepts: Understand, Apply, Analyze, Create)

Can you explain how __________ affected __________?

How would you apply what you learned to develop ___________?

Make a Venn diagram to compare and contrast ____________ and _____________.

How would you classify __________________?

How are __________ alike and different?

How could you organize _____________________?

How would you estimate _____________________?

How would you classify the type of__________________?

What can you say about _____________________?

How would you summarize _____________________?

What steps are needed to edit _____________________?

When would you use an outline to _____________________?

What would you use to classify __________________?

What do you notice about _______________________?

DOK 3

(Strategic Thinking and Reasoning: Understand, Apply, Analyze, Evaluate, Create)

How is _________ related to ____________?

What conclusions can you draw _______________?

How would you adapt ______to create a different ___________?

How would you test_________?

Can you predict the outcome if_______________?

What is the best answer? Why?

What conclusion can be drawn from these three texts?

What is your interpretation of this text? Support your rationale.

How would you describe the sequence of______________?

What facts would you select to support_______________?

Can you elaborate on the reason___________________?

What would happen if___?

Can you formulate a theory for_________________?

How would you test ________?

Can you elaborate on the reason_______________?

DOK 4

(Extended Thinking: Understand, Apply, Analyze, Evaluate, Create)

Write a thesis, drawing conclusions from multiple sources.

Design and conduct an experiment.

Gather information to develop alternative explanations for the results of an experiment.

Write a research paper on a topic.

Apply information from one text to another text to develop a persuasive argument.

What information can you gather to support your idea about_____________________?