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The MathMate

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South Carolina Council of Teachers of Mathematics

Reimagining Teaching and Learning

The MathMate

South Carolina Council of Teachers of Mathematics

Seeing the Beauty and Wonder of Mathematics

The MathMate

Mission Statement: The mission of The MathMate is to feature articles, about innovative mathematical classroom practices, important and timely educational issues, pedagogical methods, theoretical findings, significant mathematical ideas, and hands-on classroom activities and make this information accessible to students, educators and administrators.

Submission Requirements: All submissions are to be emailed to scmathmate@gmail.com as attachments along with a completed Submission Coversheet. The coversheet can be found at http://scctm.org/The-MathMate.

Submitted files must be saved as MSWord or PDF files. Pictures and diagrams must be saved as separate files and appropriately labeled. Authors are asked to not submit the same article to another publication while it is under review for The MathMate.

Submission Deadlines: The MathMate is published 3 times per year. Submissions received by November 1 will be considered for the January issue, March 1 for the May issue, and July 1 for the September issue.

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The MathMate

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Message from the SCCTM Presidents

Dear members, friends, and supporters of SCCTM,

As a team of presidents (past, present, and future), we write to you to share news, excitement, and encouragement. Your SCCTM Board members have been hard at work all summer determining the best course of action for our upcoming conference scheduled for November. In order to be well informed of the preferences of our membership, we gathered data and feedback during virtual coffee chats, from polls and surveys. The results of the data are overwhelmingly supportive of cancelling any in-person events for the fall and even for the spring semester. As such, we have cancelled our event in Greenville, SC that was scheduled for November 19-20, 2020.

During these unprecedented times, we have focused on what we might do to support and inspire our members and would-be conference attendees. As a result, we have committed to the following actions:

- ◊ Host a series of conversations with leaders in our field to be held from 4pm – 7pm on the second Thursday of each of the following months: October, November, January, February and March with our Annual Business meeting taking place on Friday, November 13th.
- ◊ Support our members by providing a vast array of real-time presentations, videos, vendor presentations, breakout/chat rooms, and, of course, the ever-popular DOOR PRIZES! (Note: only members will be eligible for door prize drawings)
- ◊ Make the cost affordable to our members (free to all members and only $50 for non-members to attend ALL of the online events).
- ◊ Keep the fee associated with receiving certificates for continuing education credits low.

The start of this school year will be like no other that we've experienced. Know that you are a part of an organization that is devoted to supporting one another – reach out to each other and stay connected. We wish that all your creativity and problem-solving skills will help make this a wonderful start of the new year.

We often celebrate the "firsts"…first day of school, first birthday, first day of college, first day as a teacher…and we hope, while it may be different, you'll continue to celebrate this first day. While we could dwell on the crazy spring that we completed; an odd summer which included no vacation time for most of us; or the loss of a conference; instead we focus on celebrating the first ever online non-conference - this year "SCCTM" means: Staying Connected: Conversations with Teachers of Mathematics.

Thank you to all educators and supporters of great educational opportunities. We hope to "SEE" you in October!

Wishing you all the best in learning,

Ryan Higgins, President

Alisa Hobgood, President Elect

Marc Drews, Past President and Program Chair

Announcements

Award Nomination Deadlines:

Outstanding Contributions to Mathematics Education Award
Nomination deadline: July 15
scctm.org/Awards

Richard W. Riley Award
Nomination deadline: July 15
scctm.org/Awards

Scholarship Deadlines:

Preservice Scholarship
Applications deadline: September 15
scctm.org/scholarships

Educator's Scholarship
Application deadline: September 15
scctm.org/scholarships

Membership News:

Renew your NCTM membership online and desgnate *South Carolina Council of Teachers of Mathematics* for the affiliate rebate.

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CELEBRATING 100 YEARS

If you would like your announcement to appear in the next issue of The MathMate, please email all information to SCMathMate@gmail.com. Announcements will be published at the discretion of The MathMate Editorial Board.

Digital Breakouts: Bridging Mathematics and Virtual Engagement

by Jennifer Zakrzewski

Abstract

Breakout rooms have become a fun way to engage students in their learning. However, physical breakout experiences can be cumbersome to create and run. Digital breakout rooms provide the same learning outcomes with less burden on the teacher. In this article, detailed steps are provided for creating digital breakout rooms.

Teachers work exceptionally hard to create fun and engaging lessons for their students. That being said, most teachers have experienced a moment similar to the teacher in Charlie Brown where students seem to be focused on anything except instruction. On other occasions teachers have employed tactics up to and almost including back flips in the classroom to gain excitement over content. It is no secret that student engagement in the mathematics classroom can be a challenge. Although educators are always passionate about their subject area, helping students find their passion for mathematics can be daunting. To engage students, a new phenomenon has swept schools called breakout rooms. Often, schools purchase kits that allow students to engage with physical breakouts. However, these are often time consuming to set up and require between-class preparation as well if a teacher has multiple classes. Another option that is equally engaging is the digital breakout. The digital version of a breakout room allows for a similar concept within an online platform. For those who are unfamiliar with digital breakouts, scan the QR code in Figure 1 to explore an example. This example breakout room includes a fun theme where students are required to help the Chick-Fil-A cows break out of jail after the chickens capture them. Digital breakouts are meant to be fun and engaging learning tools.

Figure 1: QR Code for Chick-Fil-A Breakout

Literature Review

According to Marzano and Pickering (2011), one method for engaging students is to use game-like activities and to initiate friendly controversy. Escape rooms are popular as they increase the game-like feeling to complete challenges (Nicholson, 2015). Digital breakouts meet these criteria because they have a game-like format and teams can be formed to compete against one another. In addition, Rouse (2017) states that engagement is a critical element to learning. Escape rooms allow students to engage with one another and the content in an exciting game-like format. Additional benefits of digital breakouts are that they require a multitude of skills to solve the puzzles and, when students work in teams, leaders emerge helping to develop leadership skills (Nicholson, 2015). There is also a strong correlation to resilience because students must use trial and error to some degree in order to solve the puzzles (Rouse, 2017). In addition to trial and error, students must think unconventionally, incorporating critical thinking skills to complete escape room puzzles (Nicholson, 2015). This may be an opportunity for students who have great critical thinking skills or unconventional skills to emerge and engage. In terms of design, the hands-on-learning element promotes student-centered learning (Humphrey, 2017). This allows the teacher to be the facilitator and students to take ownership of their learning. Humphrey (2017) also found that a theme is helpful to encourage students to engage with the breakout room and become invested in solving the puzzle. Finally,

Rouse (2017) recommends scaling the challenge of each puzzle and allowing students to partake in productive struggle. This allows the celebration to be much more meaningful when students are successful.

This Sounds Great, But Complicated

Developing a digital breakout for the first time can seem challenging and a bit time-consuming. However, there have been recent updates to Google Drive, and with the steps provided below it has become much easier for teachers to develop their own digital breakouts. To start, create a gmail account if you do not already have one, since Google Drive is utilized. Unfamiliarity with Google Drive should not be a deterrent, as details are provided below and tutorials are available in Figure 2.

Figure 2: SCCTM 2019 Tutorials/Presentation

Step 1 - The Content

The first step is to determine the content to be covered within the digital breakout. Due to the nature of a digital breakout, it is not likely this will be used for new instruction but rather is more likely to be used as a review of concepts prior to a test. In developing the list of concepts, decide how many puzzles will be needed. For example, if a class were working on SC Standard 6.NS.9: Investigate and translate among multiple representations of rational numbers (fractions, decimal numbers, percentages), you might have one or two puzzles for conversions, one for comparisons, one for ordering fractions, decimals, and percents, and a final puzzle for word problems.

Step 2 - The Theme

Including a theme invites students to become more engaged in the content and invested in solving the puzzles. When contemplating a theme, consider the grade level and interests of the students. For example, recently the animated movie *Frozen 2* was released. For an elementary-aged breakout room, one might create a theme in which Elsa has frozen her city and needs to complete the puzzles to save everyone. Middle and high school students are quite dependent on their phones or other electronic devices, so a possible theme could be that the principal has changed the Wi-Fi password and to earn the new password students need to complete the puzzles. Playing into these themes allows students to become excited about the digital breakout and makes it feel more like a game.

Step 3 - The Activities

The next step requires several sub-steps. Determine the type of lock that will correspond to each puzzle developed in step 1. There are four basic types of locks: directional, 4-digit, color, and word. Now is also the time to determine the topic questions for each puzzle. Generally, these can be generated from worksheets, textbooks, or problems completed in class. After the type of lock has been determined and the questions have been designed, creating the digital breakout can begin.

Directional Lock: To create the directional lock begin with a blank Google form. Generally, it is best to use the multiple-choice format on a Google form so the challenges of correct answers being listed is not an additional hurdle within the puzzle. Provide a set of directions and then begin entering questions. Be certain to mark the correct answer so students will be able to determine if their answers are correct or not. Also, within each question provide feedback. This is where the clues are revealed for the students. For correct answers, list either "up," "down," "left," or "right" as the feedback. If the answer is incorrect, use "try again" or a similar comment allowing students to know they need to retry the puzzle. After creating the puzzle, it is best to preview the Google form. Complete the puzzle with various correct and incorrect answers. Then, click submit. The page should respond saying "Your response has been recorded." It is imperative to explain to students that they must click the view score button to see which answers were correct or incorrect and receive puzzle clues. If students did not answer all questions correctly, they will need to rpeat the puzzle until they get all of the questions correct to earn all clues. Start a master list of puzzles and solutions, including the correct answer and the feedback. The master list will be needed later to pull all of the puzzles together into one breakout experience.

4-Digit Lock: While this is called a 4-digit lock, the lock can be as many digits as the creator desires. For this lock, Google Slides is a good option. Consider the task of ordering values. Open a Google slide to a new page. For directions, state that students should place numbers in order from greatest to least. Then, provide four numbers each with a corresponding problem number (see Figure 3). Finally, include a note asking students to use the problem numbers as clues for the 4-digit lock. In Figure 3, the solution would be 9.5, 0.2, -2.4, -3 3/9. Therefore, the 4 digit lock code solution would be 3412. Add the puzzle and solution to the teacher's master list.

Another idea here would be to use a Google Form similar to the directional lock. Numbers could be provided in the solution and students might need to unscramble the numbers. One note here, if the students are to unscramble the numbers, ensure that there is meaning behind the numbers. For example, consider using the classroom number or time class ends, allowing for clues to the order of the numbers.

Place the following numbers in order from greatest to least:
1. -2.4 2. -3 3/9
3. 9.5 4. 0.2
Use the problem number as a clue.

Figure 3: 4-Digit Lock Example

Color Lock: Developing a color lock is similar to developing a 4-digit lock. Again, this can be completed using Google Forms, but it can also be completed within Google Slides. Figure 4 shows one example. Here, students are provided numbers to be placed in order from least to greatest and each number is a different color. Therefore, the order of the numbers determines the order of the colors for the color lock. The solution to this puzzle would be -8.2, -2 ½, 0.4, 2.4, and the solution for the color lock would be red, purple, blue, orange. Do not forget to add this puzzle and solution to the teacher's master list.

Place the following numbers in order from least to greatest:
-8.2, 0.4, -2 1/2 , 2.4
Use the color as clues

Figure 4: Color Lock Example

Word Lock: For a word lock, Google Forms is the best choice. Similar to the directional lock, the Google Form needs to include multiple choice questions. Be certain to include a correct answer and feedback for each answer choice. In this lock, the feedback will be letters for the word students are trying to spell. To make the puzzle a bit more challenging in the upper grades, consider scrambling the letters and having students unscramble them as part of the puzzle. However, as mentioned previously, consider the theme and make the word connect to the theme. In regard to the earlier examples, the elementary school word might be "FROZEN" while the middle/high school word might be "ROUTER" or "INSTAGRAM." Also, be certain to use all lower case or all capital letters for the letter scramble and, once again, record this puzzle on the teacher's master list.

Step 4- The Platform

The next step will require a platform to house all of the information for each of the puzzles. Start by going into Google Drive and creating a Google Site, which is similar to a website. Choose a layout that includes graphics and text. Please keep in mind that more than one type of layout may be necessary as they will appear below one another on the page. Next, create the context for the theme. Type the context into the header. For example, the header for the elementary student's digital breakout might say, "Help! Elsa has frozen the city. Solve each puzzle to help Elsa melt the city and return Ana and Kristoff to safety."

For the next section, consider the number of puzzles the digital breakout will include. Each puzzle will need to be connected to either text or a graphic. Therefore, consider where each puzzle might be linked. Then, choose a few graphics to include on

the page and save them to your desktop. Next, on the right side of the screen within Google Sites there will be a red button that says “Images”. Choose the place within the layout for the image and upload the image to that position. If space permits, it might also be prudent to embed a link. On the right side of the screen on Google Sites there is a yellow button labeled “Embed”. Choose a location to embed the item on the screen then click the yellow button. Then paste the link into the box and click “Insert”. This is a good place to include additional resources for struggling students, such as a Khan Academy video.

Step 5- Create the Master Google Form

Next, insert a Google form into the Google Site for all of the puzzle solutions. To start, create a Google Form within Google Drive. Name it “Answer Form” or something similar for a title. Then include a set of directions at the top. It can be something simple such as, “Complete all of the puzzles and insert all clues into the form below.” Next, create a section for each puzzle. Here, it is most beneficial to use short-answer question types. When designing each section, give some type of clue regarding which solution belongs in that section. For example, label a solution Directional Lock or Color Lock. Then, be certain to provide directions in the short-answer text. For example, with a directional lock consider saying “Use Use U for Up, D for Down, L for Left, and R for Right. Be sure to use capital letters.” Or, for a color lock, “Use R for Red, B for Blue, O for Orange, and P for Purple. Be sure to use capital letters.” Including these details will decrease frustration on the student end. Also be certain to mark each answer as required.

Now is the time to include the answer key. To do this, click on the bottom left-hand side of the question where it says “Answer Key.” Type in the correct answer for the corresponding puzzle. This is where the master list with all solutions becomes critical. Be certain to mark the box that says “Mark all other answers incorrect.” It is important to add answer feedback for the students. Click the blue section labeled “Add answer feedback.” Provide feedback here that says something similar to, “Keep Trying,” or “Try Again.” This allows students to know their answer is incorrect. In addition, when students are putting answers into the puzzle, explain that they must type their answer and then click to another answer box. If nothing appears, the answer is correct. Incorrect answers will elicit the answer feedback in red below the answer box. Once the answer submission form is complete, return to the Google Site page. In an unused graphic section, click the plus sign. Links will appear; select “From Drive”. Then select the answer form and it will appear in the box. The size of the box may need to be adjusted in order to see the entire answer form.

Figure 5: Link Button

Step 6- Linking the Puzzles

Now comes the time to include the links for the puzzles. Link each puzzle to the Google Site with pictures or text. To link a puzzle to a picture, simply click on the picture and select “link” (see Figure 5). A box will appear for you to insert a link. Return to Google Drive and find the appropriate puzzle. On the top right-hand side of the page for the puzzle click the “Share” button. A new box will appear on the screen. Under “Get Link,” change the restricted access to “Anyone on the internet with this link can view.” Then click “Copy link,” which will immediately copy the link to the computer's clipboard. Return to the puzzle’s Google Site and paste the link into the box for the picture and click “Apply.” The process for linking a puzzle to text is similar. Highlight the text chosen for the link. A menu will appear; select “Link” and follow the

same steps outlined above. The process for linking a puzzle to text is similar. Highlight the text chosen for the link. A menu will appear; select "Link" and follow the same steps outlined above. Once the link is active, the words will be underlined and change color to indicate it is a link. Continue adding links to pictures and/or text until all of the puzzles have been linked to the Google Site.

Step 7- Previewing

This may be the most critical step in the process, checking for errors. Click each link to ensure it connects to the appropriate puzzle. Solve each individual puzzle to ensure the Google Forms are working properly. Also, check the answer form to ensure it is accurate. Finding errors before using it with students will save time and frustration during class. Therefore, while this step may seem time-consuming, it is critically important.

Step 8- Publishing

The final step is to publish the site. If the site is not published, students will be unable to access it. To publish, simply click the "Publish" button on the top right of the Google Sites page. However, it is critical to check the settings to ensure students will have access. To check the settings, click the person with a plus sign (Figure 6) near the "Publish" button on the Google Sites page. Click in the "Link" section and ensure it is set to "Anyone on the internet can find and open." Using this setting allows others to view the page, but causes less stress overall as students will have easy access. The other setting makes it more challenging to find the site. If having the site public causes discomfort, change the setting to "Anyone on the internet can find and open" during class and then change it to the other setting after the class period has ended. This will keep the puzzle private until it is to be used again.

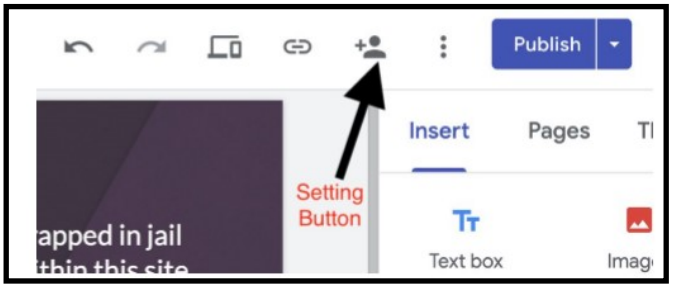

Figure 6: Settings Button

Conclusion

While creating a digital breakout may seem like a daunting task, it is truly a worthwhile one. From personal experience in middle school and at the university level, students of all ages enjoy digital breakouts. In addition, once the digital breakouts are created, it is easy to tweak them for future use. While the first puzzle may be challenging to create, creating the second and third ones become much easier, and you and your students will enjoy them time after time!

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About the Author

Dr. Jennifer Zakrzewski is a professor at Charleston Southern University in North Charleston, South Carolina, and has a degree in curriculum and instruction from the University of South Florida. While mathematics is her passion, she has an interest in technology and using technology to enhance motivation in the classroom.

CONGRATULATIONS!

Left to right: Coach Connie Gordan – Sterling School; Brandon Xu – Sterling School; Anna Zou – Meadow Glen Middle School; Ahan Shi – RC Edwards Middle School; Leo Sun – Chapin Middle School; South Carolina Math Counts Coordinator - Marguerite McClam

The MathCounts State competition was held on March 7, 2020, at Bridgestone Aiken County Off Road Tire Plant in Trenton, SC. Students in grades 6 - 8 competed in regional competitions before moving up to the state competition. The competition consists of three rounds: an individual round, a speed round, and a team round.

The winners for this year MathCounts Competitions are the following:

1st Place – Brandon Xu – Sterling School

2nd Place – Leo Sun – Chapin Middle School

3rd Place – Ahan Shi – RC Edwards Middle School

4th Place – Anna Zou – Meadow Glen Middle School

These students were supposed to go to the 2020 national competition. However, due to the COVID-19 pandemic, the event has been cancelled.

For more information about the MathCounts please visit mathcounts.org.

MATHCOUNTS®

The Path from Elementary Patterns to High School Algebra and Some Tools for the Journey

by Andrea Williams Rexroad

Abstract

Elementary school is a critical time and sets the foundation for understanding middle and high school mathematics. Children must be given opportunities to build concepts and connections, struggle productively, and make mistakes. Within this article, briefly review how standards connect across the grade levels, the Mathematical Process Standards to help dig deeper with questioning, and some steps and ideas to help meet teachers where they are and give them some extra tools for their tool belts.

We can all think back to a time during our school career that we had trouble understanding a concept, were afraid to ask a question, or when we just simply wondered, "Why do I need to know this? I will never use it." Today more than ever before, it is imperative that teachers not only make mathematics instruction rigorous and meaningful but that they also provide students time to take ownership and develop agency in their mathematical journey. To have our students truly experience success, we must understand the pathway from simple patterns and skip counting in first grade to an understanding of more complex algebraic concepts in high school. Essentially, we must begin with the end in mind. This can be accomplished in a number of ways. Within this article, three approaches are considered: using the Mathematical Process Standards to build concepts and connections through deep questioning, giving our students time to struggle productively, and making mistakes count. Following that is a discussion of three simple steps to meet teachers where they are and help them build their toolbox: providing professional development on the content standards and how they connect across grade levels, time to observe and collaborate with other teachers, and lesson resources that enhance what teachers are already doing in the classroom with respect to modeling thinking and reaching deeper with questioning.

As a student in elementary school, I enjoyed math. As I got older and the math got harder, it became something that I dreaded and felt like I understood only long enough to get through the test. As an educator who is now passionate about math, I see this mindset in many of our students and this is something that I seek to change. Asking questions, justifying answers, and really seeking to understand the "why" are all fundamental aspects of mathematics education. These foundations begin in elementary school and even before that as young children begin to explore and learn about the world around them. Math "is a language which builds on itself, and not understanding the foundations of math is like not understanding the structure of a language." (Venezky, 2018) This is one reason that it is so imperative that we give our students time to explore, make connections, work with one another, and experience productive struggle. More and more, the focus is centered on testing, testing, and more testing. We know that it is important to utilize data to drive instruction. What about being confident that our students truly understand the topic and not just have it memorized to pass a test? One thing teachers do not have enough of is time, so many of us find ourselves rushing through the information. In fact, "[t]oo much of our instruction is based on getting as much information into kids' heads as quickly

as possible because standards must be met and tests must be taken." (Venezky, 2018) While we cannot snap our fingers and change any of this immediately, there are steps that can be taken to help not only students but teachers, as well. All of these suggestions really hit home with me in an Inquiry Approach to Algebra class I took for a recent graduate course. We were given opportunities to struggle, to talk with one another, and to really make connections and see how something seemingly simple (patterns and skip counting in first grade) would lead to more complex ideas in high school (algebra, quadratic equations, and geometric sequences, for example). As teachers, we know this connection in the back of our minds, and I know I tell my students, "You are going to need this next year. All math builds on itself." It was like a light bulb went off in my head and I realized that it started with me and how I presented concepts to my own students.

From simple number patterns to equations and Algebra

Elementary school begins to build the foundation upon which all other mathematical skills are constructed. To illustrate, let's begin with first grade standards on skip counting and patterns and continue to high school Algebra in order to show the progression of skills. First graders begin to identify patterns and develop number sense through counting by ones to 120 and skip counting by fives and tens with standard 1.NSBT.1. Second graders build on that skill by counting by tens and hundreds to 1,000 (2.NSBT.2) and continuing to increase their fluency with addition and subtraction (2.NSBT.5). Third grade is the pivotal year when students delve into multiplication and division (3.NSBT.3), which are foundational skills for linear, quadratic, and exponential relationships that students will explore in great depth in middle school and high school mathematics.

The table below shows a very basic progression through high school. There are a number of combinations for each elementary standard and its effect on middle and high school. This table is not comprehensive and it should be noted that there are a number of concept combinations that could be added to the "Future Skill" and "Grade" sections. I am keeping this graph at a minimum due to space and length of this article.

Table 1: Connecting Elementary Standards to the Upper Grades

Grade	Standard	Skill	Future Skill	Grade
1	1.NSBT.1.a 1.NSBT.1.b	Count to 120, **(patterns), skip count by 5 and 10**	Add/subtract Multiply/divide	All
1	1.ATO.4 1.ATO.5 1.ATO.6	Addition and subtraction, fluency, relating addition and subtraction	Add/subtract Multiply/divide	All
2	2.NSBT.2 2.NSBT.5 2.NSBT.7	Count by 10 100, add/subtract through 99, fluency, add/subtract through 999, place value	Patterns, fluency	All
2	2.ATO.2 2.ATO.4	Fluency with addition/subtract through 20, **repeated addition**	Multiplication Linear/Quadratic/ Exponential relationships	3rd, High school
3	3.ATO.1 3.ATO.4 3.ATO.7 **3.ATO.9**	**Multiplication**, fluency, representing unknown whole number, **rule for arithmetic pattern**	Arithmetic, geometric sequences, high school Algebra concepts	High School
4	4.NSBT.2 4.NSF.3 4.ATO.5	**Patterns** Fractions Pattern and term in later sequence	Ratios, proportions, linear equations, slope, rates of change, functions	5, 6, 8, High School
5	5.NSBT.1 5.NSBT.2 5.NSBT.5 5.NSBT.6 5.G.1	Whole number exponents, **patterns** in number of zeros, **multiply/divide**, decimals	Graphing coordinates, proofs, graphing y-intercepts, slope, graphing functions	6, 8, High School

Classroom and Student Support

The concept of beginning with the end in mind is not new and is something that many teachers are already doing. My goal, and indeed my hope, is to bring more awareness to how we prepare our elementary students for what they will experience in middle and high school. We want to create lifelong learners that are able to compete in an increasingly technological world, think critically, and understand mathematics beyond a surface level understanding. In order to accomplish this, we must first give students opportunities to think deeply about mathematical concepts and reason abstractly. First and foremost, these come with setting high expectations.

At the beginning of the school year, I completed a simple mathematics survey with my students in order to discover their thoughts and opinions on mathematics. Out of 39 students surveyed (2 classes: a regular math class and a Gifted and Talented class), 15 reported some apprehension about mathematics and felt like they were not good math students. This hit home with me and I realized I needed to work on building agency with my students. Agency "is when students develop a sense that they can do mathematics and generate mathematical ideas; each student sees mathematics as a tool to use" (Bieda & Staples, 2020). Along with agency, I wanted to build confidence within my students and an ability to see mathematics in the world around us, for them to see that mathematics is not confined to the four walls of a classroom and that they can persevere and do hard things. During the first few weeks of school, we talked about Growth Mindset versus Fixed Mindset and practiced different scenarios using a Growth Mindset. Then, we discussed the expectations for mathematics work in our classroom. These expectations are based on the Mathematical Process Standards which "demonstrate the ways in which students develop conceptual understanding of mathematical content and apply mathematical skills." (SCDE, 2015) These standards are:

1. Make sense of problems and persevere in solving them.

2. Reason both contextually and abstractly.

3. Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others.

4. Connect mathematical ideas and real-world situations through modeling.

5. Use a variety of mathematical tools effectively and strategically.

6. Communicate mathematically and approach mathematical situations with precision.

7. Identify and utilize structure and patterns.

These daily expectations provide my students a guide for reasoning through mathematical questions. When we begin a new topic, students are given an initial problem to work through within their groups that focuses on our new skill. Students have the opportunity to work together, talk about math, and build connections using these mathematical standards. This leads to a richer, deeper understanding of the concepts. They practice defending their answers, listening to others, and learning from one another.

The second approach in my classroom is the use of productive struggle. "Students engaged in this process build the creativity and confidence that allows them to attempt new challenges and problems [they have] never seen before" (ST Math, 2020). This goes hand in hand with the Mathematical Process Standards. As students are working in their groups, I walk around the room and listen to their discussions. Many times, students think that the activity will be an easy one but they find themselves really having to reason and think through the activity. Students struggle with this at the beginning of the year because they are used working in a textbook or working independently at their desks while they listen to the teacher go through the lesson. While there is a place for this in the classroom, the more that we allow our students to talk, struggle productively, and seek the answers themselves, the more we will see our students grow and develop into mathematical thinkers and problem solvers.

Thirdly, we should give students opportunities to learn from their mistakes without embarrassment. Several friends and colleagues have a daily practice that they call "My Favorite Mistake." This is a practice that I now use in my classroom and it has helped not only student understanding but confidence as well. Each day, students work through group and independent tasks. As I circulate the room, I am able to see a variety of understandings emerge. I call upon volunteers and non-volunteers to answer questions and explain their reasoning. If an answer is incorrect, that becomes my favorite mistake for that day. We work through the errors together and discuss what could've been done differently to correct the problem. The key is to really build this up as exciting and to point out how much these mistakes are helping everyone's understanding. This leads to student buy-in, and it has completely changed the culture in our classroom to one of acceptance, encouragement, and confidence so that even if we make mistakes, and we will, we can learn from them. "If we want students to persevere even when making mistakes, we need to ensure that mistakes will be made" (Roicki, 2016).

Teacher Support

All of this can seem daunting, especially when it comes to planning. Mastery will not happen overnight and indeed is something that my students and I continue to work on and practice every day. How can we support teachers in the endeavor to build those foundational skills? There are three simple steps that will help. These three are not new ideas but they are ideas that continue to come up each time my colleagues and I talk about bridging the gap between the skills students learn in elementary school and what they will need for middle school and beyond. First, ask the teachers and find out what they truly need in order to have their students experience success, and tailor professional development around those ideas. Do they need resources and ideas? A better understanding of the standards and how patterns in first grade will lead to quadratic and exponential equations? Provide opportunities for teachers to interact with each other, talk and discuss ideas, and show them using concrete examples how simple patterns and multiplication are related to algebraic equations. Guide the teachers through an exploration of the big picture so that they can take those ideas and use them immediately, along with data, to guide instruction for their students.

Secondly, don't just tell teachers how to structure a lesson or question students. Show them. Invite an "expert" into the classroom to conduct a model lesson and show teachers every step of the way how to plan and carry out a lesson that guides students into thinking deeper and using those Mathematical Process Standards to guide instruction. Sometimes all it takes is a fresh idea or a different perspective to help make that shift and take us out of our comfort zone.

Finally, a database of resources can be empowering and beneficial to all teachers. "The verbal and nonverbal discourse that teachers employ, supported by rich tasks, is fundamental for developing students' agency for doing powerful mathematics." (Bieda & Staples, 2020) It is not enough to show teachers the Mathematical Process Standards or tell teachers to use higher-order questioning. We must show them, model examples, and give teachers resources to use. Some suggestions to build algebraic thinking are:

- Post Math Talk questions in the room and practice using these daily.
- Utilize manipulatives daily in the classroom to build concrete understanding of concepts and skills.
- Provide open-ended questions and allow students time to work together to problem solve.
- Ask: how did you model the problem?
- Ask: What strategy did you use?
- Ask: How are your ideas different?
- Help students build generalizations by giving time to explore.
- Listen to student conversations about mathematics.

- Ask: Would you use a different argument to convince your friends than to convince the teacher? Why?
- Ask: How would you generalize what is going on here?
- Guide students to think through the questions "will this always work" or "is this always true?"
- Be patient. Developing students that are mathematical thinkers and problem solvers takes time, practice, and flexibility.

Developing mathematics instruction that is rigorous and meaningful takes time, as does providing students time to take ownership and develop agency in their mathematical journey. Using the Mathematical Process Standards to build concepts and connections through deep questioning, giving our students time to struggle productively, and making mistakes count (along with a growth mindset) provide a few necessary resources for this journey. Finally, don't be afraid to ask for help or share resources and ideas. If the year 2020 has taught us anything, it is that we are all in this together.

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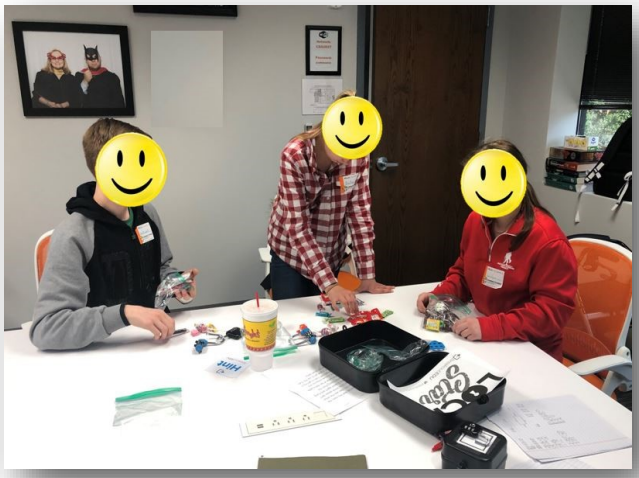
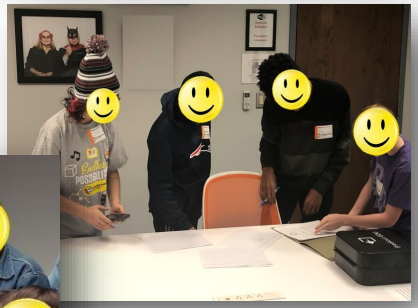
A Conference, an Escape Room, a Grant, and Good Math Fun

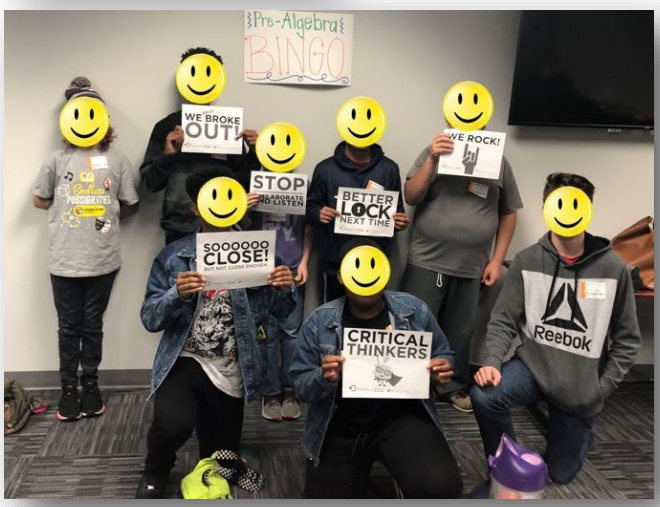
By Chris Higgins

Each year the South Carolina Council of Teachers of Mathematics host their annual conference to learn, collaborate and sharpen teaching skills. I had the good fortune to attend the 2018 conference in Columbia where a variety of sessions meant many opportunities to see what educational practitioners are doing in their classrooms, including integrating hands-on activities in new ways, having students think by Notice and Wonder, future assessments, curriculum updates, and too many other things to list. One session stood out to me; a session presented by one of the publishing companies involving an escape room. The activity wasn't entirely math- based, but the potential was there. A seed was planted for me to research later.





Months after the conference, I was thinking about the escape room and how the presenters said it could be adapted to suit many needs. After researching various options which included making it from scratch to premade scenarios with all the items needed. I decided on premade. The kits come with everything needed to engage students on multiple levels, at a price. Unfortunately, the price was steep for personal out of pocket expense, which is where applying for an SCCTM Teacher Grant came into play. The grant offered by the organization presented an opportunity to purchase not one but two (bundle and save) escape room kits. A few months after submitting the grant proposal I was informed the full amount would be funded. I was excited and relieved, but the real work would not start until the following school year.



I teach for South Carolina Connections Academy (SCCA), a virtual charter school with students and teachers statewide working remotely. How does one present a tactile activity in the virtual environment? SCCA has Learning Experiences (field trips) across the state. These last few years the 8th-grade math teachers hosted a Math Trail in Charleston, which happened to be created for a past NCTM Regional conference. Previous Math Trails were well attended but we wanted a change in event and location. An escape room learning experience was now possible which also included other math-based games, rotating groups, and a date cleared on the calendar for February 21, 2020.

The day before the learning experience, storms hit the state hard and falling temperatures forced some districts to delay school. The impact caused some families to avoid the drive, hurting attendance. We made sure those that made the drive had a memorable experience with scenarios that were interesting and standards-based. Storylines were adjusted to make them more relevant but overall everything was well laid out by the designer. Selecting subject, grade, and standard made it customizable for my particular group of students. Each scenario involved solving multi-step equations, exponents, the order of operations, and the Pythagorean Theorem. Most of all they addressed a component we sometimes lack in the virtual environment, collaboration. In fact, after the first group was finished, we asked them what tips they had for future groups. The first thing all participants said was "work together". Seeing them work so hard and eventually coming together in order to "escape" made all the work that went into the learning experience worth every minute and every effort.

In the end, we saw students engaged in problem-solving mathematics with no interference, only the occasional hint (students were allowed two hints). We saw that, with a little intervention, students were able to overcome their misconceptions. We helped families with questions about what strategies they could use at home to reinforce essential skills. We saw individuals come together as a team, and they were greater than the sum of the parts. We saw our students with smiling faces, which doesn't often happen in the virtual world. All these things came to be thanks to a conference, an escape room, a grant, and good math fun!

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Field Notes: Creating an Interactive Mathematics Lab for Elementary Students

by Tiffany Johnson Coleman

Abstract

An analysis on the development and implementation of a mathematics lab classroom in an elementary school setting and the potential impact on students' mathematical understanding.

Katherine Johnson, noted NASA mathematician, told a group of students, "There will always, always be mathematics. Everything is physics and math." (Wild, 2015) Ms. Johnson had a natural love for math at an early age that made her eager to attend school and learn as much about numbers as she could. Is she representative of how most Americans feel about math? Well, that depends on who you ask. There are polls, surveys, stories and jokes about how many people dislike math. Every math teacher has at least one story about a student who was determined to hate math. My experiences as a math teacher are no different in this respect. But do kids really hate math or is it the fear of failure and being confused? Is it because they've heard an influential adult say that they hated math? At the beginning of this school year, I heard the sentiment repeated multiple times from students and parents. I took this as a personal challenge and began to formulate a plan to change their minds about math.

A New Role

Roughly a year ago, the administrators informed our faculty that we could no longer financially support our beloved science lab and that the district was encouraging elementary schools to consider implementing a mathematics lab. This new possibility was intriguing to me, a third-grade math teacher who had spent the previous ten years advocating for the need to focus on mathematics education as much as we were focusing on reading instruction. Ideas and questions began to consume my waking thoughts. What would a math lab look like? How would it function? What types of activities would it include? Who would it serve and who would run it? I found myself generating a list of ideas and activities that could be used in the math lab. I had no real thought about personally taking on the role of designing and leading our math lab as I loved third grade math. It was my happy place. Without thinking about the implications or the appearance, I decided to share my ideas, questions and excitement about the possibilities with my administrators. It was, therefore, surprising to me when I learned that I was one of the primary people they had in mind for the position. Thus began an adventure to create the perfect elementary math classroom.

The Best Laid Plans

The design was largely left to me to create. Aside from a schedule and a location, I was given the freedom to plan and formulate a program to boost our students' mathematical understanding and achievement. During this same time period, I had an opportunity to apply for a program to obtain a master's degree in teaching mathematics. This would become even more beneficial than I first realized and would ultimately lead me to the plan that I implemented following winter break.

My initial efforts in creating the perfect math lab were quite challenging, produced mixed results, and frustrated me tremendously. In my third-grade math class I used a rotational model that was preceded by a mini lesson based on the daily objective. The rotations included small group instruction, video tutorials, fluency practice, independent practice, math vocabulary work, and math games. I thought this same model would work well in the lab and would allow me to continue my love of small group instruction while having students work with partners in games and fluency practice. I'd planned to break my short 45 minutes of class time up with a quick activator followed by three 10 minute rotations and then the last few minutes to wrap up. However, time management was a struggle and students needed constant help with the activities or technology issues. The only area that was working well was the fluency practice, but I wanted the lab to be more than that for students. Fortunately, one of my graduate classes was beginning to help me change my perspective on what math instruction could be.

New Year, New Plan

Over our winter break, I formulated a new plan to try which would allow students the chance to explore math. My graduate course had led me to do my own research into the idea of having students explore mathematical concepts rather than using the traditional method of direct instruction. According to the NCTM, effective teaching is impacted by several key, productive beliefs a teacher has about mathematical learning. One of the notable comparisons was the belief that students can learn mathematical concepts before basic skills mastery through exploration and problem solving. (NCTM, 2014) This was exactly what I had first envisioned when the math lab proposal was introduced to our faculty, but I didn't know how to go about creating that learning environment. I kept returning to the way our professor introduced mathematical concepts to us and how the tasks she'd given us stuck with me.

Rather than use the rotational model, I began class by presenting students with a mathematical challenge and encouraged them to work with a partner to solve. I provided them access to a variety of math tools, but I was careful not to tell them which tools to use. While students worked, I walked around to the different groups. I listened to their discussions, asked questions and offered bits of advice. The result was almost immediate and I was seeing those aha moments from several students. As partner groups completed the challenge and explained their findings to me, they would transition to our computerized fluency practice. They could choose from a variety of math activities and games once they had finished their fluency practice. During this time, I served as a facilitator and guide. Minor modifications were made for kindergarten and first grade to accommodate for the lack of a computerized fluency program and to provide more structure for the math games. The issues from the previous attempts did not manifest in this new plan and I was pleased with the overall success even as I raised the rigor on the challenges.

The mathematical challenges were intended get students thinking and talking about math in real contexts. Students had access to a variety of tools and manipulatives. However, I did not direct them in what tool to use nor how to use it. The goal was to have them explore. The challenges varied depending on the grade level, but the following are a few examples that were used:

Second Grade Arrays and Repeated Addition

Kylie is in line at the ice cream store. There are 4 windows to order from. Three people are standing in line at each window.

A. Draw a model or use objects to show the people in line at the bank.

B. Write the total number of people.

Fourth Grade Fractions

Mrs. Coleman bought some orange juice. Each member of her family drank 2/3 cup for breakfast. There are 5 people in her family. How many total cups of orange juice did they drink? Be sure to show your work! You must explain your mathematical thinking!

Fifth Grade Measurement

First, explore the table top lengths with your partner. You should measure the table in inches AND feet. Talk to your partner about how these lengths are related.

Now solve this problem. Jaxen is 73 inches tall. His dad is 5'8". Who is taller? How do you know? Be sure to justify your answer.

What Worked and What Didn't

From the very beginning of the creation of the math lab, a place we were now calling the Math Acceleration Class (MAC), one area that worked well was the fluency program. I'd used it with a good deal of success for the last few years with my classes and had my grade level team members also using it. Since the current fourth and fifth graders had experience with the fluency program, I was able to focus on teaching students in second and third grade how to use the program. Part of the fluency program was to perform mastery checks three times a year, which we called our Masters of Multiplication. The parents of our fourth and fifth grade students were familiar with the program and they embraced the opportunity to have their students continue to develop that mastery of the basic facts. The number of students showing mastery grew 60% from the first check to the second and although the COVID-19 virus has prevented us from having our final check for the year, students practice records indicated that even more students would reach mastery.

Along with my struggles to find a productive flow and successful routine for the MAC, there were several other areas that didn't work well. The first, and most widespread, of these came from replacing the beloved science lab with a mathematics lab. Our student population and parent community were invested in the science lab and the decision to not continue it was very unpopular. I had big shoes to fill. Although the MAC is still a work in progress, I am slowly building support and a love of mathematics. One of the ways I have tried to encourage this is by introducing the Monday Math Mystery. Each week, I publish a challenging problem for families to work through together. Students submit their answers by the week's end and I pull winners from the correct submissions. The goal is to get families talking about math in a fun and positive way. The program has had its ups and downs, but one of my favorite moments came during late fall. I'd suddenly received numerous notifications about that week's Math Mystery through our parent-teacher communication app. A large debate was ensuing among the parents on social media about how to solve the problem. One of our teachers remarked to me that I'd made the problem too difficult and even parents were arguing about it, but what I took away from that evening was that the activity had accomplished just what I hoped it would. Families talking about math and engaging with one another over math in a positive way. I intend to keep this goal for our next academic school year and find ways to improve it.

An additional area of struggle has been the mindset of my colleagues about mathematical instruction and getting them to move from traditional instruction to a focus on building conceptual understanding. For some teachers, it simply boils down to time, resources and the demands of standardized testing. However, there are some

who hold firmly to the belief that traditional algorithms and memorization are the right ways to teach math. Many times I have encountered a reaction of frustration or dismay when a fellow teacher hears about the topic we were exploring in the lab. The response is often to tell me that the students haven't learned that skill yet or that problem is too hard for the students. I think it will take some time, but the students' demonstrations of understanding will help shift the thinking of the adults.

The final source of difficulty for me in creating this new classroom was the freedom of design and implementation. Although on the surface this sounds like a teacher's dream, I found it to be an overwhelming task with no clear way to judge if I was doing the right thing or not. As one of only four such classes created throughout our district, I felt considerable pressure to get it right. Whether that pressure was external or a result of my own perfectionist nature, I can't be certain. Through this process, the four district math lab teachers have created our own professional learning community in which we share ideas, challenges and successes. Our math lab designs and implementations, as well as how our schools utilize us, have been different, but we have found commonalities and developed mutual goals. We hope to be able to compare our data in the future and determine if there is information that stands out, especially in regards to who we serve and how we serve them.

A Look to the Future

The four programs in our district were implemented in different ways. I serve all of our kindergarten through fifth grade students as a special area teacher, like music, art, PE and library. Another of the schools is using their math lab as a special area class as well, but there are differences in our classroom routines. The third school, which is similar in size to the first two, uses their math lab for interventions. The teacher serves only the students who are below grade level with targeted interventions using a commercial program. The smallest of the four schools uses their lab as a combination of these two models. During part of the week the teacher serves as a special area teacher, and the rest of the week the teacher serves as an interventionist for their struggling math students. The Covid-19 pandemic has certainly affected this new endeavor, just as it has with all aspects of education, but the abrupt interruption might provide us with extra time to determine the best ways to boost students' mathematical understanding. Although we will have very little in the way of data since there will be no state testing this year, I am hopeful that we will be able to find ways to compare the effects of having mathematics labs in elementary schools. There is certain to be some impact, but we will need the time to determine the extent of it and which model works best.

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Measuring Our Way to Success

By Savannah Catoe

Based on the 2018 "State Scores by Grade Level and Standard" data on the South Carolina Department of Education's webpage, students in fourth and fifth grades struggle with the topic of measurement. Only 24.4% scored "high" and 32.7% scored "middle," while 42.9% scored "low" in fourth grade. Fifth graders have similar scores with 30.3% "high," 27.4% "middle," and 42.3% "low." This project, "Measuring Our Way to Success," is a way that our school's fourth and fifth grade teachers hope to improve our measurement scores and help students become more successful mathematicians. This prompted a question...what am I doing as a teacher to help increase the percentage of students in the "high" and "middle" range for fourth grade? My answer: NOT ENOUGH! I started digging into the standards and the data and realized that converting units of measure was the skill holding most of my students back. My immediate thought was to make this experience hands-on. This is where the grant came into play. The grant allowed me to purchase manipulatives with metric and customary units to make converting measurements concrete instead of abstract. At first we reviewed...and reviewed...and reviewed concepts from previous grade levels. I collected data using formative assessments, anecdotal notes and Measures of Academic Progress (MAP) scores to determine what knowledge the students were retaining and where I needed to start for my first lesson. There was a drastic difference in the amount of material the students were able to acquire with these manipulatives in front of them. I teach in a Title One district, so the majority of the manipulatives we used were materials the students had never seen before. By the end, I saw students not only engaged in measurement, but I saw them looking for it in the real world. They looked for it everywhere, including the capacity of the milk and juice cartons at lunch, the heights of bridges, and the liters in soda bottles at the store. They even started comparing the different sizes on their own. All of this was thanks to a grant provided by people who see hope in a math future.

Savannah Catoe
Pine Tree Hill Elementary School
Camden, South Carolina

Unlocking the Magic of Math

by April Ray

Abstract

For some, math is like magic; but not everyone gets warm, fuzzy feelings when they are tasked with a math activity. Why do so many students hate math? When does this negativity towards math develop and how can we move beyond that to help our students develop a love for it? This article discusses ways to help create a classroom environment that helps students see the magic of math.

As teachers, we have all had those first encounters with students where you tell them how exciting math class is going to be and they give that twisted face and/or a giant sigh. You also hear, "I hate math!" "I'm not good at math!" "I'm better at reading!" "I don't understand math!" and the list goes on. When I see and hear these reactions, it absolutely breaks my math loving heart, but I also feel a sense of empathy because I was that student.

Growing up, math was definitely not a strong subject for me. There were many tears throughout the years, and I remember thinking that once I got through high school, I would not have to worry about math anymore. Then came college, so I was not quite done with math yet. I pushed through, with a tutor, and thought I had finally made it to the end of the math torture chamber. Well, we know where this story ends, and that is that it does not end. Math is everywhere!

After several years of teaching ELA, I landed a job that I could not refuse, teaching fifth grade math. So, there I faced the stuff of my nightmares, math! Not only did I have to learn it, but I also had to teach it. Faced with this, I did what I thought all math teachers did and that was pick up a textbook, follow through the lesson, give a worksheet, check it and voila', I'm a math teacher. Well, not quite; it was a disaster!

I could not sustain students' attention and I had no idea what to do when they struggled. I was lost. Therefore, I had to dive into an exploration of how to teach students to love a subject that I did not really have the best relationship with. Well, that is where my attitude with mathematics changed. It was through a journey of math discovery that I finally began to understand it!

I began to read and watch videos on best practices for teaching mathematics. I learned math through visuals and practicing with manipulatives, and I began to finally unlock the mystery of math. As I look back now, I understand that it was at that time I actually began to gain conceptual understanding of basic math concepts that I had struggled with for years.

So, how can we unlock that "magic" for our students?

In order to understand how to help students with math, we first have to understand why they struggle with it in the first place. What is it about math that makes so many people cringe? Well, one reason math can be so difficult, compared to other areas of study, is that it is seen as very black and white. There really is not much wiggle room. Sure, there are various ways to solve problems and some problems can have multiple answers, but early math is very basic. Two plus two will always be four.

Math also builds on previous skills and as students progress through various levels of math, they have to tap into those skills they have already learned. We all know if you struggle with basic multiplication facts, you are going to struggle with multiplying and even dividing multi-digit numbers. You have to master those basic facts in order to be successful with the more complicated math operations.

Reading is somewhat different. Yes, you start by learning your letters and sounds, and then forming them into words. Once students master those reading strategies, they practice decoding harder words using those strategies; they develop stamina, vocabulary, and comprehension. Eventually, students are able to analyze what they read and discuss it.

With reading, even if you do not quite understand a word or two, an average student can usually still comprehend what he or she is reading if it is the appropriate level. With math, there is not much flexibility. You can know the algorithm, and know the basic facts, but if you forget to carry your one over the next column, your answer is then wrong. This can be very difficult for students and often can be a source of complete frustration.

As students go through their early years of foundational math, that is usually when they decide that they either love math or hate it. As a result, when students make their way to upper elementary and into middle school, teachers have to not only overcome academic gaps, but they have to overcome math anxiety that many students are bringing with them.

Math anxiety can be described as an intense feeling of fear, apprehension, and helplessness when it comes to math (Tran, 2018). It has also been stated as "a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in … ordinary life and academic situations (Ashcraft, 2002). We are already aware that math requires much memorization, so for students that already struggle with math, the anxiety affects their working memory and adds to the stress they are already feeling.

So, how do we get beyond these struggles and the negative relationship many students already have with math when they come to us?

The first step is to create a welcoming classroom environment. Research has shown that many students directly relate their like or dislike for math based on the characteristics of the teacher delivering the content. Students want a teacher that is not only knowledgeable, but also enthusiastic and energetic (Simmers, 2011). Students should know that you are there as their coach to support them in their successes as well as their struggles. The only way to create a classroom environment where students feel comfortable is to provide students with opportunities to explore mathematics, make mistakes, and learn from those mistakes. This leads to students building their own generalizations and conceptual understandings of math as opposed to someone just telling them how it is.

What does it mean to "explore" mathematics? Mathematician Dan Finkel states in his TEDx Talk that students must be able to play with math (2016). When we teach students to read, we have them play with words, such as when they learn the word "at", we have them play around with other words they can make, such as "cat", "hat", "mat" and so on. We have to think about students' ability to learn math the same way. Allow them to play around with numbers and problems. Albert Einstein once said, "Play is the highest form of research." Students need plenty of opportunities to play around with math concepts.

One way that I have set this up in my classroom is with manipulatives and games. These games can be in the form of whole class games, groups, partners, and even independent. Yes, students can play some games independently. Dice are an easy and cheap way to incorporate games into your math classroom. My students play multiplication games, decimal games, fractions games, etc. The possibilities are truly endless. One game my students can play together or independently

is where they roll the dice to fill in three two-digit numbers, so six total spaces. They then add the numbers in an attempt to get a predetermined number. If they go over that number, they are out. This can be adapted in many ways for various operations. Last year I came across some inflatable dice, like beach balls, but dice. My students got into a circle, and we played hot potato with the dice. If the students caught the dice, they had to multiply the two numbers their hands were touching. I eventually added another die to the game to make it more exciting. The kids loved it and they begged to play it all the time. Another plus is that my students pull out these games on days they may have a substitute and since they want to play them, it becomes an incentive to get their other work done.

You can also make these games competitions. Students love to be competitive. We play a game where I have everyone stand up, and I pull up math facts on the board. I go around the room having students answer the facts. If they get it correct, they remain standing. If they are not correct, they sit down. The last one standing wins a prize. Sometimes, as students' skills get better, I will have multiple kids standing at the end and I just have to call time. In that case, they all get a prize. The kids all enjoy it and it is an incentive to learn their facts. When giving the answer, students must repeat the entire fact, such as "7 x 3 is 21." If they only say "21", I make them repeat the entire thing. I have not had a problem with students getting embarrassed if they do not answer, because I always give them an opportunity to say, "Pass." They are still out, but they are not made to feel uncomfortable if they are not sure of the answer. This is meant to be fun and not create added anxiety. The learning happens, and if students are having fun, the pressure they often feel in math class is not there. An activity like this also takes the place of those timed tests. There is no reason to give a timed fact fluency test, which adds more anxiety, when I can easily access who knows their facts through this game. Since the incentive is something they all want, they give it their all. If they pass on a question, I know they really are unsure of the answer.

Once students learn to play the games you have introduced them to, you can put them into center rotations that allow you to work with small groups of 1-4 students. This is the next step in setting up a productive math classroom. Small groups are essential for success in any math classroom! I know it sounds almost cliché because you hear it repeatedly in so many professional development meetings. If you are like me and many other teachers, you sit through those meetings, quietly taking those things in, then go back to your room, shut your door and continue teaching as you have been. This is not the time to do that.

If small groups are not a part of your current math instruction, I urge you to give it a serious try and the results will speak for themselves. First, it helps build those relationships with students because they are in a smaller, less threatening group, as opposed to the whole class. Secondly, it helps you narrow down student needs and meet them where they are. This is truly, where much of the magic happens. I love my small groups because this is where confidence is built, and where students learn that it is okay to make mistakes. I have seen students work in a small group with me, and then be so excited when we are going over that topic in whole class. For example, during our closure they know the answer and have the confidence to share their answer.

Another key component to a successful math classroom is to start your lessons by posing a question to students. Give students an opportunity to ponder that question independently for at least a minute or two before they discuss it with a partner or group. Communication with others must happen in a math class (Silver, 1990). Students learn from each other and their ideas. It is also important to allow your students to struggle during this time. Think about a baby learning to walk. If you always carry them because they are struggling to walk, that baby will never walk. As teachers, it is difficult to watch our students need help, but we must allow this to happen for mathematical understanding to develop.

Give groups of students a reasonable amount of time to think through the task. Once groups have

come to an answer, allow them to explain their thinking. Even if they cannot verbalize their thought process, have them draw their thinking. This component is powerful because this is where students really learn from each other. Seeing how fellow peers solved the problem can turn on a light bulb for them or make them see the problem another way. This leads into great classroom discussions and real-life solutions.

Relevance is another key to teaching math. Students need something they can relate to in order to fully grasp math concepts and the application of it. Give them real-world scenarios. At Thanksgiving, have students plan a meal. Bring grocery sales papers, give them a budget and let them "shop" for their meal items. This brings about all sorts of skills, such as working with decimals. You can also teach them to determine which the better buy is for the money and how they know. You can do the same thing at Christmas with a wish list and a budget. I have even seen some teachers do this with vacation planning. Students really enjoy these activities and it is an important life skill.

We all know change is not easy. Many of us fall into the trap of teaching math the way we were taught; I know I have been guilty of it. So, how do we move beyond that and tailor our instruction to foster a positive learning experience with math for our students?

Just as we expect our students to learn by communicating, educators learn by communicating. We have so much power when we come together. Everyone brings something unique to the table of conversation. Edward Silver suggests finding a colleague that is willing to try out the new ideas with you (1990). This makes it easier because you can discuss what works and does not work. You can work together to refine your math structure. Silver also suggest that if it is too overwhelming to change everything at once, start with the weakest areas and then move on the stronger areas. It does not all have to happen at once and you will find as you go through that some things work for you while others need to be adjusted. That is okay, as that is what good educators do; we monitor and adjust to fit the needs of our students.

In conclusion, it is important to stay focused on the goal, which is to foster a love of math in or classrooms. With love, will come confidence and success. We all want what is best for our students and sometimes that means change. Change is not easy, but it is necessary in order to grow.

Start by creating a welcoming classroom environment where your students feel comfortable making mistakes. Allow your students to explore mathematics through games and the use of manipulatives, challenging questions, and peer collaboration. Focus on your small group instruction just as much as you do on your whole class lesson. This is where your students need you the most and this is where you will see those light bulbs come on.

My son, who loves math, once called me because he was so excited about his math class. He was taking 7th grade pre-algebra at the time. He started telling me all the steps they were doing, and how they came to the answer. He said, "Mom, it was like a magic trick!" Seeing my math-loving son so excited about a math problem made my heart swell with pride. However, it also made me think that somewhere along the way math clicked with him. At some point, the magic was awakened for him. Now, we need to go spark that same excitement for our students. We have the skills to show students the magic of math, we just have to be willing to step out of our comfort zones and lead the charge to change the negative reputation!

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