

## **Lesson Study, Cycle 1: Literature Synthesis**

*Students share and reflect on unique strategies they used to approach a problem with other students in class (either small group or whole class).*

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Growing up while learning high school level math I remember we would all sit facing the board and the teacher would do most of the talking. When I got to college and took college level math, things didn't change much. During my training as a Math teacher I have learned that teaching math is not about the teacher or instructor doing the talking or sitting and facing in one direction. Teaching and learning math has evolved to become something different. Teaching math is about providing real life meaning in math, building student confidence, and being able to create an environment where students can discuss their thinking. After getting to know specific students through empathy interviews and completing PDSA cycles my team and I started to form a problem of practice.

Our initial problem of practice emphasized teaching students multiple modalities in their problem solving strategies, through discussion and critical thinking. As a team we knew that providing an environment rich in discussion was important. We also discussed the importance of making students aware that math can happen in several different ways. Through multiple modalities and on the basis that math is relevant to real life in many different ways. "To ensure that students have the opportunity to engage in high-level thinking, teachers must regularly select and implement tasks that...encourage reasoning and access to mathematics through multiple entry points, including the use of different representations and tools, and they foster the solving of problems through varied solution strategies" (p. 17). We were able to better understand our student thinking by implementing lessons on gathering data such as the "Dear Data" project as well as surveying our students on how they viewed math. We wanted to highlight that math is about finding patterns and that math has multiple ways to get to an end result. In essence, math is more about a process, not just procedural. Our goal was to have our students share and reflect their unique strategies. By providing certain tasks that would help with student sense of identity this would also promote engagement and motivation in their learning. Fine tuning and synthesizing our ideas mentioned above took multiple iterations, but resulted in three key concepts that came out in our practices:

1. Process of learning happens when students are challenged with high level thinking.
2. The use of multiple modalities can help students build a strong sense of identity as mathematicians.
3. Engaging in rich discussion while sharing unique strategies to approach a problem.

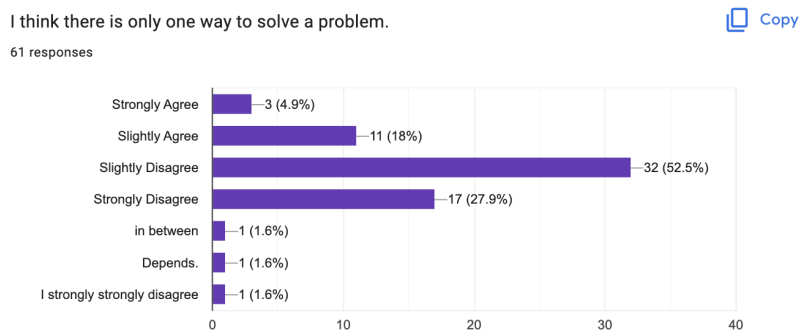
### **Process of learning happens when students are challenged with high level thinking**

In the process of creating lessons specific to our students and their needs we wanted to better understand how they thought about math. We wanted them to be aware that math was a way to connect patterns and ideas together and that it was not specific to one way of doing a

problem. In essence, we wanted their learning to come full circle. Engaging in active inquiry, connecting with each other, connecting with us as instructors to better serve our students, and finally allowing our students to remain curious and motivated to learn. This was evident when we were intentional with creating high level thinking lessons. “What is critical is that a task provides students with the opportunity to engage actively in reasoning, sense making, and problem solving so that they develop a deep understanding of mathematics” (pg. 20). This led to the idea of also creating our lesson that was open ended. We wanted our students to have a desire to remain curious and request more information as they made connections with the different ways to find their solution. The other component in building strong high level thinking lessons is the idea of gamifying a lesson. When you create a lesson that is appealing to the students by creating an immediate hook and story it is more likely that the students will remain interested in the lesson. “The goal of learning (and using) mathematics in the 21st century is more about noticing, identifying, and analyzing abstract patterns as they arise in the world. Instead of simply learning procedures to solve problems, students develop a deep understanding of underlying concepts and justify the methods and techniques they choose to use” (p. 24). The idea of gamifying a lesson helps students feel connected throughout the lesson. One tool our team has become comfortable using is the website called Desmos. This teaching site is based on the idea of gamifying their lesson and builds on understanding the student and their needs or understanding by giving quick feedback as well. Students and teachers are allowed to engage in the lesson and give each other feedback. Perhaps, this component ties back to high level thinking as students can become comfortable with being themselves and sharing their own unique approach to a problem.

### **The use of multiple modalities can help students build a strong sense of identity as mathematicians**

When we began our research one of the first things we wanted to understand was whether or not our students understood that math was about using multiple strategies and that there were different ways to get to a response. As a team we created a survey with a set of questions. One of the questions asked specifically if there is only one way to solve a problem. The results were as expected. Most of our students disagreed that there was only one way to solve a problem.



Since our goal was for our students to be able to share and reflect on their unique strategies to approach a problem, our understanding of what students thought about approaching a problem was crucial. This allowed us to create a lesson with higher level thinking that would promote the use of multiple modalities. “Additionally, by exposing the students to various modes of representations, teachers can understand students’ misconceptions and idiosyncratic algorithms, which emanate from problem solving driven by rule memorization and mechanical procedures” (15). The use of multiple modalities allows for an environment filled with several ideas where all the students can learn from each other. This perhaps also ties with the notion that mistakes are important in math. As students make mistakes and learn about different ideas their confidence and motivation to try different strategies starts to grow. As a result students become less afraid of making mistakes and are able to identify as confident mathematicians.

### **Engaging in rich discussion while sharing unique strategies to approach a problem**

Creating lessons rich in discussion and collaboration is not easy. However, when teachers have some level of experience and undergo certain training they are able to swiftly come up with ways to question their students and allow them to further their thinking. It is evident that teaching takes practice and with practice better routines and structure is created along the way. When better routine practices and structures are implemented students have the ability to be more open to sharing their unique ideas. During my research I came across what is known as mathematical modeling. Mathematical modeling (MM) is a “process that uses mathematics to represent, analyze, make predictions or otherwise provide insight into real-world phenomena” (2). Not only does mathematical modeling bring forth the idea of creating lessons that allow students to connect math to the real world but it also brings up the idea of creating lessons that are full of productive struggle. Perhaps it is when teachers are able to place their students in certain teams or ask students the right questions when productive struggle actually takes place. During our lesson we used the routine called “swap meet”. Students from different groups were challenged to engage and share their ideas with each other. This would be an example of productive struggle as students question each other's thinking. Furthermore, this can lead to growth in thinking and the chance for students to engage in rich discussion. As different ideas are shared, this can also lead students to connect different ideas to real world situations. When rich discussion takes place while sharing unique strategies this is when empowering students takes place.

Completing this lesson study has allowed me to be more intentional with my teaching practices. Preparing my students to share and reflect on unique strategies they use to approach a problem has definitely allowed me to grow as an educator. Although I seek to continue to find areas of growth I believe this lesson study cycle has allowed me to better understand myself as an educator and how I can better serve my students.

## Reference List

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