The Thinking Classroom: An exciting transformation for math instruction

few years ago, I began my first administrative position as a K-12 math supervisor. While I was a successful high school teacher, I had a lot to learn in this new position. With 17 years of experience at the secondary

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level, I knew I would need to turn my focus and attention to the lower grades. Right away, I began observing elementary classrooms, and I was amazed

at the way the teachers were able to engage the students in exciting math lessons. The lessons were student centered, hands on, interactive, and fun. I couldn't help but wonder why math looked like this in the lower grades, but then completely changed as students progressed through the school system.

I reflected on what my teaching had looked like as a high school teacher. If I was honest with myself, my class was the opposite of hands on. I suspect I was often the only one truly enjoying class. I did sacrifice my self-respect for the benefit of my students. Whether it was making up songs so they would remember content or using what would affectionately be referred to as "teacher humor"-the cornier the better-to help students retain concepts, I did whatever I could to help my students. But when I thought about it, I was the one doing all the work; I was the one who held all the answers; I was the one who left every class exhausted. If I thought about the adage, "Whoever does the talking does the learning," I would have to question if my approach to high school math instruction was what was best for student learning. Would it be possible to apply the principles of elementary math instruction to the high school level?

Luckily, this was not only a time of growth for me in my new role as supervisor, but also a time of professional development in the area of mathematics. Social media fueled ideas among like-minded teachers and kept the math community connected. I became acquainted with the intriguing teachings of Peter Liljedahl, and his philosophies led me to consider what good math instruction looked like.

The principles of Liljedahl's Thinking Classroom seemed to answer so many of my questions (www.peterlijedahl.com). Why couldn't we create learning spaces that were hands on, interactive, exciting, and fun at any level? Why couldn't we shift the "work" of learning from the teacher to the students at the high school level? What would be the best way to achieve this? By incorporating aspects of Liljedahl's works, we were able to adapt the Thinking Classroom and bring a new vision for mathematics teaching and learning to Chatham High School. I knew

Peter Liljedahl's Thinking Classroom

Peter Liljedahl writes, "A thinking classroom is a classroom that is not only conducive to thinking but also occasions thinking, a space that is inhabited by thinking individuals as well as individuals thinking collectively, learning together, and constructing knowledge and understanding through activity and discussion. It is a space wherein the teacher not only fosters thinking but also expects it, both implicitly and explicitly."

Over more than a decade, Liljedahl has developed a 14-point plan for encouraging students to engage deeply with math content. Read more about his work in "Building a Thinking Classroom in Math," which he contributed to Edutopia: https://www.edutopia.org/ article/building-thinking-classroom-math

we had a really innovative idea, but I also knew it would be quite expensive. I needed to think big about how to fund such a project.

How to Fund the Change?

I embarked on the process of writing a grant to the Chatham Education Foundation, a non-profit

organization within the School District of the Chathams. To do so, I needed a clear vision for what the Thinking Classroom could look like. Realizing I could not do that alone, I found two teachers, Jennifer Kessler and Mallory Lynn, who were willing and eager to go down this exciting path with me. Together, we came up with a design for two non-traditional classrooms where tables would be of different heights; all surfaces, both desks and walls, would be non-permanent writing spaces; and flexible seating options would allow students to move around the room as they learned. The teachers and I discussed extensively how a Thinking Classroom could change instruction and we believed we were at the start of something really exciting. Luckily,





We went through many steps to ensure a successful transition. Planning was essential. We started with empathy regarding the student experience. What did we want it to feel like to be in a Thinking Classroom? And what would it take to achieve that feeling? How would this impact instruction and planning?

We knew, first and foremost, that we wanted students to have the freedom to explore their thinking on any surface they could find. The classrooms were designed with white board tables, standing desks, and glass white boards covering all the walls. Varying surfaces allowed for student choice when deciding where to work, offering opportunities for individual practice, collaboration among peers, or one-on-one instruction with the teacher. We acknowledged that students work differently at different times, and true thinking experiences require varied learning spaces. Collaboration became more natural, with students noticing other students' work on the writing spaces and seeking conversation about it. Student errors and successes could be highlighted throughout the lesson. Reaffirmation became instant. Students could quickly compare their work with that of others in the class, rather than their single desk partner. Gallery walks in the classroom became the new normal, allowing students to observe and reflect on one another's findings while touring the room. Quite simply, the work of the classroom was in the students' hands. Curious about how students were perceiving this new normal, we asked for their feedback. The

the Chatham Education Foundation agreed and, in September 2019, two Chatham High School Thinking Classrooms were born.

How Did This Learning Environment Change the Student Experience?

student voice was consistently positive with regard to flexibility and engagement.

- I like the boards because it gives a lot of space to work and allows you to work with others easily.
- The whiteboards help me to see where I made a mistake and help me determine what I need to study and work on.
- The whiteboards are very helpful for doing problems and seeing how others do it easily.
- The whiteboards are really fun! I love being able to get up and work somewhere besides my desk.

One thing we had not considered was the positive psychological impact the whiteboards would have regarding making mistakes. Jo Boaler, Professor of Mathematics Education at Stanford University, has spoken about the role that mistakes play in the learning process:

"Understanding the power of mistakes is critical, as children and adults everywhere often feel terrible when they make a mistake in math. . . . [W]hen students perceived their classroom as mistakes friendly-above and beyond other aspects of their classrooms environment-they increased their effort in their work."¹

Mistakes are part of the learning process. While teachers have known this for years, the students suddenly began to agree. The non-permanent spaces allowed for non-permanent mistakes. Students were able to rework a





given problem multiple times. With a quick pass of the expo eraser, the surface was clean and shiny again-a new slate without any marks from pencil erasings or crumpled paper left behind.

The paradigm of what it meant to be a good math student began to shift. The focus became process over product. While arriving at a correct answer was still a goal, students' attention was more frequently drawn to analyzing their work and the work of others. Speed became inconsequential. Students were working on different problems at different times. Those who finished early were leaving their work up for others to view, finding a new blank surface in the room, and beginning the next challenge. Those students who began the year with low self-efficacy were emerging as mathematicians.

How Did This Learning Environment Change the Teacher Experience?

From an instructional perspective, teachers' planning had to completely change. Instead of standing at the board and following the "I do, we do, you do" instructional method that I had used as a teacher, students would be invited into the learning through accessible questions designed to frame the lesson. This process would facilitate a discussion in which students would ask questions about their learning. Lessons would begin and end with student questions. The role of the teacher had been redefined as a facilitator who guided student thinking and engaged all members of the classroom. This idea aligned with the department initiative to have students "see it before we show them and say it before we tell them," a philosophy introduced during professional development time with educator Sara VanDerWerf.

Adoption of the Thinking Classroom to our context required real-time adjustments and modifications from the teachers. Teachercentered lessons were no more. Instead, content would be presented to students through an introductory activity guided by student inquisition. Because of the constant and rapid feedback students were receiving from their peers, less teacher instruction was required. Students were never passively seated at their desks with their hands up. Instead, they became empowered to seek out the answers needed through constant collaboration.

Teacher preparation looked different. Focus shifted from the standard worksheet, and prep time was used to create higher-level thinking problems. Students were given fewer hand-outs and documented their work by taking photos of the white boards. Contentrich documents and problem sets covered in class were still pushed out to students through an online forum, to use as a guide in preparing for assessments.

Students would enter the Thinking Classroom with enthusiasm and ask, "Are we using the white boards today?" And, of course, the answer was "Yes!" A captive and engaged audience in a high school math classroom . . . this was a teacher's dream.

When looking at students doing math in a thinking classroom, your eye is drawn to the work, not simply the answer. Students are moving along the learning process at their own pace-a personal journey.

As students pursued true inquiry into different concepts with a focus on how to solve problems as they explored the visible thinking around the room, the teachers shifted to a role of facilitator guiding students' learning. This shift would personalize the learning to each class, and each student. As a teacher circulated the room, he/she

would have immediate formative assessment of students' comprehension driving the instruction based on the needs of each student or class. The teacher would support the learning from the periphery, without being the "holder of knowledge." Students would also learn from each other as they ventured down their learning path together.

Notes:

¹https://www.youcubed.org/wp-content/uploads/2017/09/ Mistakes-Grow-Your-Brain-Revised.pdf



What Else Is Possible?

Throughout the year, we recognized ways we could improve moving forward and identified challenges we still hoped to overcome. These ideas ranged from the simple (what is the best marker and eraser to use?) to the more involved (what technology would best support us de-fronting the classroom?). We are also considering more effective ways for students to record their learning to serve as a resource for homework and studying. Because of the success we have experienced, we are writing another grant to outfit more rooms as thinking classrooms next year, including some at the middle school level with the goal of eventually extending into the elementary schools.