



Cathy Seeley

**About This Paper**

Dr. Seeley has been a mathematics teacher, K-12 district coordinator and K-12 State Director of Mathematics for Texas. She is author of several books, including: Making Sense of Math (for teachers); Building a Math-Positive Culture (for leaders); Faster Isn't Smarter—Messages About Math, Teaching and Learning in the 21st Century (2009/2015); and Smarter Than We Think—More Messages About Math, Teaching, and Learning in the 21st Century (2014).

# Moving Toward a Student-Centered Classroom

by Cathy Seeley

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**M**any PK–12 teachers of mathematics have come to recognize the power of organizing their teaching less around presenting content and more around active student discussion of mathematical ideas. Making this kind of shift can seem like a daunting task, especially if you have not experienced student-centered teaching yourself. But the benefits can be significant for students on a day-to-day basis and also for the long term, making the effort a rewarding investment.

## Why Move Toward a Student-Centered Classroom?

**T**here are many reasons why mathematics classrooms are moving toward more focus on student thinking and student-centered classroom discussion as a foundation for learning. Numerous reports show that the United States has made gains in some areas of mathematics achievement but that we still have room for improvement in terms of student learning (Organisation for Economic Co-Operation and Development, 2013; U.S. Department of Education, 2014). Regardless of the reasons why not all students may be achieving at the level we might wish, looking at how we structure our mathematics classrooms is a reasonable place to begin to look for solutions.

In particular, we know that not all students receive the same opportunity to develop a strong and broad foundation in mathematics nor the same opportunity to engage in thinking or to solve nonroutine problems (Aguirre et al., 2013). Major inequities persist at a systemic level in schools, with advanced or deep mathematics too often seen as appropriate only for certain students. Too many students, like many adults, believe that they cannot do math and that they will be fine without it.

While such beliefs cross demographic categories, some students are far less likely to experience classrooms in which they are likely to overcome those beliefs. In particular, access to rich, stimulating learning environments may be limited to some students based on race, ethnicity, or class, denying them opportunities to develop an enjoyment in doing mathematics or to see themselves as mathematically capable. This lack of access is pervasive in our educational system and often the result of geography or unconscious biases.

Even students who have excelled in mathematics and those who have been accelerated into advanced levels may be missing out on opportunities for deep thinking. While we may move such students faster through more advanced content, even these students may not be challenged to solve problems they have not been specifically taught how to do or to engage in rich mathematical discussion. Many of these students may not have had the opportunity to engage in reasoning and justifying their ideas with other students as they learn to listen to and value how others may be thinking.

Students who have missed out on success in mathematics, as well as students who have done well in a traditional teacher-directed classroom, can benefit from more focus on student involvement. In shifting toward a more student-centered approach in teaching mathematics:

- Teachers can apply what research has shown about effective instructional practice for mathematics learning.
- More students can build conceptual understanding and computational proficiency.
- Every student can develop the ability to tackle challenging problems of all sorts.
- Within well-structured classroom discussions, all students learn to value the thinking of every individual as they discuss mathematical ideas from different perspectives.
- We can help every student come to see herself or himself as someone who does math, giving each of them more voice, strengthening each mathematical identity, and increasing the ability to use mathematical thinking to tackle increasingly complex and abstract problems within and outside of mathematics.

Perhaps the most important reason to shift our teaching toward more emphasis on students' thinking is this last point—to better respect student voice and open the door for more students to see themselves (and each other) as “math people” as they develop a strong mathematical background (Aguirre et al., 2013). The opportunity if we succeed is to equip every student with confidence, knowledge, skills, and the willingness to tackle problems, even those they have not previously been taught how to solve.

## What Does Effective Student-Centered Teaching Look Like?

**T**here is no one magic recipe that will work every day for every teacher with every student, but there are some research-based principles and practices that can help more students learn more mathematics more deeply. The National Council of Teachers of Mathematics (NCTM, 2014a) has articulated eight research-based teaching practices associated with the kind of effective teaching that leads to student learning. These practices describe general principles for shifting teaching toward more emphasis on classroom discourse built on students' own thinking and discussion. NCTM and others continue to produce resources to support teachers in implementing these practices in the interest of better serving the needs of every student.

In addition to articulating the importance of the teacher identifying a mathematical goal for each lesson, NCTM’s eight teaching practices focus on helping students develop fluency and build understanding and gathering evidence of students’ thinking and understanding to make instructional decisions. The practices call for teachers to help students come to value mistakes as part of their productive struggling as they work through challenging tasks and solve problems they have not already been told exactly how to solve. The eight effective teaching practices are centered on:

- Selecting *tasks* that promote reasoning and sense-making.
- Emphasizing *connections among different mathematical representations* of the same idea, concept, or problem.
- Facilitating classroom *discourse around student thinking*.
- Posing *purposeful questions*.

## What Student-Centered Teaching Is Not?

In spite of the evidence that traditional teaching methods as a whole have not led our students to achieve the high level of performance we expect in this nation, any change is likely to face resistance. Some critics may worry that allowing students to work collaboratively or creating classrooms focused on student discussion might lead to chaos or might not allow the teacher to “cover” all of the necessary material. They may fear that teachers will turn over control of their classrooms and let students work without any guidance. It is reasonable to anticipate that not every teacher will smoothly implement new practices without a hitch. But it is not correct to believe that shifting some of the responsibilities of learning to students means giving away control of the classroom.

It simply is not the case that a student-centered classroom is one in which the teacher simply hopes students will discover what we want them to learn without teacher guidance. Rather, a student-centered classroom is one in which students are engaged in thinking early on in a lesson and setting the stage and priming their minds to be open to the intended mathematical outcome of the lesson. The teacher creates and structures the flow of the classroom, planning learning toward that outcome, and knowing that progress may arise naturally within classroom discussion or may call for the teacher to more directly guide that discussion or offer direct instruction over some content.

Nor is it the case that such classrooms lack teacher structure—in fact, the kind of classroom described in NCTM’s effective teaching practices is very teacher-structured, even if not

teacher-centered. Student-centered classrooms may not look the same every day. As always, teachers are ultimately responsible for determining on a day-to-day and moment-to-moment basis how to best help students take in new learning, making decisions constantly about when to ask and when to tell. In a student-centered classroom focused on thinking, it is quite likely that the balance between asking and telling is continually shifting, even as it moves toward the teacher doing more asking than telling.

Shifting teaching to a more student-centered approach also does not mean that the emphasis is only on concepts or strictly on problem-solving. Rather, the teacher is constantly balancing the development of concepts, procedures, and problem-solving to ensure that students' learning is both broad and deep. The teacher knows that the best way to build procedural fluency is on conceptual understanding (NCTM, 2014b) and that solving the many kinds of problems students are likely to face calls for them to have a strong foundation of both concepts and skills.

## Advancing Equity in Support of All Learners

In a well-designed student-centered classroom, every student's ideas are valued, helping each come to see herself or himself as a person who does mathematics. (Aguirre et al.) (2013) offer five equity-based teaching practices that connect with and enhance NCTM's eight teaching practices. These equity-based practices offer insights into research about how we can transform the traditional culture of the mathematics classroom in support of increasing student agency and strengthening students' mathematical identities. Further, these practices provide the kind of deep and lasting learning that NCTM (1991, 2000) and others have long identified as necessary and appropriate for all students.

The five equity-based practices include:

- *Going deep with mathematics*: Implementing lessons with high cognitive demand, which help students develop proficiency, fluency, conceptual understanding, reasoning, and problem-solving.
- *Leveraging multiple mathematical competencies*: Tapping students' various mathematical strengths, backgrounds, and competencies.
- *Affirming mathematics learners' identities*: Valuing all students' contributions and creating multiple entry points to the mathematical ideas of a task or lesson.
- *Challenging spaces of marginality*: Moving past lecture and seatwork to embrace student competencies, decrease the emphasis on status, and value all contributions.

- *Drawing on multiple resources of knowledge:* Tapping all sources of students' knowledge and experiences, including those from their culture, home, and community, and connecting those experiences to support mathematical learning that includes authentic problems relevant to their lives.

When we create classrooms centered on students' thinking and classroom discussions based on their thinking, as described in NCTM's eight teaching practices, the very nature of the classroom establishes fertile ground for naturally incorporating these five equity-based practices. The strategic selection of tasks with high cognitive demand and multiple entry points allows students to go deep with the mathematics and provides a way to tap into the knowledge and experience of many or most of the students in the classroom. Artfully structuring and facilitating classroom discourse that values and considers the thinking and contributions of every student provides an opportunity to leverage all students' competencies while strengthening and supporting the development of the mathematical identity of each of them. The classroom becomes a space that need not be limited by the potentially damaging sense of marginality toward some students that might be found in more traditional instructional models. In other words, implementing effective teaching strategies can be a powerful way to break down long-standing equity barriers and, instead, can truly empower every student to see himself or herself as a "math person"—someone who knows math and can use her or his thinking to reason through complex situations and solve all kinds of problems.

## Making the Shift

**T**he eight effective teaching practices describe a rich and engaging classroom that is achievable by most teachers, given the right kind of support. Many teachers have never experienced teaching that did not primarily rely on teacher lecture. And many may be insecure about how to create a classroom built around students' own thinking or how to orchestrate a productive classroom discussion around that thinking. An increasing number of publicly available classroom videos show classrooms based on students' wrestling with challenging problems, working together, and participating in well-orchestrated classroom discussions. More and more resources—print-based, online, or in-person—offer support for how to restructure classrooms to emphasize student thinking, understanding, reasoning, and problem-solving. For a start, consider the tips below:

- *Choose a starter task or problem* that you have not already taught students how to solve. If you use a textbook, check out the textbook and also any supplemental materials that may accompany it as sources for tasks. Look especially for tasks or problems identified as project suggestions, enrichment, or various selected or bonus problems, many of which may be excellent as starter tasks.

- *Allow students to work collaboratively.* Give students time to wrestle with a problem on their own before telling them how to solve it or having them work with others. Also allow time for them to work with a partner or in a small group. Some teachers find it easier to start with partner work.
- *Ask questions as students work, while planning for class discussion.* Look for students who may get stuck in unproductive struggle and ask questions that can push their thinking and reasoning (How did you decide to use multiplication? What does the 7 tell you? How are the two functions similar/different?). As you circulate among students, make note of whose work would be most beneficial to share in a group discussion (whether correct or incorrect), and in what order.
- *Create a safe environment for discussion.* Discuss classroom norms that set ground rules for how everyone in the class will respect the thinking and sharing of others as they contribute their own thinking and ask clarifying questions. Discuss how mistakes and discussions about mistakes can lead to learning. Over time, help students come to expect that in math class we talk about our ideas and our thinking.

## Conclusion

It may seem overwhelming to fully implement a student-centered approach in the classroom. Taking one step at a time can be a productive approach, with a commitment to stay the course and with the right kind of support. Working with colleagues can smooth the bumps in the road and can provide moral support as teachers work together with each other and with coaches or instructional leaders. Planning for ongoing, collaborative professional development during this kind of transition is an important consideration.

In spite of the challenges, more and more teachers are finding that moving through the inevitable obstacles and stumbles on this journey is more than worth the effort as they come to see the dramatic results that are possible, both with students who have traditionally done well and with students who may never before have been successful in math class. Perhaps shifting classroom practice in these proven ways can help us finally move past achievement blocks and gaps to unlock the potential in every student and allow each of them to flourish as a mathematical thinker and reach the level of achievement we all want to see.

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