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Mathematical Competence and Status: What "Being Smart" Means

In chapter 2, I laid out the following principles for equitable mathematics teaching, which should undergird collaborative learning in mathematics classrooms:

- Principle 1: Learning is not the same as achievement.
- Principle 2: Achievement gaps often represent gaps in opportunities to learn.
- Principle 3: All students can be pushed to learn mathematics more deeply.
- Principle 4: Students need to see themselves in mathematics.

Each principle influences the main topics of this chapter: mathematical competence and status. Mathematical competence has to do with a student's ability to complete a variety of mathematical tasks: his or her "smartness." Students can use and show their smartness through the structure of group work in many ways. A student's mathematical competence will often have direct bearing on his or her status in the classroom. Status is how competent a student both feels and is perceived to be by his or her classroom peers. Both concepts are important for students' learning and achievement, and both have important consequences for how successfully students will be able to carry out group work. Thus, understanding status and mathematical competence is foundational work for any teacher hoping to bring collaboration into the classroom.

The Organization of Smartness

By the time they are in secondary school, students enter their mathematics classes with strong ideas about who they and their peers are as mathematics learners. They can tell you who is smart and who is not. They base these judgments on earlier school achievement, as well as on categories such as race, class, popularity, and gender. These assessments play out in the classroom. Some students' contributions are sought out and heard, whereas others' contributions are ignored. This imbalance obstructs productive mathematical conversations because an argument's valuation comes from *who* is speaking and not *what* is being said.

This chapter addresses how to support productive mathematical conversations in the classroom by looking at important social dynamics. I will use the following definition:

> ***Productive mathematical conversations are ones in which arguments are weighed on the basis of the mathematical validity of what is being said, not on who is speaking.***

Judgments about who is smart based on prior achievement or social categories violate a fundamental principle of equity and are consequential: *learning is not the same as achievement.* Confounding this problem, American schools tend to be organized in ways that obscure distinctions between learning and achievement. In fact, they are often built around the idea that differences in student achievement are the natural consequence of differences in ability. The logic of tracking, particularly in the early grades, rests on notions of identifiable differences in ability that require different approaches in teaching.

In reality, tracking often only reinforces achievement differences by giving high-achieving students better teaching and more enriched learning environments (Oakes 2005). Recall the second principle of equitable teaching discussed in chapter 2: *achievement gaps often reflect opportunity gaps*. We typically think of opportunity gaps as existing across schools, with schools serving upper middle-class populations having greater resources than schools serving poor students. Although this tragically remains the case in the United States (Kozol 1991), the resource differences within schools are often overlooked. Two students in the same school placed in different tracks—on the basis of their prior achievement—typically have radically different learning opportunities through the quality of their teachers, the time spent engaged in academic activities, and the rigor of the curriculum. Once you are behind, getting ahead is hard (Oakes 2005).

As chapter 2 noted, all students in the United States should have the opportunity to learn mathematics more deeply. In 2009, on an international measure sponsored by the Organization for Economic Cooperation and Development (OECD), fifteen-year-olds in the United States scored statistically significantly below the average, in comparison with other nations in the OECD, in mathematics. Indeed, among the OECD's thirty-four participating countries, the United States ranks twenty-fifth in mathematics achievement.

However, looking more closely at the data, one sees that although all students could benefit from higher-quality mathematics instruction, not all students are receiving equitable education. One can often predict these opportunity gaps by a student's race or socioeconomic status. In U.S. reading, mathematics, and science instruction, student socioeconomic status accounts for 17 percent of the variation in student performance. In higher-performing countries, such as Canada and Japan, socioeconomic status accounts for only 9 percent of the variation in student performance (OECD 2011).

The belief in ability as the root of different levels of achievement is so entrenched in the organization of curriculum and schooling that many people have a hard time imagining another model. Other conceptualizations are possible, however. Japanese education attributes differences in achievement to students' different levels of effort instead of differences in ability (Stevenson 1994). Classrooms are organized to see student differences as a resource for teaching, instead of viewing them as an obstacle to be accommodated. Tracking does not occur in the early grades.

Psychologists James Stigler and James Hiebert reported this distinction in data from the TIMSS video study, where they compared mathematics teaching in the United States, Germany, and Japan. They summarize some fundamental cultural beliefs that organize teaching, describing the Japanese view of student difference: "Individual differences are beneficial for the class because they produce a range of ideas and solution methods that provides the material for students' discussion and reflection. The variety of alternative methods allows students to compare them and construct connections among them. It is believed that all students benefit from the variety of ideas generated by their peers. In addition, tailoring instruction to specific students is seen as unfairly limiting and as prejudging what students are capable of learning: All students should have the opportunity to learn the same material" (Stigler and Hiebert 1999, p. 4).

Considering students' robust views on who is smart along with schooling practices such as tracking, which naturalize differences, it is no wonder that most students' mathematical self-concepts seem immutable by the time they arrive in secondary classrooms. Everything around them fixes their sense of their ability, be it low, high, or average.

Status versus Ability: Interrupting Ideas about Smartness

If learning is not the same as achievement, and if achievement gaps often reflect opportunity gaps, what do we make of students' prior achievement when they enter our classrooms? Who are the students who have succeeded in mathematics before entering our classrooms? How about those who have not? Disentangling achievement and ability may sound reasonable, but we need a new model for thinking about students we teach. Elizabeth Cohen's (1994) work on complex instruction frames these issues around *status,* a concept that clarifies the conflation of achievement and ability. *Status* gives teachers room to analyze this problem and respond through their instruction.

In this context, we will use the following definition of status:

> ***Status is the perception of students' academic capability and social desirability.***

The word *perception* is key to this definition. Perception drives the wedge between social realities and perhaps yet unrealized possibilities of what students can do mathematically. Perception involves our expectations of what people have to offer.

Where do these status perceptions come from? As the chapter opener discusses, the perception of academic capability often comes from students' earlier academic performance. It might come from their academic track, with *honors* students having higher status than that of *regular* students. Status judgments about ability might also draw on stereotypes based on class, race, ethnicity, language, or gender.

The perception of social desirability arises from students' experiences with peers. For instance, students often see attractive peers as desirable friends—or perhaps just undesirable enemies. Likewise, whatever drives popularity in local teen culture will show up in the classroom as status. The team captain, the talented artist, or the cut-up rebel—whomever students clamor to befriend or win the approval of—will have higher social status.

> **"Thinking about status issues is what, for me, differentiates complex instruction from just 'regular' group work. Addressing and being aware of status issues is what makes all the other interactions productively possible."**
> *—Clint Chan, Mathematics Teacher*

Status plays out in classroom interactions. Students with high status have their ideas heard, have their questions answered, and are endowed with the social latitude to dominate a discussion. On the other side, students with low status often have their ideas ignored, have their questions disregarded, and often fall into patterns of nonparticipation or, worse, marginalization.

Recognizing the relationship between status and speaking rights highlights an important way for educators to uncover these issues in their classrooms. Status manifests through participation patterns. Who speaks, who stays silent, who is excluded, and who dominates class discussions are all indicators of status. Individually, this concept influences students' learning. If some students' ideas are continually ignored, their questions will go unanswered and their confusions will remain unaired. Over time, this system may reinforce negative ideas they have about themselves as mathematics learners, because they may conclude that their ideas are not valuable. Conversely, students whose ideas are consistently heard and worked with will have greater opportunities to engage and sort through them. Socially, if students' dominance becomes unregulated, they may develop an overblown sense of their value in the social and intellectual world of the classroom. Thus, status-driven interactions not only influence learning but also reinforce existing status hierarchies.

Skeptics might protest linking participation and status. "Some students are just shy," someone might say. That is true. Likewise, students learning English often go through a silent period or may be self-conscious of their accents. Our goal with reluctant speakers is to design ways for them to comfortably participate more than they are perhaps naturally inclined to do. As we will cover in chapter 5, strategies such as small-group talk first or individual think time may help build the confidence of shy or nervous speakers. The emphasis on participation in classroom discussions comes from several research studies showing that such involvement is essential to developing conceptual understanding and academic language (Cohen et al. 2002; Webb 1991).

Socially, status plays out in participation patterns. Individually, status influences students' mathematical self-concepts, or their ideas about what kind of math learners they are. As mathematics educators, we have all encountered students who claim that they are not "good at mathematics" before they even give a new idea a chance. Intuitively, we know that students' mathematical self-concept influences their motivation and effort in mathematical learning. If students *know* they are not good at mathematics, why should they push past their confusion when problems become difficult? If students *know* they are smart, why should they bother to explain their thinking, let alone pay attention to a classmate's? Students' self-concept is deeply tied to their attitudes about learning mathematics, in and out of our classrooms. Societal biases predispose students to think of themselves and their peers as more or less competent in mathematics, playing into students' choices to engage, persist, and take risks in the classroom.

> **"My students and I talk a lot about what it looks like to be a powerful math learner—taking risks, contributing productively, and persisting. I've started making those behaviors transparent to students when they happen. We talk about how brains learn and how they should expect to move from surface knowledge to confusion to deeper understanding. I want them to experience that journey whenever I ask them to do tough math together (group work). I know group work is working when they take risks, contribute, and persist. It bleeds into whole-class discussions, too."**
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> *—Laura Evans, Complex Instruction Educator, Mathematics Teacher, and Coach*

Seeing Status in the Classroom

Status hierarchies manifest in classroom conversations and participation patterns, often leading to *status problems,* or the breakdown of mathematical communication based on status rather than the substance of mathematical thinking. Before we talk about remediating status problems, let's delineate how teachers can see status problems in their classrooms.

Participation

One of the most important and tangible status assessments teachers can do is ask who speaks and who is silent. Some students might dominate a conversation, never soliciting or listening to others' ideas. These are probably high-status students. Some students may make bids to speak that get steamrolled or ignored. Some students may seem to simply disappear when a classroom conversation gains momentum. These are probably low-status students.

If you want to get a better handle on the participation patterns in your classroom, give a colleague a copy of your seating chart and have this person sit in your classroom. He or she can check off who speaks during a class session. This simple counting of speaking turns (without worrying about content or length for the moment) can give you a sense of dominance and silence. Surprisingly, teachers' impressions of speaking turns are sometimes not accurate, so this exercise can help sort out participation patterns. I have seen this in my own work with teachers and in earlier research. Dale Spender (1982) videotaped teachers in high school classrooms, many of whom were "consciously trying to combat sexism" by calling on girls and boys equally. Upon

reviewing the tapes and tallying the distribution of participation, the teachers were surprised that their perceived "overcorrection" of the unequal attention had only amounted to calling on the girls 35 percent of the time. The teachers reported that "giving the girls 35 percent of our time can feel as if we are being unfair to the boys." Although (we hope) the gender ratios in this research may be dated, the phenomenon of teacher misperception still holds. (For more on working with colleagues, see chapter 7.)

Teachers attending to participation patterns can use certain moves to encourage silent students to speak. For example, teachers might introduce a question with "Let's hear from somebody who hasn't spoken today." High-status students sometimes assert their standing by shooting their hands up when questions are posed, letting everybody know how quickly they know the answer. To get around this, teachers can pose a difficult question prefaced with the instructions, "No hands, just minds. I want all of you to think about this for the next minute. Look up at me when you think you know and I will call on somebody." By allowing thinking time, teachers value thoughtfulness over speed and have more opportunity to broaden participation. Eye contact between students and teacher is a subtle cue and will not disrupt others' thinking in the way that eagerly waving hands often do. Finally, teachers can make clear that they value partial answers as well as complete ones. When posing tough questions, they can say, "Even if you only have a little idea, tell us so we can have a starting place. It doesn't need to be all worked out."

Listening

Part of effective participation in classroom conversations requires listening and being heard. As a follow-up to an initial assessment of participation patterns, having an observer pay attention to *failed* bids for attention or to ideas that get dropped during a conversation might be useful.

Of course, part of the complexity of teaching is deciding which ideas to pursue and which ideas to table. But the choice of whether to entertain students' thinking communicates something to them about the value of their ideas, which ties directly to status. Students whose ideas are consistently taken up will have one impression about the value of their ideas; students whose ideas are consistently put off will have another idea entirely.

Teachers can model listening practices during class discussions, directing students to listen to each other. By showing students that rough-draft thinking—emergent, incompletely articulated ideas—is normal, teachers can help develop a set of clarifying questions that they ask students, and eventually, that students ask each other. For example, a teacher might say, "I'm not sure I follow. Could you please show me what you mean?" Saying this makes confusion a normal part of learning and communicates an expectation that students can demonstrate their thinking.

Body Language

During class, where are students focused? Are they looking at the clock or at the work on the table? Students who have their heads on the desk, hoodies pulled over their faces, or arms crossed while they gaze out a window are signaling nonparticipation. In small-group conversations, their chairs may be pulled back or their bodies turned away from the group. Body language can tell teachers a lot about students' engagement in a conversation.

Teachers' expectations for participation can include expectations about how students sit. "I want to see your eyes on your work, your bodies turned to your tables."

Organization of Materials and Resources

If students cannot see a shared problem during group work or put their hands on manipulatives, they cannot participate. If fat binders or mountains of backpacks obstruct their views of shared materials, they cannot participate. As with body language, teachers can make their expectation for the organization of materials explicit. "No binders or backpacks on your desks. All hands on the manipulatives."

Inflated Talk about Self or Others

Certain phrases or attitudes can be defeating and signal status problems. Adolescents often engage in teasing insults with each other, but such talk might become problematic in the classroom. Scrutinize judgments about other students' intelligence or the worthiness of their contributions. The statement "You always say such dumb things!" signals a status problem. "Gah! Why do you always do that?" might be more ambiguous. Teachers need to listen carefully and send clear messages about the importance of students treating each other with respect. "We disagree with ideas, not people" might be a helpful way to communicate this value.

Negative self-talk can be just as harmful. It not only reinforces students' impressions of themselves but also broadcasts these to others. "I'm so bad at math!" should be banned in the classroom. Give students other ways to express frustration: "I don't get this yet." The word *yet* is crucial because it communicates to students that their current level of understanding is not their endpoint. In fact, several teachers I know post *YET* on their walls so that any time a student makes a claim about not being able to do something, the teacher simply gestures to the word *YET* to reinforce the expectation that they will learn it eventually.

The converse of the negative self-talk issue also exists. If a student defends an idea only on the basis of his or her high status, this is a problem. Arguments should rest on mathematical justification, not social position. "Come on! Listen to me, I got an A on the last test" is not a valid warrant and should not be treated as one. By emphasizing the need for "becauses" or "statements and reasons" in mathematical discussions, teachers can winnow away arguments that rest on status.

The Opposite of Status Problems: Equal-Status Interactions

If students arrive in the classroom with expectations about whose contributions are worth listening to, they will act accordingly. They will solicit information and attend to the questions of high-status students. From a certain perspective, this *limited-exchange model* is an efficient way to get work done: go to the person who will have the information you need to complete the task.

In contrast, an *equal-exchange model* for working together serves different purposes, supporting all group members' engagement in higher-order thinking. Instead of a divide-and-conquer strategy with a goal of efficiency, equal exchanges involve deliberation and consideration of multiple perspectives with a goal of deeper understanding. When teachers want students to engage in conceptual learning and students are given a cognitively rich task, an equal-exchange model of interaction is vital.

Many teachers build in the expectation that students will learn to engage equitably even when students are engaged in less complex tasks. Teaching with the expectation that "no one is done until everyone is done" allows for this. Students begin to take responsibility for their own learning, as well as the need to support the learning of others in their group.

The first teaching challenge is to support students in shifting from limited to equal exchanges when they are working with rich mathematical tasks. Students need a purpose for soliciting the ideas of peers whom they may not expect to have worthwhile contributions. Teachers can cultivate equal-exchange or equal-status interactions in small groups by using two main strategies: structuring activities that necessitate group input (see chapter 4) and reworking students' assumptions about whose contributions are worthwhile. This latter strategy is the focus of this chapter.

In equal-status interactions, low-status students' participation and influence is not strongly distinguishable from that of their higher-status peers. Researchers Elizabeth Cohen and Rachel Lotan found that teachers' use of status treatments (see the Status Interventions section later) positively related to increased participation and influence of low-status students. Likewise, at the classroom level, the more teachers used status treatments, the less participation and influence were bound up in students' status (Cohen and Lotan 1995). In other words, equal-status interactions are the foundation of productive mathematical conversations.

Illustrations of Status Problems in Mathematics Classrooms

Status may be a useful concept to help teachers make sense of conversational breakdowns in their classroom as well as patterns of participation. The previous discussion highlighted specific signs of status problems, along with some ways to begin to address them, apart from any specific scenario. Of course, as status problems are embedded in particular interactions, untangling them gets trickier.

The following vignette is based on classroom observations in a school where teachers were learning to use complex instruction. More obvious examples of status problems exist, but I hope that the preceding discussion offers a way to identify egregiously problematic status dynamics. This excerpt presents a nuanced look at how status can operate in a group. Status may not be the first lens teachers might take to understand this interaction, but I suggest a status-based analysis to convince you that it might be a productive lens to increase participation in this classroom. Please take a moment to work out your thinking to the problem at the start of the vignette to better follow the students' conversations.

Vignette 3: Benign Dominance

The students in Ms. Munson's ninth-grade class are working in small groups on problems that require them to extrapolate data from linear graphs, build tables of values, and find rules. Jonah, Violetta, Ahmed, and Oliver sit around a table, working together.

Jonah and Oliver are European American and native English speakers. Ahmed is an African immigrant who speaks fluent English. Violetta is a Latina immigrant and less confident in her English.

After finding a table and a rule for a linear function with a positive slope, the group gets stuck on the following problem:

A family starts out with 100 pounds of flour. They use 10 pounds of flour every 5 days. How long will it take for them to run out of flour?

A graph accompanies the word problem, and the students have produced a table of values from the graph. They are having difficulty finding the corresponding equation.

Jonah articulates the trouble: "It *decreases*. It doesn't *increase*."

Oliver, watching Jonah closely, chimes in, "It decreases 20 pounds every 10 days."

Jonah says, "Or two pounds a day. But it *decreases*, so we can't multiply. Can we do division? I can't figure this out. We need to think of an equation for the amount of flour *gone*."

Jonah calls the teacher over and explains that "they" are perplexed by the decreasing function. She asks the group what kind of "special numbers" they might use to show that something is decreasing. Jonah tries out, "Fractions? Percents?"

Ms. Munson says, "What are we doing *every time*?"

Violetta answers, "Subtracting."

Ms. Munson nods. "So what kind of number can we use? Think about it."

Violetta: "Negatives?"

Ms. Munson nods. "Think about it. How can you use negatives to show our graph going down?" Then she walks away.

After she leaves, Jonah takes up the conversation again. "So it's going down 2 pounds a day. So, so . . . $-2f$ times d, for days? It's like $y = mx + b$. Plus 100 because you start out with 100. Maybe $100x - 2f$?"

Oliver asks, "$100x - 2f$ what?"

Jonah responds, "f for flour; d for days."

Ahmed is listening with a frown on his face. "Let me try this. I got my calculator."

Jonah says, "So let's pick some data." He turns to the table that they have produced and tells Ahmed what to enter.

Ahmed finishes the calculation and says, "Nope. No, no. It doesn't work."

Jonah and Oliver groan. Violetta raises her head. She has been working away on her own during this conversation. "Do you guys have a rule?" she asks quietly.

The boys continue arguing over different arrangements of the numbers 100 and $-2f$ that might produce a correct equation.

Violetta then says, a little more forcefully, "I have an equation."

Jonah grabs her paper and puts it in the center of the table. "Let me see."

He reads from her paper, "$100 - d(2)$."

Ahmed grabs the paper. "Let me see!"

Violetta says quietly, "I tried it. It works."

Ahmed gets out his calculator and tests out an ordered pair. "She's right! She's smarter than I am."

The teacher comes by and the group shows her Violetta's equation. Ms. Munson asks, "Violetta, why don't you have an *f* in there?"

Violetta says, "Because you're talking about the days."

Ms. Munson asks her to explain it to her group. The boys still look surprised.

After Ms. Munson walks away, Violetta takes her paper back and tries to share her thinking. "We started out with 100 pounds, so we're going to need that number. Since we had 2 pounds of flour a day . . . How do you spell *flour*?"

Oliver spells it for her.

Violetta continues, "Since he says 2 pounds of flour in a day, I thought 100 subtracted . . . I don't know how to explain it."

Jonah's curiosity is not satisfied. "How'd you come up with it?"

Violetta says, "It's just the smartest thing to do. I just knew."

Ahmed says, "You used guess and check?"

Violetta: "No, I didn't check it." She pauses for a moment. "I got 100 because we started with 100. And since we're using the number of days, I put a *d*. And since the number of days is always 2 pounds of flour a day, I thought, well, *d* times 2. Two pounds of flour *per* day. But then we have to subtract it from how much we started with."

Jonah and the others look at her paper. Jonah says, "So *d* times 2. Very good." Then he applauds.

Analysis

In the preceding vignette, the group solves the problem and works through their mathematical confusion. Different students contribute to the solution. The students treat one another with respect. In a certain light, this is a successful instance of collaborative problem solving.

Nonetheless, issues of status are playing out in ways that might influence students' participation. Jonah, as the dominant speaker, appears to have the highest status in the group. We see this in how other students defer to him, as when Oliver repeats Jonah's assertion that "It *decreases*. It doesn't *increase*." Also, Jonah does not involve other students in sorting out the variables by soliciting their input. His talk focuses solely on his own ideas. When Ahmed, Oliver, and Violetta contribute, they have to make a bid to speak that he either allows or does not allow. Jonah's dominance may come from the other students' perceptions of him as smart, or it may come from his natural inclination to talk through his thinking.

Why does this matter at all, if ultimately the group solved the problem? Jonah's dominance here is a problem for several reasons. First, recall that while in class, students not only are learning mathematical content but also are developing their mathematical identities. Jonah's controlling the conversation reinforces the worthiness of his contributions over the others'. This situation could have been especially problematic if Violetta's good thinking had not been given a chance to be heard. (It almost didn't: Ms. Munson gave a two-minute warning just before Violetta raised her head and asked her groupmates whether they had found a rule. I wonder whether the teacher's calling time gave Violetta a sense of urgency about sharing her thinking and helped her gather the courage to do so.) Yet Violetta had the key insight in constructing the equation: the input of the function is *days,* not *pounds of flour* as Jonah had formulated.

Recall equity principle 4: *Students need to see themselves in mathematics*. While they learn mathematical content, students are also learning who they are in relation to mathematics during a class session. This awareness influences their persistence on hard problems and future engagement in the subject. Why should they continue, on this problem or in this content area, if they know that they are not good at it? If their ideas or questions are ignored, students will not see themselves in mathematics. For these reasons, status plays heavily into this equity principle.

Teachers do not always know the source of students' status within a group. We cannot necessarily discern whether Violetta's prior achievement, accented English, brown skin, or gender led the boys in her group not to seek out her ideas. Instead of assuming that students' characteristics *necessarily* indicate their status, cautious teachers recognize that class, race, gender, and language fluency *might* signal status to their peers but wait to observe how these play out in interaction. Sometimes individuals bear the burden of negative stereotypes about their intellectual ability on the basis of their social groups—a phenomenon called *stereotype threat* (Aronson 2004) that makes people reluctant to speak and confirm these assumptions. Sometimes these stereotypes are not in play. In this vignette, for instance, Ahmed, an African immigrant, participated more confidently than Oliver by taking on the job of equation checking.

Status Interventions

When status plays out in the complex world of the classroom, it takes many shapes. Although blatant dominance, insults, or nonparticipation are easy to spot, the more subtle manifestations take skill to identify and remedy. Effectively intervening with status problems first requires analysis of the situation. Figuring out the best strategy for remedying the problem is often a trial-and-error process. Teachers get better at managing status in their classrooms over time, but even accomplished teachers run into challenges that force them to further sharpen their intervention tools.

The following strategies outline a starting point for status interventions. Unfortunately, this is not a recipe that will make status problems magically disappear. Status will always be part of our social world. The trick is to manage it such that students begin to reimagine themselves and their peers in the context of their competence and not their deficits. Every class you teach will have different personalities and dynamics, so these will play out differently in each circumstance. Nonetheless, here are some tested status interventions that can be adapted to any classroom.

Establishing and Maintaining Norms

Effective classroom norms support equal-status interactions. (This is one place where the CI practice I learned from the teachers differs from the CI research. The teachers I worked with felt that effective norms could actually curtail status problems. The research of Elizabeth Cohen et al. suggests that norms do not affect status problems; it is really status treatments and multiple-ability orientations that do.) In the previous discussion of status problems, I suggested some structures teachers can use, such as "no hands, just minds," that help curb status problems. These all communicate norms for participating and interacting. For our purposes, I will use the following definition of norms:

> *Classroom norms are agreed-upon ways of behaving.*

Establishing norms requires a conversation with students. Some teachers do this interactively, asking students to contribute their answers to the question, "What makes you comfortable in a classroom?" Other teachers let students know that they have found certain behaviors helpful in making a positive classroom environment where students feel comfortable to learn. However they are arrived at, posting a list of norms on the wall as a reminder can help keep these at the forefront.

Norms can help curb status problems. For example, establishing the norm of *no put-downs* can minimize negative talk about oneself or others. The YET sign is another means of establishing the norm that everybody can learn over time. Examples of other norms that help support equal status interactions include the following:

- *Take turns.*
- *Listen to others' ideas.*
- *Disagree with ideas, not people.*
- *Be respectful.*
- *Helping is not the same as giving answers.*
- *Confusion is part of learning.*
- *Say your "becauses."*

Because norms are associated with classroom behavior, they are often thought of as a classroom management tool. In a sense, they are, but they go beyond that. Classroom management is often understood as serving the important goal of managing the crowd in the classroom. Students may or may not value that goal. The use of norms as I describe them *helps students learn.*

To make norms more relevant to students, always link norms to your learning goals. For example, *helping is not the same as giving answers* values explanations and learning over the completion of work. Similarly, *say your "becauses"* values the mathematical work of justification over assertions of correct answers that may be based in status. This norm also helps alleviate the problem of nonmathematical assertion of an argument by helping a lower-status student demand that a higher-status student better explain an assertion. In classrooms where this norm is in use, I hear students say to one another, "Yeah, but *why*? You didn't say your 'because.'"

Telling students expectations for acceptable behavior does not, of course, ensure that they will always meet them. Norms require maintenance. New situations might create a need to reestablish them. Even new content—particularly content that highlights differences in prior achievement—can heighten status issues and therefore require a strong reminder about classroom norms.

Addressing Status through Norms

Over time, teachers get better at analyzing which norms might help shift negative status dynamics in their classrooms. Teachers pick one or two norms for a particular activity and tell students, "While you are working on this, I am going to watch how you do on these norms." The teacher then reminds students of the expectation for acceptable behavior.

Sometimes the choice of norms comes from a teacher's reading of the dynamics in prior class sessions. For example, if student conversations are coming too close to personal attacks, a teacher might highlight the norms *be respectful* and *disagree with ideas, not people.* If the teacher then circulates around the room and reminds students of these norms, he is not picking on problem students; rather, the teacher is stating a classroom goal that everybody is trying to work on.

Likewise, teachers can predict mathematical activities that might lead to status problems and use norms to head these off. Any topic that is confusing may make students vulnerable to status concerns. Reminding students that *confusion is a part of learning* can help. I have heard teachers say, "Now, I don't expect you to get this problem quickly. It's really hard and you will need each other's help. If you get confused, that's great because it means you are learning."

Sometimes, specific topics expose students' status concerns. Calculations with fractions commonly bring out insecurity in previously low-achieving students and impatience in students who are already fluent in these calculations: a recipe for a status collision. Anticipating this, a teacher can let the class know that she will be watching for the norms *helping is not the same as giving answers* and *say your "becauses."* The first norm will send a clear message that students who can calculate quickly need to do more than show the other students their answers. The second norm offers less confident students a means to demand explanations from their peers ("Okay, but you didn't say the 'because'").

Multiple-Ability Treatment

So far, this discussion of status has acknowledged the different status levels of students in any classroom and how it can undermine productive mathematical conversations. No doubt, addressing status through norms is crucial to creating equal-status interactions. By helping students interact more productively—listening respectfully, justifying their thinking—we help support meaningful mathematical conversations.

Norms, however, will take us only so far. Unless we address underlying conceptions of smartness, we risk reverting to the commonly held belief that group work benefits struggling students because smart students help them. As long as we have a simplistic view of some students as smart and others as struggling, we will have status problems in our classrooms. Students quickly pick up on assessments of their ability. For example, when teachers arrange collaborative groups to evenly distribute strong, weak, and average students, children will figure out that scheme and rapidly learn which slot they fill. No doubt, learners benefit from seeing more expert performance and should have opportunities to do so. But if we value only certain kinds of expertise, the same students will always play the role of experts. The question then becomes, What kinds of mathematical competence have a place in your classroom activities? If the mathematics is rich enough, the strengths of different students will come into play, rendering the common mixed-ability grouping strategy useless. Ordering the students by achievement and evenly distributing *strong, weak,* and *average* students across the groups will no longer be enough.

	Team Captain	Recorder	Facilitator	Resource Monitor
Team 1	Abby	Brian	Jeff	Alene
Team 2	Adam	Andrea	Melanie	Emily
Team 3	Lisa	Rich	Lee	Doug
Team 4	Cliff	Brenda	Deb	Kevin
Team 5	Sandra	Nick	Bridget	Mike
Team 6	Paul	Hugo	Jackie	David
Team 7	Anne	Kathy	Angie	JJ

Fig. 3.1. A wall-hanging seating chart to organize group assignments

In fact, an essential practice for a multiple-ability classroom is *random group assignment*. If we believe that students can all learn from each other, then group assignments should have no underlying design based on assessments of ability. Teachers often do this by using a wall-hanging seating chart that has pockets for each student's name (fig. 3.1). When it is time to rearrange groups, they will shuffle the cards and simply redistribute them in the pockets to make a transparent show of the randomness of group assignments. If a teacher judges a certain pairing of students to be unwise, she can publicly state the reason for this (e.g., "You two tend to get too silly together, so I think I will switch you out"). These reasons are not judgments about smartness but are instead social considerations. Random group assignment, however, is just one component of multiple-ability treatments.

Another component of multiple-ability treatments involves reconsidering what being mathematically competent means. In schools, the most valued kind of mathematical competence is typically quick and accurate calculation. A facility with numbers and algorithms no doubt reflects important mathematical proclivities. To broaden participation in our classroom in an authentically mathematical way, however, we need to broaden our notions of what mathematical competence looks like.

In the history of mathematics, mathematical competencies other than quick and accurate calculation have helped develop the field. For example, Fermat's Last Theorem was posed as a question that seemed worth entertaining for more than three centuries because of its compelling intuitiveness. When Andrew Wiles's solution came in the late twentieth century, it rested on the insightful connection he made between two seemingly disparate topics: number theory and elliptical curves. Hyperbolic geometry became a convincing alternative system for representing space because of Poincaré's ingenious half-plane and disk models, which helped provide a means for constructions and visualizations in this non-Euclidean space. When the controversy over multiple geometries brewed, Klein's Erlangen program developed an axiomatic system that helped explain the logic and relationships among these seemingly irreconcilable models. In the 1970s, Kenneth Appel and Wolfgang Haken's proof of the Four Color Theorem was hotly debated because of its innovative use of computers to systematically consider every possible case. When aberrations have come up over the years, such as irrational or imaginary numbers, ingenious mathematicians have extended systems of calculation to encompass them so that they become number systems in their own right.

This glimpse into the history of mathematics shows that multiple competencies propel mathematical discovery:

- posing interesting questions (Fermat);
- making astute connections (Wiles);
- representing ideas clearly (Poincaré);
- developing logical explanations (Klein);
- working systematically (Appel and Haken); and
- extending ideas (irrational/complex number systems).

These are all vital mathematical competencies. Surprisingly, students have few opportunities to recognize these competencies in themselves or their peers while in school. Our system highlights the competence of calculating quickly and accurately, sometimes at the expense of other competencies that require a different pace of problem solving.

Evaluating people on one dimension of mathematical competence ranks students from most to least competent. This rank order usually relates to students' academic status, and students tend to be aware of it. One way to interrupt status is to recognize multiple mathematical abilities. Instead of a one-dimensional rank order, we create a multidimensional competence space. Although some students may have multiple mathematical competencies, more places in which to get better surely

exist. Likewise, a student who ranks low on the hierarchy produced when we focus on quick and accurate calculation may have a real strength at making astute connections, working systematically, or representing ideas clearly. We cannot address status hierarchies without emphasizing multiple mathematical competencies in the classroom.

A multiple-ability classroom represents a dramatic shift in the topography of mathematical ability. Instead of lining students up in a row in order of smartness, a multiple-ability classroom has students standing on different peaks and valleys of a hilly multidimensional terrain. No one student is always clearly above another. This structure may unsettle students who are used to being on top, as well as those whose vantage points and contributions have been presumed less valuable. In other words, challenging the status hierarchy by developing a multiple-ability view can provoke strong emotions from students, positive and negative. Teachers should not be surprised to see this response in their classrooms.

In chapter 4, I will discuss choosing and adapting tasks to encompass multiple abilities. If teachers have a rich mathematical task, they can head off status problems by carrying out a multiple-ability treatment (Cohen 1994). A multiple-ability treatment comes in the launch of a task. After presenting the directions and expectations, teachers list the specific mathematical abilities that students will need for the task and add the phrase, "No one of us has all of these abilities, so you will need each other to get this work done." By publicly acknowledging the need for more than just quick and accurate calculation, teachers offer an in for a broader range of students. Multiple-ability treatments do other work too, particularly fostering interdependence. I will discuss this in more detail in chapter 5.

Assigning Competence

> **"Assigning competence is the hardest aspect of CI to do well, but by far the most essential. I had to be honest with myself about my assumptions about what it means to be smart, and push myself to expand that definition in ways I genuinely believed. I had to train myself to have eyes and ears for smartness when it happened, and also the vocabulary to name it. I need to be able to assign competence every time a student presents at the overhead, and every time I work with a team."**
> *—Carlos Cabana, Complex Instruction Educator and Mathematics Teacher*

The two status interventions described so far operate on the classroom level. Norms give clear expectations for behavior to push students toward more productive mathematical conversations. Multiple-ability treatments highlight teachers' valuing of broader mathematical competencies.

The next step is to help students recognize where they and their classmates are located on the complex topography of mathematical competence to shift their self-concept and their ideas about others. Students need to recognize these other competencies for themselves so that they know their own strengths and can work confidently on hard problems. They need to recognize the strengths of their peers in order to interrupt assumptions based on a simplistic smartness hierarchy. If students believe their classmates have something to contribute, they have a mathematically motivated reason to listen to and learn from each other.

Teachers can communicate these messages to students through the practice of *assigning competence*.

> ***Assigning competence is a form of praise where teachers catch students being smart. The praise is* public, specific to the task, *and* intellectually meaningful.**

The *public* part of assigning competence means that this praise is not an aside to an individual student or a communication with the parent. It takes place in the public realm of the classroom, whether in small-group activity or whole-class discussion. It needs to be *specific to the task* so that students make a connection between their behavior and their mathematical contribution. Simply saying, "Good job!" is not enough. Students need to know exactly what they did that is valued. The praise must be *intellectually meaningful* so that it contributes to students' sense of smartness. Praising a student for a "beautiful poster" does not qualify as assigning competence, because making a beautiful poster does not display mathematical intellect. In contrast, if a teacher praises a student for a clear representation on a poster that helps explain an idea, that is intellectually meaningful because it is tied to mathematics.

In the vignette, for example, if Ms. Munford had noticed Violetta's good thinking on the problem, she could have *assigned her competence* by making it public to either the group or possibly even the class. She could say, "Wow, Violetta! Your group was having trouble figuring out the equation. That was great how you recognized that D was the unknown. That was a really important connection." If she wanted to do more to bring Violetta's groupmates into the status treatment, Ms. Munford could add, "Jonah, Ahmed, and Oliver, make sure to get Violetta's ideas in there. She's got some good insights!"

> **"If I were to have a teacher concentrate on one aspect of CI, it would be to focus on learning how your students are smart and how they are developing confidence in their learning of mathematics and their encouragement of each other."**
>
> *—Ruth Tsu, Retired Mathematics Teacher and Complex Instruction Educator*

Summary

Status plays into teachers' and students' ability to have productive mathematical conversations in their classrooms, at both the whole-class and small-group levels. Status is based on judgments of worthiness that arise from prior academic achievement and social desirability. Patterns of participation and nonparticipation (or even marginalization) signal whose contributions are valued in a particular classroom. Status problems interrupt productive mathematical conversations because speakers' ideas are entertained or discounted on social rather than mathematical grounds. Figure 3.2 represents the influence of status on students' mathematical learning.

Teachers can address status problems in the classroom in several ways (fig. 3.3). Most fundamentally, teachers need to establish classroom norms that value respectful listening and the use of mathematical practices, such as justifying as the grounds for discussion. Teachers establish norms through initial conversation with students but then must maintain the norms by aligning conversational practices with stated values. Teachers can target specific norms to respond to or head off status problems in their classrooms.

As long as linear views of mathematical competence exist, norms will not sufficiently address status problems in the classroom. To broaden student participation, teachers must authentically extend views of smartness in their classroom. Typically, quick and accurate calculation is the primary mathematical competence valued in school. Other forms of competence, such as making key connections or working systematically, happen over more than one class session—but mathematics classrooms often obscure these. To help students understand their own mathematical competencies, teachers can also disrupt status problems by assigning competence to students. Assigning competence is a particular form of praise that is public, specific, and intellectually meaningful and can help shift students' perceptions of the value of their own and others' contributions.

In the next chapter, we will extend these ideas and explore the nature of mathematical tasks that support broadened notions of smartness.

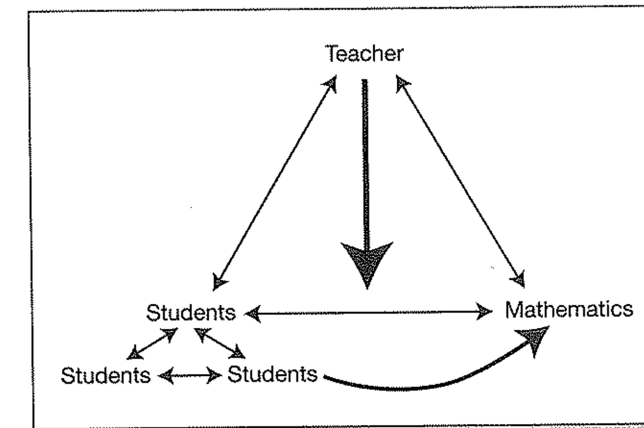

Fig. 3.2. Students' interactions with each other influence their access to mathematics.

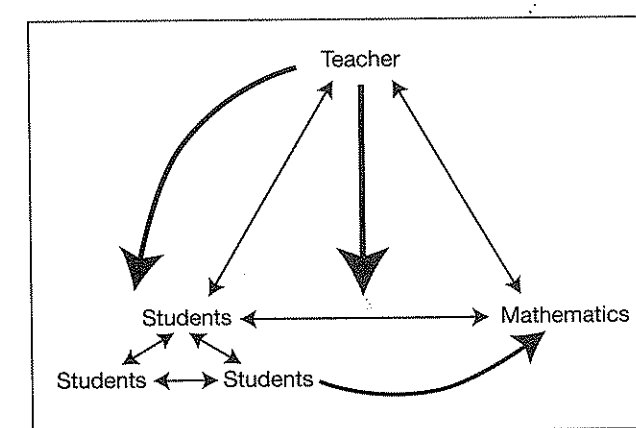

Fig. 3.3. Teachers can actively shift the dynamic among students by using status interventions, supporting equal-status interactions in small groups.