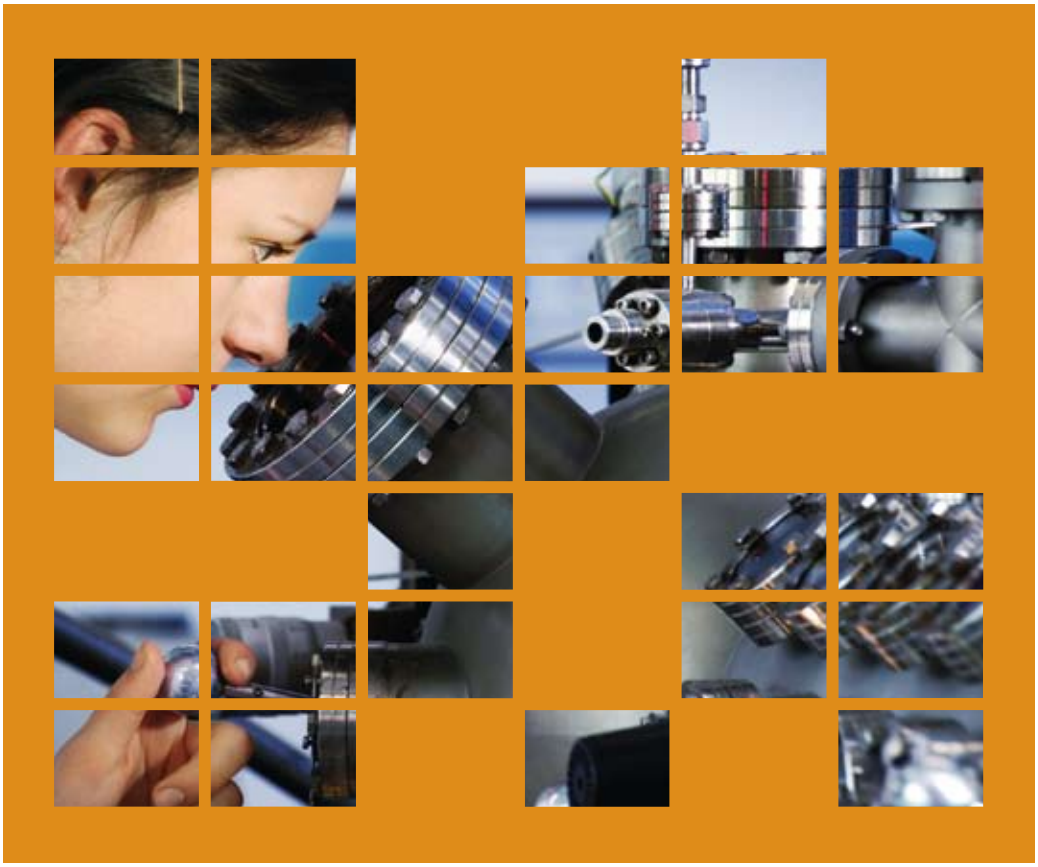


Chapter 2.
Beliefs about Intelligence

So often, when something comes quickly to a student, we say, "Oh, you're really good at this." The message there is, "I think you're smart when you do something that doesn't require any effort or you haven't challenged yourself." Someone said to me recently, "In your culture, struggle is a bad word," and I thought ... "That's right." We talk about it as an unfortunate thing, but when you think about a career in science or math or anything, of course you struggle. That's the name of the game! If you're going to discover something new or invent something new, it's a struggle. So I encourage educators to celebrate that, to say: "Who had a fantastic struggle? Tell me about your struggle!"

—Carol Dweck[3]

Carol Dweck is a social and developmental psychologist at Stanford University. For 40 years she has studied the foundations of motivation. In an interview with AAUW, Dweck described how she first became interested in this topic:

> Since graduate school, I've been interested in how students cope with difficulty. Over the years it led me to understand that there were these whole frameworks that students brought to their achievement—that in one case made difficulty a terrible indictment but in the other case made difficulty a more exciting challenge. In one of my very first studies where I was giving failure problems, this little boy rubbed his hands together, smacked his lips, and said, "I love a challenge." And I thought, "Where is this kid from? Is he from another planet?" Either you cope with failure or you don't cope with failure, but to love it? That was something that was beyond my understanding, and I thought, "I'm going to figure out what this kid knows, and I'm going to bottle it." Over time I came to understand a framework in which you could relish something that someone else was considering a failure.

Dweck's research provides evidence that a "growth mindset" (viewing intelligence as a changeable, malleable attribute that can be developed through effort) as opposed to a "fixed mindset" (viewing intelligence as an inborn, uncontrollable trait) is likely to lead to greater persistence in the face of adversity and ultimately success in any realm (Dweck & Leggett, 1988; Blackwell et al., 2007; Dweck, 2006, 2008).

According to Dweck's research findings, individuals with a fixed mindset are susceptible to a loss of confidence when they encounter challenges, because they believe that if they are truly "smart," things will come easily to them. If they have to work hard at something, they tend to

[3]Carol S. Dweck is the Lewis and Virginia Eaton Professor of Psychology at Stanford University and a leading researcher in the field of student motivation. Her research focuses on theories of intelligence and highlights the critical role of mindsets in students' achievement. She has held professorships at Columbia and Harvard Universities. Her recent book, *Mindset* (Random House, 2006), has been widely acclaimed and is being translated into 17 languages.

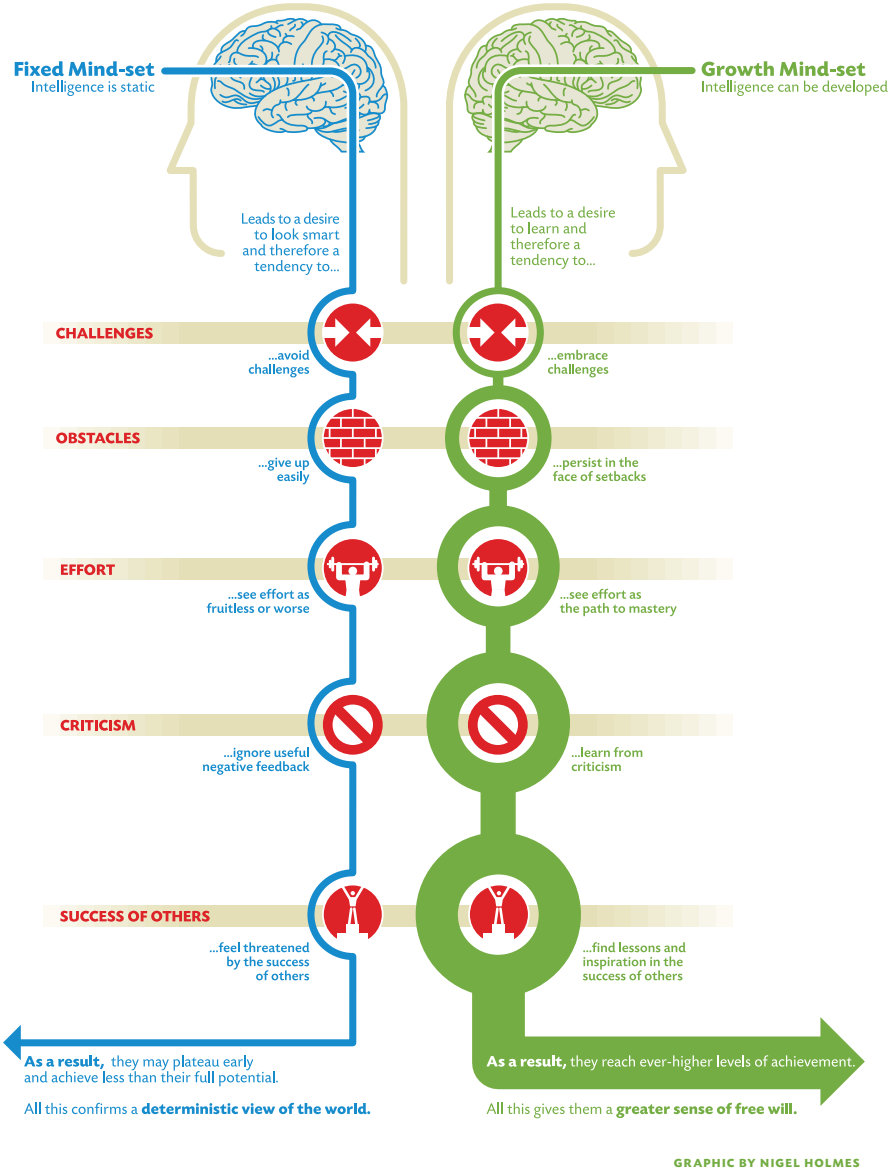
question their abilities and lose confidence, and they are likely to give up because they believe they are "not good" at the task and, because their intelligence is fixed, will never be good at it. Individuals with a growth mindset, on the other hand, show a far greater belief in the power of effort, and in the face of difficulty, their confidence actually grows because they believe they are learning and getting smarter as a result of challenging themselves (see figure 14). Dweck and her colleagues found that students—in both middle school and college—are about equally divided between the two mindsets.

The significance of an individual's mindset often does not emerge until she or he faces challenges. In a supportive environment such as elementary school, students with a belief in fixed intelligence may do just fine; however, upon encountering the challenges of middle school, differences are likely to emerge between students with a fixed mindset about intelligence and those who believe that intelligence can increase with effort.

Because of this, and because math skills are particularly likely to be viewed as fixed (Williams & King, 1980), Dweck and her colleagues chose to test their theory by assessing the mindset of students entering junior high school and then tracking the students' math grades for two years. The study included 373 moderately high-achieving seventh graders in four successive entering classes of 67 to 114 students in a New York City public school. One math teacher taught each grade, and the school had no mathematics tracking. The researchers assessed whether each student held a fixed mindset or a growth mindset at the beginning of the study by asking the students to rank their agreement with a number of statements, such as, "You have a certain amount of intelligence, and you really can't do much to change it" and "You can learn new things, but you can't really change your basic intelligence." Nearly two years later, students who endorsed a strong growth mindset were outperforming those who held a fixed mindset, controlling for prior achievement. The researchers concluded that a student's motivational framework rather than her or his initial achievement determined whether students' math grades would improve.

In light of this finding the researchers conducted a second study to see if an intervention to teach seventh graders that intelligence is malleable would have any effect on their motivation in the classroom or on their grades. This study included 91 relatively low-achieving seventh graders from a different New York City public school. The students were split into two groups for a 25-minute period once each week for eight weeks. During this time, one-half of the students were taught that intelligence is malleable, and one-half were taught study skills. The students in the intervention group were taught that learning changes the brain and they should think of the brain as a muscle that becomes stronger, developing new connections and strengthening existing ones as someone learns. As a result, the person becomes smarter. The lessons also stressed that mistakes made in the course of learning are necessary and help

Figure 14. A Fixed versus a Growth Mindset



Source: Used with permission of Carol S. Dweck.

students learn. The lessons concluded with the message that students are in charge of this process and that being smart is a choice.

The results of this intervention were remarkable. While grades for all students in the experiment were declining on average before the intervention (between spring of sixth grade and fall of seventh grade), as is common in the transition to junior high school, for those students who were taught that intelligence is malleable, the decline in grades was reversed and their average math grades improved within a few months of the intervention. In contrast, the students in the control group continued to experience a decline in grades. This study provides evidence that the learning environment can influence an individual's mindset (fixed or growth).

Dweck's research is particularly relevant to women in STEM, because she and her colleagues have found that for both middle school and college students, a growth mindset protects girls and women from the influence of the stereotype that girls are not as good as boys at math (Good et al., 2003, 2009). If a girl with a fixed mindset encounters a challenging task or experiences a setback in math, she is more likely to believe the stereotype that girls are not as good as boys in math. On the other hand, if a girl believes that doing math is a skill that can be improved with practice, she thinks, in the words of Dweck, "OK, maybe girls haven't done well historically, maybe we weren't encouraged, maybe we didn't believe in ourselves, but these are acquirable skills." In the face of difficulty, girls with a growth mindset are more likely than girls with a fixed mindset to maintain their confidence and not succumb to stereotypes. A growth mindset, therefore, can be particularly useful to girls in STEM areas because it frees them of the ideas that their individual mathematical ability is fixed and that their ability is lower than that of boys by virtue of their gender. Interestingly, in cultures that produce a large number of math and science graduates, especially women, including South and East Asian cultures, the basis of success is generally attributed less to inherent ability and more to effort (Stevenson & Stigler, 1992).

A GROWTH MINDSET PROMOTES ACHIEVEMENT IN STEM

Dweck and others have also found gender gaps favoring boys in math and science performance among junior high and college students with fixed mindsets, while finding no gender gaps among their peers who have a growth mindset (Good et al., 2003; Grant & Dweck, 2003; Dweck, 2006). Dweck and her colleagues conducted a study in 2005 in which one group of adolescents was taught that great math thinkers had a lot of innate ability and natural talent (a fixed-mindset message), while another group was taught that great math thinkers were profoundly interested in and committed to math and worked hard to make their contributions (a growth-mindset message). On a subsequent challenging math test that the

students were told gauged their mathematical ability, the girls who had received the fixed-mindset message, especially when the stereotype of women underperforming in math was brought to their attention, did significantly worse than their male counterparts; however, no gender difference occurred among the students who had received the growth-mindset message, even when the stereotype about girls was mentioned before the test (Good et al., 2009). This research clearly demonstrates that a growth mindset can help girls achieve in math. Dweck explains: "Students are getting this message that things come easily to people who are geniuses, and only if you're a genius do you make these great discoveries. But more and more research is showing that people who made great contributions struggled. And maybe they enjoyed the struggle, but they struggled. The more we can help kids enjoy that effort rather than feel that it's undermining, the better off they'll be."

A GROWTH MINDSET PROMOTES PERSISTENCE IN STEM

Achievement is one thing, but as we've seen, girls and women are achieving at the same levels as boys and men in math and science by many measures yet are not persisting to the same degree in many STEM fields. Ongoing research by Dweck and her colleagues has shown that a growth mindset promotes not only higher achievement but increased persistence in STEM fields as well. Good, Rattan, and Dweck (2009) followed several hundred women at an elite university through a semester of a calculus class. Women who reported that their classrooms communicated a fixed mindset and that negative stereotypes were widespread showed an eroding sense that they belonged in math during the semester, and they were less likely to express a desire to take math in the future. Women who said that their classrooms promoted a growth mindset were less susceptible to the negative effects of stereotypes, and they were more likely to intend to continue to take math in the future. At the beginning of the semester, no difference was seen in interest, excitement, sense of belonging, or intention to continue in math, but by the end of the study, girls who were continually exposed to the fixed-mindset message along with the stereotype that girls don't do well in math lost interest. Dweck and her colleagues are finding similar results in a current study on girls in middle school. Dweck told AAUW, "In all of our research, we've seen that in a fixed mindset, if you are hit with negative messages, you are much more likely to succumb and lose interest." A growth mindset can help maintain a spark of interest.

But how much difference can a growth mindset make? Aren't some people just born with more ability than others? While Dweck does not deny that there can be "talent differences" among students, she reminds us of the difficulty of measuring individual potential: "I don't

know how much of talent—even among prodigies—comes from the fact that a person is born with an ability versus the fact that he or she is fascinated with something and passionate about it and does it all the time. I'm not saying anyone can do anything, but I am saying that we don't know where talent comes from, and we don't know who's capable of what."

MINDSET MATTERS

Dweck's research findings are important for women in STEM, because encountering obstacles and challenging problems is the nature of scientific work. In addition, girls have to cope with the stereotype that they are not as capable as boys in math and science. When girls and women believe they have a fixed amount of intelligence, they are more likely to believe the stereotype, lose confidence, and disengage from STEM as a potential career when they encounter difficulties in their course work. The messages we send girls about the nature of intelligence matter. Eradicating stereotypes is a worthwhile but long-term goal. In the meantime, communicating a growth mindset is a step that educators, parents, and anyone who has contact with girls can take to reduce the effect of stereotypes and increase girls' and women's representation in STEM areas. The more girls and women believe that they can learn what they need to be successful in STEM fields (as opposed to being "gifted"), the more likely they are to actually be successful in STEM fields. Dweck's work demonstrates that girls benefit greatly from shifting their view of mathematics ability from "gift" to "learned skill."

RECOMMENDATIONS

- **Teach children that intellectual skills can be acquired.**

  Teach students that the brain is like a muscle that gets stronger and works better the more it is exercised. Teach students that every time they stretch themselves, work hard, and learn something new, their brain forms new connections, and over time they become smarter. Passion, dedication, and self-improvement—not simply innate talent—are the roads to genius and contribution.

- **Praise children for effort.**

  Praise children for the process they use to arrive at conclusions. It is especially important to give process feedback to the most able students who have often coasted along, gotten good grades, and been praised for their intelligence. These may be the very students who opt out when the work becomes more difficult.

- **Talented and gifted programs should send the message that they value growth and learning.**

  The danger of the "gifted" label is that it conveys the idea that a student has been bestowed with a "gift" of great ability rather than a dynamic attribute that she or he can develop. Talented and gifted programs should send the message that students are in these programs because they are advanced in certain areas and that the purpose of the programs is to challenge students in ways that will help them further develop and bring their abilities to fruition. Consider changing the name of talented and gifted programs to "challenge" programs or "advanced" programs to emphasize more of a growth mindset and less of a fixed mindset.

- **Highlight the struggle.**

  Parents and teachers can portray challenges, effort, and mistakes as highly valued. Students with a fixed mindset are threatened by challenges, effort, and mistakes, so they may shy away from challenges, limit their effort, and try to avoid or hide mistakes. Communicate to these students that we value and admire effort, hard work, and learning from mistakes. Teach children the values that are at the heart of scientific and mathematical contributions: love of challenge, love of hard work, and the ability to embrace and learn from our inevitable mistakes. In Dweck's words, "The message needs to be that we value taking on challenges and learning and growth. Educators should highlight the struggle."