Reading Packet for
"Student Mental Health and Today's College Teaching"
Dr. Michael Pietrus
January 15, 2015

Contents:

1. Terry Doyle, "Who Are Our Learners" from Learner-Centered Teaching (Sterling, 2011)

2. "Psychological Insights for Improved Physics Teaching"
LEARNER-CENTERED TEACHING

Putting the Research on Learning Into Practice

Terry Doyle

Foreword by Todd Zakrajsek

1996-2011 15th Anniversary
Stylus Publishing, LLC.
Sterling, Virginia
WHO ARE OUR LEARNERS AND HOW DO WE GET TO KNOW THEM BETTER?

We must understand the needs and the beliefs of our students as they are, not as we think that they ought to be.

(Rogers & Renard, 1999)

I taught my first class, sophomore English, at an all-girls academy in 1972. As I recall, I was the only male in the building. When I opened my mouth to introduce myself, my voice cracked from nervousness and all the girls laughed. I was embarrassed, but I survived. I went on to get to know the students, appreciate their talents, and gain their trust, and as a result I helped them learn some English literature.

Relating to the Students We Have

What I learned in 1972 was that teaching is in most ways no different than any other human-to-human interaction. If we take the time to get to know our students, respect and value them, explain why we need them to engage in the learning process, and share with them the benefits of learning the subject matter, while proving to them that we have their best interest at heart, then the learning experience is likely to be a very positive one.

This chapter is about the human-to-human interactions that take place in our classrooms every day and how those interactions determine, to a great extent, whether learning is happening. It may be true that some of us learned in spite of our teachers but that was not how we would have liked to learn. Understanding our students and their agendas, attitudes, mindsets, and goals
is necessary if we are to create an engaging and exciting learning environment. We must commit ourselves to unlocking the learning potential of the students who sit in our classes and quit wishing for "better" students.

Chapter 5 has three distinct sections. The first section discusses the work of Carol Dweck. Many in higher education are not familiar with her work on the learning mindsets of students. It is among the most important research ever developed in helping teachers to understand the learning behaviors of their students and how teachers may help students change their learning behaviors, leading to greater academic and life success.

The second section in this chapter offers specific strategies for getting to know our students and for building relationships that create mutual trust, respect, and care. If learning in school meets students' emotional needs, they are more likely to engage in the learning. School becomes a motivating place to be (Rogers, Ludington, & Graham, 1998).

The third section in this chapter looks at the work of Spence Rogers and Lisa Renard who, for 15 years, have been developing a model of relationship-driven teaching. This teaching model is based on research that shows the brain does not naturally separate emotions from cognition, either anatomically or perceptually (Caine & Caine, 1994). The emotional centers of the brain are intricately interwoven with the neocortical areas involved in cognitive learning (Zins, Weissberg, Wang, & Walberg, 2004, p. vii). When we become aware of and tend to the emotional needs of students, we enter the realm of learning as well (Rogers, Ludington, & Graham, 1998).

The Mindsets of Our Students

Since the late 1960s, when she was a graduate student at Yale, Carol Dweck has been exploring the mindsets of how students learn. Recently, she put her findings in her book Mindset: The New Psychology of Success, written for a lay audience (Dweck, 2006). Her research findings reveal that the students we meet every day in our classes have deep-seated views about their own intelligence and abilities. These views affect their willingness to engage in learning tasks and how much, if any, effort they are willing to expend to meet a learning challenge. These deep-seated views of intelligence fall into two categories, which Dweck refers to as fixed mindsets and growth mindsets (Dweck, 2006, p. 67). In a fixed mindset, students "believe that intelligence is a fixed trait—that some people have it and others don't—and that their intelligence is reflected in their performance" (Dweck, 2006). Many students who believe their intelligence is fixed also believe they either shouldn't need to work hard to do well or putting in the effort won't make any difference in the outcome. In fact, they see putting in effort as sending a signal that they are not smart. They have come to the conclusion that learning just comes easy to smart kids.

A growth mindset is one in which students value hard work, learning, and challenges while seeing failure as something to learn from. In this view, students are willing to take learning risks and understand that, through practice and effort, their abilities can improve. A growth mindset believes the brain is malleable and intelligence and abilities can be enhanced through hard work and practice. These students believe only time will tell how smart they become.

These views of intelligence begin to surface in junior high school, where more stringent academic work appears in the curriculum. Students who could be successful with little effort in elementary school begin to doubt their abilities when the learning challenges increase. Dweck discovered that these students had abilities that inspired learner self-confidence—but only when the going was easy. When setbacks occurred, everything changed. Dweck, with her colleague Elaine Elliott, discovered that the difference between those students who were not put off by the setbacks and those that were put off lie in their goals. "The mastery-oriented students (those with growth mindsets) are really hell-bent on learning something," and learning goals inspire a different chain of thoughts and behaviors than performance goals (Dweck, 2007). Students for whom performance is paramount want to look smart even if it means not learning a thing in the process or putting others down to make themselves look better. For them, each task is a challenge to their self-image, and each setback becomes a personal threat. So they pursue only those activities at which they're sure to shine—and avoid the sorts of experiences necessary to grow and flourish in any endeavor (Dweck, 2007, p. 58).

Dweck is careful to point out that these mindsets are contextual. The same student who believes he cannot do math because he wasn't born with math abilities and that working harder or getting extra help won't help him learn math will take guitar lessons and practice his guitar three hours a day because he knows only practice will improve his playing abilities. Another surprising finding from Dweck's research is that there is no relationship between students' abilities or intelligence and the development of a growth mindset. The explanation for one bright student developing a fixed mindset while another develops a growth mindset has to do with how each student
views ability. In the case of a fixed mindset, through misinformation and a lack of input to the contrary from others (including teachers), the student has accepted a belief system that to him makes sense: “The work is getting harder. I must not be all that smart and if I don’t have the ability, then effort won’t make any difference.”

The significance of this research for all of us in higher education is profound. Each fall, tens of thousands of students enroll in classes that they believe they do not have the ability to pass. They also believe that going to tutoring, seeing us in our offices for extra help, or just working harder will make no difference. They hold this belief because their view of their own intelligence is flawed. One of our jobs is to help them recognize that their current level of performance reflects only their current skills and efforts, not their intelligence or worth. We need to correct their misconceptions and get them to see that all of us have the potential to get smarter every day.

Recognizing Our Students’ Mindsets

When I first read Carol Dweck’s research findings, my mind turned to how I had been viewing my students for many years. I realized that I always saw a lack of effort as laziness and not going to tutoring or coming to my office for extra help as being irresponsible or immature. I realize now that, for many of my students, these behaviors were a direct reflection of their mindsets. They held a belief that they had never been a good reader and nothing was going to change that now. I also recognized that those students who would work hard to improve probably held a completely different mindset than my students who struggled or did not try. They weren’t smarter; they just saw themselves differently.

To help us recognize the characteristics of our students’ behaviors and attitudes that are displayed in each mindset, I am turning to the work of Michael Richard, who divided the characteristics into six areas for both the fixed mindset and the growth mindset.

Fixed Mindset

1. **Self-image**. Because students see their intelligence as fixed does not mean they don’t continue to seek a positive self-image. This action takes the form of wanting to look smart by taking on only easy tasks, trying to make others look dumb, and/or discounting others’ achievements.
2. **Challenges**. Students with a fixed mindset often stick to what they know they can do well. Other challenges are to be avoided because they present a risk to their self-image should they fail. As an advisor, I heard for years students ask, “Are there some easy classes I could take?” This request is likely the sign of a fixed mindset.
3. **Obstacles**. In the case of obstacles, which are defined as things that are external or beyond one’s control and therefore harder to avoid, students often make excuses or avoid them by being absent.
4. **Effort**. Students’ view of effort is that it is unpleasant and does not pay off in any positive gains; therefore, it is to be avoided. Their perception of what “great effort” is can fall quite short of what is actually required to succeed academically. This may also contribute to their view of effort as futile.
5. **Criticism**. Any criticism of students’ abilities is seen as criticism of them at a personal level. Useful criticism is usually ignored or, even worse, seen as an insult. This personal response to criticism leads to less and less chance of improvement because they are not open to using any of the feedback that could help them improve.
6. **Success of others**. Students with a fixed mindset see others’ success as making them look bad. They may try to convince their peers that others’ successes were due to luck or some objectionable actions. They may even try to distract from the success of others by bringing up their own unrelated personal successes or previous failures of those persons currently successful.

Growth Mindset

1. **Self-image**. Students’ self-image is not tied to their abilities because they see their abilities as something that can be further developed and improved. Their desire to learn is paramount.
2. **Challenges**. Challenge is embraced because students believe they will come out stronger for facing it. They believe they will discover valuable information by engaging in the effort.
3. **Obstacles**. Because their self-image is not tied to their success or how they look to others, students see failure as an opportunity to learn. So, in a sense, they win either way. An obstacle is just one more thing on the road of learning and improving.
4. **Effort**. Students see effort as necessary if growth and eventual mastery is to be gained. It is viewed as a natural part of the learning process.
5. **Criticism**. Although these students are not any more thrilled about hearing negative criticism than anyone else, they know it is not personal and that it is meant to help them grow and improve, which
they believe they can do. They also see the criticism as directed only at their current level of abilities, which they see as changing with time and effort.

6. Success of others. The success of others is seen as inspiration and information that they can learn from.

Changing Our Students’ Mindsets

A classroom that teaches students to equate their intelligence and their worth with their performance will, in general, stifle the desire to learn and will make students afraid of challenges. After all, the next challenge may show you up and lead you to be branded as less intelligent or less worthy. (Dweck, 2006)

The question that often arises as a result of reading this research is, “Why don’t students or their teachers recognize a fixed mindset and do something about it?” From the students’ view, as mentioned earlier, they often have no other counsel that might provide a different view, and protecting their self-image is very important. In addition, students can hide this fixed belief by wrapping it in a sense of entitlement and selective self-validation (Atkins, 2007).

Teachers are often unfamiliar with this research and attribute these behaviors to other causes such as laziness or immaturity, as I had done for years. How do we help our students to change their mindsets? Dweck’s research, conducted in 2007 with junior high students, offers some important insights. The study involved teaching an eight-session workshop for 91 students whose math grades were declining in their first year of junior high. Forty-eight of the students received instruction in study skills only, whereas the others attended a combination of study skills sessions and classes in which they learned about the growth mindset and how to apply it to schoolwork. Included in the eight sessions was the reading and discussion of an article entitled, “You Can Grow Your Brain.” Students were taught that the brain is like a muscle that gets stronger with use and that learning prompts new neurons to grow in the brain. From such instruction, many students began to see themselves as agents of their own brain development. Students who had been disruptive or bored sat still and took note. One boy said, “You mean I don’t have to be dumb?” The results of the research showed training students to adopt a growth mindset about intelligence had a catalytic effect on motivation and math grades; students in the control group showed no improvement despite all the other interventions (Dweck, 2007, p. 56).

Dweck’s research has found that, with students of all ages, from early grade school through college, the changeable view can be taught. Students can be taught that their intellectual skills can be cultivated through their hard work, reading, education, confronting of challenges, and other activities of growth (Dweck, 2007). Dweck explains that students may know how to study, but they won’t want to if they believe their efforts are futile. “If you target that belief, you can see more benefit than you have any reason to hope for” (Dweck, 2007). Researcher Joshua Aronson of New York University demonstrated that college students’ grade point averages go up when they are taught that intelligence can be developed (Aronson, 2007).

The following are several specific suggestions that Dweck offers about how we can help our students to change their mindsets:

1. Praise students’ effort and strategies, not their intelligence. Praising students’ intelligence, even after great performance, makes them feel good in the short run, but research shows it had many, many negative effects. In contrast, praising students’ effort had many positive effects (Dweck, 2007). The dilemma is this: If the praise makes students believe they did well because of their intelligence, what are they to think when they do poorly?

2. Tell students they can grow their own brains. Each of us need to share with our students the neuroscience research findings that clearly show new neuron networks are created and become permanent through effort and practice. These new networks make us smarter. This is vital to shifting students away from a fixed mindset. I have detailed much of this information in chapter 1 and on my website, www.learnercenteredteaching.com.

3. When students fail, focus feedback on having them increase their effort and use improved strategies. This is a key ingredient in creating growth mindsets. We need to focus our feedback on how students can improve, which usually involves sharing new or different strategies for them to try and strongly suggesting they put forth more effort. The more specific the suggestions we share, the more likely students will improve. If a student gives me feedback that my tests are too hard, it is difficult for me to know what changes to make because the feedback is just too vague. If I am to write a better test, I need specific details about what to change.

4. Help students understand that their ability to face a challenge is not about their actual skills or abilities; it’s about the mindset they bring to
Building Relationships That Enhance Learning

Students engage in learning when it is meaningful—but meaningful means when the activity satisfies a deep-rooted human emotional need. (Glasser, 1998)

A question one might ask about relationship-driven teaching is, “Can there be any other kind of teaching?” I suspect some might say, “Sure, if you consider that many teachers have little or no relationship with their students but march forward unconcerned, introducing new information, assigning homework and giving tests.” In a learner-centered model of instruction, however, relationships play a major role in optimizing students’ learning.

Consider these two common learning situations as examples. First, we introduce a new lesson that is difficult and challenging for students, and we know they will struggle with their initial understanding of the material or new skill. In this learning situation, students need to be able to trust that we have their best interest at heart and that we would never put them in a learning situation that was too difficult for them to succeed. What will sustain our students in this difficult learning situation is a trusting relationship that we have nurtured and built over time through deliberate efforts to engage with them on both personal and professional levels. It is the trust that helps them to persevere.

A second example is giving criticism. Let’s say that we have just finished checking a major piece of work and are not thrilled with the level of competence displayed or the effort put forth. We recognize the need to give significant amounts of constructive criticism that address both the substance of the work and the effort, or lack of it. The likelihood of our criticism being accepted and valued by our students is tied directly to the relationship we have with them. If they know we care about them and want only for them to improve and reach their potential, then there is great hope that the feedback will be accepted and used to improve future work.

Given the amount of time and effort we put into our teaching, it seems to be common sense that we would want to do everything we could to have our efforts with our students bear fruit. This means creating a learning environment where students want to be because they know they are valued and respected. I am not suggesting that we must be their friends or buddies. After all, how many 18-year-olds want to hang out with a 59-year-old guy who loves to read? I am simply saying that in any human interaction, and

What Can Students Do to Help Themselves?

The answer is a lot of self-talk. Carol Dweck offers the following suggestions:

Step 1. Students need to learn to hear their fixed mindset “voice.” Students can learn to listen and recognize when they are engaging in a fixed mindset. Students may say to themselves or hear in their heads things like, “Are you sure you can do it? Maybe you don’t have the talent.” Or “What if you fail—you’ll be a failure.”

Step 2. Students need to recognize that they have a choice. How they interpret challenges, setbacks, and criticism is their choice. Students need to know they can choose to ramp up their strategies and effort, stretch themselves, and expand their abilities. It’s up to them.

Step 3. Students need to talk back to themselves with a growth mindset voice. The fixed-mindset voice says, “Are you sure you can do it? Maybe you don’t have the talent.” The growth-mindset voice answers, “I’m not sure I can do it now, but I think I can learn to with time and effort.”

The fixed-mindset voice might also say, “What if you fail—you’ll be a failure.” But the growth-mindset voice can answer, “Most successful people had failures along the way.”

Step 4. Students need to take growth-mindset action. The more our students choose the growth-mindset voice, the easier it will become for them to choose it again and again (Dweck, 2009).
especially in one as important as the education of our students, the degree to which there is trust, respect, and caring often determines how much effort one is willing to put forth. If I have no relationship with you, then you are less inclined to do anything for me beyond common courtesies. For example, I have asked dozens of faculty members during my presentations on learner-centered teaching (LCT) if they would give me $20.00. I tell them I could really use the money. Their response varies from a polite no to “Are you crazy?” What’s my problem in getting the $20.00? I have no relationship with these faculty members and I have not given them any good reasons to give me the money. The point I am trying to make is that, if I could establish a relationship with them built on respect and trust, they would be more willing to give me the money. And if we were to build a relationship, I would feel the need to give them good reasons for needing the money. This is how our classrooms work, too. If the positive relationship is not in place, the willingness to try, learn, and succeed won’t be either.

Using Common Sense in Building Relationships With Students

I taught my first class in 1972. Since then I have learned a few things I think have real value in building relationships with students. The following are my suggestions.

1. Treat students like they were your son or daughter. My wife Julie, who coordinates our Hospitality Management Program here at Ferris State University, has used this as her motto for 25 years. She says that it helps her to have more patience and to work to connect on a more personal level with her students. She tells me all the time, “That could be Brendan or Jessica [our kids] sitting there, so I give my students the same level of interest, care, and respect I would give them.” How has this motto worked out for her? Since she took over the leadership role, the program has more than tripled in size. Almost daily, she helps students transferring into the program because their roommate or friend told them about the amazing personal interest that the hospitality faculty members show to their students. It has also allowed Julie to give her students much needed criticism about their professional development without them directing resentment or hostility toward her or the program. The results are better prepared graduates whom companies love to hire, with an impressive 98% job placement rate after graduation.

2. Give students some choice in the learning process. This is a topic I cover in detail in chapter 6. The key point is that giving students learning choices sends a message of trust in their decision-making abilities, trust in their ability to take responsibility for their learning, and a willingness to let students use their talents (often in ways not found in most syllabi) to demonstrate what they have learned. The result is often discovering the talents that our students have that don’t fit traditional assessment measures.

3. Talk with students one to one whenever possible. It might sound a bit strange, but I have met many teachers throughout my career who don’t like young people. They don’t like talking with them or being with them. I guess someone forgot to tell them who they would be teaching when they were hired! One of the easiest ways to build positive relationships with students is just to talk with them. Talk with them before and after class, but also during class. A few minutes of instruction time spent building relationships can go a long way toward improving engagement in the learning process. Students want us to talk with them. They don’t always show it, but research says that it’s true and that is has academic benefits. In the book Building Academic Success on Social and Emotional Learning: What Does the Research Say? by Zins, Weissberg, Wang, and Walberg (2004), the authors show that when we engage with students in building personal and professional relationships in which students can be partners, they not only feel better about the learning process, but they also learn social and emotional skills that aid them in their professional development and increase their academic performance. In addition, it’s just plain fun.

I have always really enjoyed first-year students. I’m not saying that they can’t be frustrating, but they are going through so much change that I find a great sense of purpose in helping them make these changes. What do I get for my effort? I get more relaxed learners who enjoy my class and learn that they can become better readers. I know that in the beginning of the semester, my students are not happy to be taking what in their minds is a grade-school–level class in reading. I can either choose to address this attitude and work to connect with them by using humor, stories, personal anecdotes, and assurance that the skills they are being asked to improve are vital to their college success, or I can face a group of grumpy young people three times a week. I vote for the former. Plus, they tell me the most
amazing stuff about their lives, and these confidences enhance my joy in teaching. They also write some entertaining things in their papers, like the student who wrote, “Jesus went out from Galilee to teach the genitals.” Either he meant “the gentiles,” or we were reading different stories!

4. Care about them personally and educationally. I do not doubt for a minute that 99% of teachers care about their students and want them to succeed. However, holding that belief inside is different than expressing it openly and often to our students and demonstrating it by our actions. I know my children know I love them, but I also know they need to hear me say it and show it. We need to use this same thought process in our courses. Tell students you value them and demonstrate it by giving them input, choices, and some control over their learning. Listen to their issues and complaints, and appreciate where they are coming from. This doesn’t mean you need to give in or lower standards; it just means caring about your students both personally and educationally.

5. “Never attribute to malice what you can attribute to ignorance” (Ruggerio, 1995). I was introduced to this concept by Vincent Ruggerio (who has written widely on critical thinking) when he spoke on our campus several years ago. The idea that our students are often unaware that their actions are angering or out of step with the expected behaviors of college students in a learning environment was something I had not really considered. I recognized that my students in particular were immature in their academic readiness and that immaturity often caused them to behave in ways that were inappropriate for a college learning environment. However, I had never really considered it might be because they didn’t know how to behave or that, due to their lack of metacognition or prior knowledge, they didn’t understand the social clues that their behavior was inappropriate. This idea changed the way I looked at their behaviors. I began to see each instance of students’ behavior issues, both personal and academic, as opportunities to teach them the proper way to behave rather than as reasons to be angry or annoyed with them. I found that when I used each instant as a teaching moment, I not only had better behavior in the class, I also had better relationships with my students. I’m certain that students sometimes act out of malice, but these actions are few. Much more often, students are unaware that

their actions are bothering someone, or they are ignorant of the protocol of the classroom.

Principles of Relationship-Driven Teaching

Spence Rogers and Lisa Renard, in the September 1999 issue of Personalize Learning Journal, outlined two basic principles of relationship-driven teaching:

1. Seek first to understand your students. What do they find motivating? What do they believe in?
2. Manage the learning context, not the learners. Establish conditions that are likely to foster intrinsic commitments to quality rather than seeking to control students; students will seek to do what needs to be done.

Standards to Meet

Rogers and Renard also set out the following list of standards all teachers need to work toward:

1. Establish a safe classroom.
   - Safe from embarrassment and physical threat. If students see you as removing threats, they will feel safe.
   - Only when students feel safe will they take learning risks.
   - Teachers do not penalize themselves when they try new strategies or ideas. We just reteach and try again until we have met our teaching goal. Students need to have dress rehearsal time, too.
2. Strive to make the work students do be of value to them.
   - Ask students to find ways in which the information can be used outside the classroom, in real-world applications.
   - Embed the content in activities that students find interesting, like field trips, hands-on simulations, and role-playing scenarios.
   - Brainstorm with the students for ways that the learning can be more pleasant or unique.
   - Find an audience for the students’ efforts. Present their work to other classes, people in industry, or other faculty members.
   - Have students chart their progress.
• Offer clear, meaningful feedback that requires the students to apply the feedback to improve their learning.

4. Establish a caring classroom.
• Smile!
• Use inviting language: “I would like us all to . . . .”
• Build community: “We are all in this together.”

5. Use best practices.
• Learn how to be a better teacher.
• Talk with colleagues, read the literature, and use the teaching strategies that you have had success with.
• Make learning active, authentic, challenging, and meaningful.

We Are All on the Same Team

Teaching is not an us-versus-them competition. Perhaps some days it feels like that, but that feeling won’t help optimize our students’ learning. We are all on the same team, and we need to communicate that to our students every day. Our goal is simple. We want them to be academically and personally successful, and our promise is to do whatever we can to help them make that happen. Our students need to know we can’t make them succeed: Their success will always be up to them. But at the same time, they need to know that we will never act as a barrier to that success. We communicate this support in the relationships we foster.

SHARING CONTROL AND GIVING CHOICES

One important rule for helping students learn is to help the learner feel she is in control.

(Zull, 2002)

The first thing our controlling brain sees in a reward or punishment situation is a loss of control.

(Kohn, 1993)

At the 2007 Australian Society for Computers in Learning in Tertiary Education (ASCILITE) Conference, there was an amazing presentation on an authentic learning simulation developed to enhance the preparation of preservice teachers. The presenters’ goal for this simulation “was to design a learning environment that allowed for: multiple means of representation, providing learners various ways of acquiring information and knowledge; multiple means of expression to provide learners alternatives for demonstrating what they know; and multiple means of engagement to tap into learners’ interests, challenge them appropriately, and motivate them to learn” (Ferry, Kervin, Carrington, & Pricevich, 2007). Or, simply put, the point of the simulation was to give learners choices in how they engaged with the material and control over how they would demonstrate what they had learned. This is learner-centered teaching (LCT) at its best.

Process of Choice

Our students make choices all the time about their learning. They choose to engage in learning or tune it out. They choose to do the assignment or blow
Many physics faculty in the US are looking for ways to increase the diversity of the physics community to enhance the long-term health of our field in an increasingly diverse society. They attempt many things to help their students—particularly from historically underrepresented groups such as women, Latinos, and African Americans—to succeed. Here are three approaches that caring faculty commonly try.

Professor Jones wants all her students in a class for potential majors to succeed, and she hopes to increase the diversity of physicists. So she schedules a weekly help session for students who might be having difficulty, and she personally invites all the women and minorities to attend.

Professor Smith is concerned about the high failure rate in his introductory physics course. To encourage students to work harder, he starts the first class by telling the students how difficult the course is and that usually about 30% of the students fail. They must study hard, particularly if they think that their background preparation is weak.

Professor Doe wants all students to feel encouraged and capable in class, so whenever a student asks a question or offers a comment, he says it is a “great” question or comment. He is particularly enthusiastic if the student is a woman or person of color. Whenever he critiques students’ homework, particularly the work of women and minorities, he prefaches it with “Good job, but . . . .”

Recent research in social psychology indicates that those well-intentioned efforts would likely backfire, undercutting the motivation and achievement of many students, especially those from underrepresented groups. For most physicists, that is a profoundly nonintuitive finding.

Many factors contribute to the lack of diversity in physics, including large societal issues over which an individual faculty member has little control. But advances in social psychology have shown that what happens in the classroom also plays a significant part and that every faculty member can take specific actions to make a difference. In this article we summarize that work, give examples of brief classroom interventions that have improved the success of students from groups underrepresented in physics, and explain why the well-intentioned efforts of Jones, Smith, and Doe will likely fail.

How students see the classroom
The problem with the efforts described above is that the professors did not fully understand their students’ perspectives. As teachers, we tend to focus on what content to teach and how to present that content. While those issues are important, a focus on them can cause us to overlook how students feel in class and the associated social dynamics. Just as

Lauren Aguilar is a postdoctoral research fellow and Greg Walton is an assistant professor in the department of psychology at Stanford University in Stanford, California. Carl Wieman is a professor in the department of physics and in the Graduate School of Education at Stanford.
Do I belong in a physics class? Will the teacher and the other students respect me? 

This article is copyrighted as indicated in the article. Reuse of AIP content is subject to the terms at: http://scitation.aip.org/termsconditions. Downloaded to 171.64.40.115 On: Fri, 02 May 2014 21:09:48

As illustrated in figure 1, the theory behind the interventions involves a combination of how people faculty members start each course wondering how they will be perceived and hoping that students will like them, students come to class with their own questions and concerns. Those include the following:

- Do I belong in a physics class?
- Am I smart enough to be successful in physics?
- Will the teacher and the other students respect me?

The coupling between peoples’ internal concerns and the social dynamics of their environment determines how they perceive and respond to events. In educational settings, those responses can help or hurt motivation and success. People who are part of a group that is recognizably different (see figure 1) tend to be particularly attentive to negative social dynamics and more likely to suffer detrimental effects. In a physics class, two psychological dynamics are particularly important to the academic success of students from underrepresented groups: beliefs about intelligence and awareness of negative stereotypes.

Can I get smarter?

How quickly students learn is affected to a large degree by whether they believe that ability in physics or some other area of interest is something that can grow and develop like a muscle (a “growth mindset”) or something you are born with and can do little to change (a “fixed mindset”). Students with a fixed mindset who encounter a difficult problem or concept see that difficulty as evidence that they lack ability. Across many different research studies, such students tend to seek out easy problems (to prove their ability) and avoid challenging ones that would help them learn. They avoid speaking up in class or in group discussions so they don’t seem stupid. When they face setbacks, they lose motivation and turn their attention to subjects for which they feel more “natural” ability.

In contrast, students who have a growth mindset see difficulties as opportunities to learn—“I love a good challenge!” So they work harder and ask more questions, which naturally improves their learning. In physics, students inevitably encounter material that they find demanding. Their mindset plays a substantial part in how they respond to that situation and their subsequent level of success.

Students are particularly likely to see physics ability as something that is innate, because our culture consistently sends them that message. Science in general, and particularly math-intensive science like physics, is portrayed as something only special and different people can do. It is the conventional, if erroneous, wisdom that the population can be divided into math-brained and non-math-brained people. In a new line of research, Carol Dweck and coworkers have begun to study the impact on students of teachers with a fixed mindset. The preliminary results are disturbing, although not entirely surprising: Professors with a fixed view of math ability see struggling math students as having lower potential. They comfort them and assign them less homework, which actually undermines students’ motivation and expectations for success.

Do I belong?

Another drag on motivation and learning is the worry students have that people like them don’t belong in physics and that the teacher or other students will view them negatively because of their group. In demanding intellectual settings, people are often aware of negative stereotypes about their group. In the physical sciences, those stereotypes are most threatening for women and non-Asian ethnic minorities.

That awareness casts daily events in a new light. It is sensible for a student who is one of only a few women in a physics class to wonder whether women belong in physics. If a classmate excludes her from a study group, she might infer that women, in fact, don’t belong in physics. When a teacher criticizes minority students’ work, the students might wonder whether the criticism reflects a negative judgment on their ability and potential. Students who are aware of negative stereotypes tend to ask fewer questions in class and interact with fellow students in less educationally and socially beneficial ways. They feel more stress and distraction, which results in reduced learning and poorer exam performance.

Social psychologists have studied beliefs about intelligence and negative stereotypes across a wide range of contexts. The results have been consistent across many different educational levels and academic subjects, including undergraduate physics, chemistry, math, and engineering. Student beliefs take on extra importance during transitions from high school to college and from college to graduate school, as each transition introduces new standards and new social situations with new unknowns.

Fortunately, the research has also shown that the detrimental impacts of the psychological factors discussed above can be changed with surprisingly brief interventions. The effects of such interventions seem almost magical—for example, a one-hour reading and writing exercise enabled African American college students to improve their grades and even reduce their visits to the doctor, three years after they completed the exercise. The apparent magic is simply the result of the underlying science behind the interventions.

As illustrated in figure 2, the theory behind the interventions involves a combination of how people...
interpret ambiguous events and the feedback loops that come into play. Any social interaction can be interpreted in multiple ways. How a person construes a particular event then plays out over time in self-fulfilling ways. For example, if individuals interpret not receiving an invitation to a social event as indicating that their coworkers do not like them, they will be likely to withdraw and become less friendly. That makes it more likely their coworkers will, in fact, come to dislike them. Alternatively, those who interpret the event as innocuous will be more likely to behave in ways that sustain a positive working relationship. When people tend to interpret events in global, negative ways, a small, well-timed intervention that suggests an alternative perspective can have lasting effects.

We can illustrate the idea with an example familiar to many academics—the assistant professor worried about receiving tenure. Those of you who have been in that situation know how a passing comment by the department chair about not bothering with the informal six-month review or that casual faculty lunch that took place without you can take on quite sinister implications. They reinforce your worry that the faculty are planning to get rid of you. The result is that you feel even more threatened and are more inclined to interpret each new event as reinforcing your fears. Rather than focusing on doing good research and teaching, you spend more time and energy stressing about tenure. In fact, your colleagues’ intentions might have been the opposite of what you surmised. It could well have been that the chair and other faculty thought you were a successful and busy assistant professor, and they hoped to shield you from unwelcome distractions.

In such cases, your negative interpretation can be reversed by a rather brief intervention such as a 10-minute talk with the department chair in which you are reminded that most assistant professors worry they may not get tenure, but they usually do, and you learn that the department thinks you are doing well and will have no problem. Now, rather than wasting time and energy worrying, you are less stressed and more focused. You perform better in your work and are friendlier with your colleagues, which further solidifies your chance of getting tenure.

**Keys to effective interventions**

Effective psychological interventions are precise tools that encourage students to think about their place in school in more hopeful, optimistic ways. Such interventions, typically short reading and writing exercises, target worries like “Maybe I don’t belong” in ways that lead students to entertain benign interpretations of difficulties. Examples of such interventions and the anxieties they address are shown in the table on page 46.

Successful interventions include several key elements. First, they deal with the specific concerns students have that prevent them from taking advantage of academic resources, including beneficial interactions with their teachers and fellow students.

Second, they deliver their message without singling out any specific groups, as such special attention may do more harm than good. For example, if an African American woman in an introductory physics course gets an email inviting her to participate in a program to help nontraditional students in physics, but her classmates do not get the email, she is likely to wonder why she is being singled out. She may feel stigmatized or devalued, thinking that others expect her to need help or do poorly because of her race or gender. So all students in the class should participate equally, and the intervention should not seem remedial or be presented as something that some students need more than others.

Third, the interventions employ methods that psychologists have found to be particularly persuasive and long lasting. Rather than subjecting students to a direct appeal such as “All students can be good in physics if they work at it,” the interventions get students to generate the desired message themselves. For example, a student might be told, “Here’s some information about how the brain develops and gets ‘smarter’ as a result of mental exercise. Think about your own experience—how you have learned material that first seemed impossible. Write a letter for younger students summarizing what you now know about the brain and how that information can be helpful when school is hard.”

Psychologists call that letter-writing instruction the saying-is-believing technique. It allows students to pull from their own experiences and integrate them with the message. Thus the intervention is more personal and more persuasive. Rather than being treated as needing help, the student acts as a benefactor and an expert who possesses important information to share with other students.
Fourth, interventions should not be presented as interventions and, in general, should be delivered briefly and without repetition. That way, students do not think they are “receiving treatment,” which could undermine or reverse the desired effect. Changing students’ psychology is fundamentally different from teaching physics content.5 The more students think about and are taught physics, and the more explicit their learning goals, the more students learn. But with psychological interventions, often less is more.

**Practice in an educational setting**

We now turn to more detailed descriptions of the interventions summarized in the table. Although we will describe how each could be implemented in an introductory physics course, they also have been used in engineering and mathematics courses in middle school, college, and graduate school.

The social-belonging intervention addresses the tendency of women and underrepresented minorities who perceive the negative stereotypes and underrepresentation of their group as questioning whether they fit in. If you have that worry, then when something negative happens, like being left out of a study group or doing poorly on an exam, it’s easy to think you don’t belong in general. The social-belonging intervention gives students a more hopeful, optimistic way to understand such negative experiences.

Early in the term, students in an introductory physics class are given the results of a survey of successful graduates of the same course. The survey indicates that most students worry at first about whether they belong in physics, but over time they come to feel at home. The students read quotes attributed to a diverse group of previous students—rich stories that make worries about belonging in physics seem normal and temporary. Here’s an example from a study currently being carried out by two of us (Aguilar and Walton) and colleagues: “When I started physics, I worried that I was different from the other students and whether I had the right preparation. But eventually I realized that almost everyone worries at first about whether they fit in, and feels isolated and insecure at times—it’s a big class and it’s challenging. It’s just something everyone goes through. Eventually you find study partners and make friends. Now it seems ironic—everybody feels like they are unprepared or different from everyone else when they start taking physics, when really we’re all going through the same things.”

Students are then told that as new physics students, they are the experts in what first entering physics is like. They are asked to reflect on their own experience so far, and why students at their current stage are likely to worry at first about their belonging in physics and why that worry typically lessens with time. They are asked to share their insights by writing a letter to a future physics student describing what entering physics is like, ostensibly to help that future student adjust.

Such an intervention can be done in a class period or as part of a homework assignment. In one application, an intervention improved women’s performance enough to eliminate the substantial gender difference in first-year grades among students enrolled in engineering majors with less than 20% women. A similar social-belonging intervention with new college students improved minority students’ grades for the next three years, halving the achievement gap between majority and minority students.6

Another activity, the growth-mindset intervention, teaches students that intelligence is not a fixed quality—people aren’t “smart” or “dumb.” Instead, intelligence grows with hard work on challenging problems, help from others, and effective strategies. Those ideas can be conveyed in various ways—for example, with information from neuroscience about how the brain grows with learning or with testimonials from older students. In an extensive set of rigorous experiments, even relatively brief messages and activities that support a growth mindset have improved the academic performance of college

---

**Interventions and implementation**

<table>
<thead>
<tr>
<th>Intervention type</th>
<th>Core psychological concern addressed</th>
<th>Helpful intervention message</th>
<th>Typical implementation format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social belonging</td>
<td>When I feel excluded or disrespected in school or class, does it mean I don’t belong there in general?</td>
<td>At first, all students worry about whether they belong, but with time they come to feel at home.</td>
<td>One-hour-long reading and writing (R&amp;W) activity in or out of class.</td>
</tr>
<tr>
<td>Growth mindset</td>
<td>When I struggle, does it mean I can’t do it?</td>
<td>Challenges and struggles are opportunities for the brain to grow and get smarter.</td>
<td>One-hour-long R&amp;W activity in or out of class.</td>
</tr>
<tr>
<td>Values affirmation</td>
<td>In school, am I more than just a member of a group that is negatively stereotyped?</td>
<td>Class is a place where I can articulate and express my personal values.</td>
<td>One or two 15- to 20-minute R&amp;W activities in or out of class.</td>
</tr>
<tr>
<td>Critical feedback with assurance</td>
<td>When I receive critical feedback, does it mean that the teacher judges me or is biased against me?</td>
<td>Instructors give critical feedback because they have high standards and are confident their students can reach those standards.</td>
<td>Brief notes attached to teacher feedback or a one-hour R&amp;W activity.</td>
</tr>
</tbody>
</table>

See reference 5 for a comprehensive review of social-psychological interventions in education.
Critical feedback can raise important questions for students, especially those in a new environment. “Why are you giving me this feedback?” “Are you judging me unfairly?” “Are you trying to help me improve?” Students who face negative stereotypes deal with extra ambiguity. They may ask, “Are you biased? Do you think people like me can’t succeed?” That kind of mistrust can prevent students from treating critical feedback as valid and learning from it.

Critical-feedback-with-assurance interventions clear up the ambiguity in critical feedback. They go beyond vague bromides like “Good job, but . . .” to communicate that critical feedback reflects high standards and the teacher’s confidence that the student can reach those standards.12

In one study,13 the teacher’s feedback to students was accompanied by a note that said, “I have high standards but I believe you have the potential to meet them, so I am providing this critical feedback to help you meet those standards.” That simple assurance increased, from 17% to 72%, the number of African American students who chose to revise their essay when encouraged to do so (see figure 4). In a related study, students were taught to view critical feedback in general as reflecting high standards and the instructor’s confidence in their ability to meet those standards.11 The study used a saying-is-believing procedure like that of the social-belonging intervention. As a result, the semester grade-point averages of urban black youths increased by one-third of a grade point and the black–white achievement gap decreased by 40%. In a laboratory study, women college students doing projects in the natural sciences were 6.5 times as likely to make substantive improvements to their work in response to critical feedback when the criticism was accompanied by the statement of high standards and assurance.12

**Unintended messages**

Do you want to use psychological interventions in your classes? We hope so; however, you’ll need to implement them with care, since well-intentioned efforts can backfire. In this section we’ll discuss how to avoid common pitfalls.

---

**Figure 3. Values-affirmation interventions** reduce the academic gender gap. (a) Overall mean scores for four exams administered during a semester-long introductory physics course, adjusted for baseline math performance. The values-affirmation group participated in an intervention as described in the text; the control group did not. (b) End-of-semester scores for the Force and Motion Conceptual Evaluation standardized exam, adjusted for beginning-of-semester FMCE scores. In both panels, the error bars represent one standard error. (Adapted from ref. 11.)
Psychological interventions are not magic bullets. To be effective, they have to speak directly to students’ worries and concerns. Delivering them requires one to be thoughtful and to have a good understanding of the students’ perspectives. Interventions to instill belonging, a growth mindset, or a sense of affirmation hinge on subtle and not-so-subtle details of implementation. Classroom activities or messages like “everyone belongs here” that promote a rah-rah ethos or that express platitudes can backfire; they make students feel they are the only ones with worries, inevitably at times when they feel they don’t belong. Instead, students need to know that worries about belonging are common and, further, that they fade with time. A focus on growth and improvement—a positive change in students’ trajectory— is crucial.

The seemingly encouraging remark “What a smart comment” can also backfire. It conveys a fixed mindset about ability, an attitude that makes students crumble when they struggle. Far better is to emphasize that being smart is about learning and that students learn by struggling with challenging material. Values-affirmation exercises might backfire if delivered in a cursory way that suggests the teacher does not take the exercise seriously and does not personally value and respect the student.

A light and stealthy touch can be important for psychological interventions. Excessive repetition of a message that a student can succeed or belongs, particularly if it singles out members of an underrepresented group, can send the opposite message. Students might well ask themselves, “Why am I constantly being told I can succeed, unless my teacher really believes I will fail?” In targeting women and minority students for a weekly help session, Professor Jones, whom we met at the beginning of this article, makes that mistake.

Many teachers are inclined to overpraise students for mediocre work in the belief that it will boost their self-esteem—and they are especially likely to do so for students who face negative stereotypes. For the same reason, some teachers excessively praise students for things like asking routine questions in class. Such overpraising can send a message of low expectations or suggest that ability is more important than effort and good strategy use. Professor Doe makes that mistake, along with that of singling out women and minority students.

Another common mistake is to encourage students to work harder when they need not only to work harder but also to work smarter—for instance, by changing their learning strategy. Effort is necessary but not sufficient, and most undergraduate students are still learning how to learn effectively. When confronted with continued failures despite heightened effort, it is easy for students to have their motivation sapped and conclude, “I guess I’m just not a physics person.” By teaching the fuller formula for success—effort plus good learning strategies plus help from others, including collaboration—effective growth-mindset interventions challenge the myth that raw ability or raw effort matters most. Research in physics education provides guidance on learning strategies that are effective for physics (see the article by Carl Wieman and Katherine Perkins, PHYSICS TODAY, November 2005, page 36).

Professor Smith errs in telling his students that 30% of them will fail and directing them to simply “study hard.” Moreover, in singling out students who think their background preparation is weak, he exacerbates the concerns and stress of students who worry about their prospects in a field in which their group is negatively stereotyped. One of us (Wieman) did a small unpublished study on how stu-
تمكن الطلاب الذين وكم عليهم من هذه التحذيرات خطر الفشل العالي للدورة. حيث أن بعض الطلاب رأوا التحذير كتحدي وتمثيلهم أنهما قادرين على التغلب عليه، بينما تقول عموماً جميع الطلاب الذين ردوا على هذا الطريقة أنهم كانوا ذوي جنسية عربية أو أسيوية. تختلف الطريقة التي رأوها في التحذير في بعض الطلاب. حيث أنهم رأوا التحذير كإشارة أنهم سيتعرضون للإخفاق وسرضيق المعلم في ذلك. في المقابل، فإنهم رأوا أن الرسالة كانت تقدم إجابة على أنهم أكثر من خجل وقلت عن الاهتمام والجهد في الدورة.

عادة ما تشير التحقيقات 최근 أن دور العوامل الاجتماعية النفسية في الفصول الدراسية في الفيزياء والمجالات الأخرى ذات الطلب العالي من التعليمات. لكي تكون فعالة، يجب أن تكون التدريس غير فقط حول ما يريد الطلاب أن يتعلموه وكيفية تقديمها بل也应该 يجب أن تكون المعاني التي يتعودونها الطلاب. حيث أن الطلاب من الجماعات التي تمثلها عادةً أن تكون أقل نموذجة في الفيزياء، إن تلك المعاني قد تكون مختلفة عن المعاني التي يتعودونها الطلاب من الجماعات الأغلبية أو الفيزياء. فلكل الطلاب من جميع الجماعات العضوية، فإن الوعي بالطريقة التي تمثلها عنما يعودون إليها سوف يساعد المعلم في التعلم الفعال أكثر ومساعدتهم في استخدام جميع الموارد التعليمية المتاحة.

따لاً، نأمل أن تكون هذه الجهود تتؤثر على التنوع والصحة في مجال الفيزياء.

المراجعات