Using Growth Mindset to Improve Teaching and Learning

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Center for Teaching and Learning

Learning Goals and Objectives

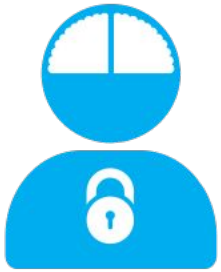
Learning Goal. To understand the value of having a growth mindset both for yourself and for your students.

Learning Objectives.

By the end of this workshop, you will be able to:

- Define "**growth mindset**" and "**fixed mindset**."
- Explain how students with a fixed vs growth mindsets **view effort, attribute failure, and strategies**, and how these can contribute to differences in their behavior.
- Describe why having a growth mindset **matters**.
- Develop **strategies** you can use in the classroom to help your students to develop a growth mindset.

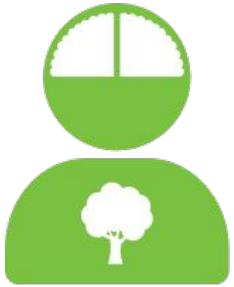
Mindsets about Intelligence



fixed

Human traits are fixed

Fixed mindset about intelligence: You have a certain amount of intellectual ability and can't do anything to change it



growth

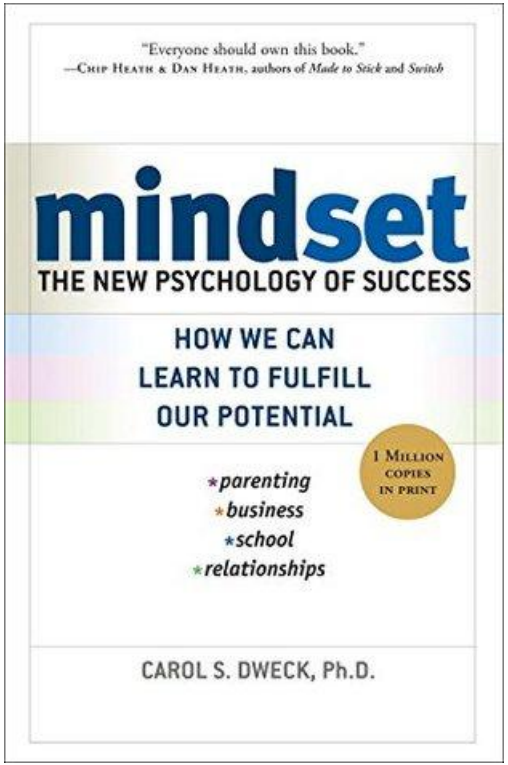
Human traits are malleable, they can be shaped and developed

Growth mindset about intelligence: Intelligence can be developed through personal effort, good learning strategies, and lots of mentoring, support, and feedback from others.

What is mindset?

Image: Stanford

Carol Dweck, Ph.D.
Professor of Psychology (Stanford)



(2006)

Dweck, Carol S. *Mindset: the New Psychology of Success*. Ballantine Books trade pbk. ed. New York: Ballantine Books, 2016.

For each of the six categories below, both a growth mindset and a fixed mindset characteristic are provided. Decide which characteristic is **growth mindset oriented** for each of the six categories and box it:

Views on effort	Effort is seen as an important component of learning	Effort is seen as sign of weakness
Goal orientation	**Performance goal orientation** (picks challenges they know they can meet, uses them to prove yourself to others)	**Mastery goal orientation** (picks increasingly more difficult challenges)
Attribution of failure	Attributes failure to lacking ability or blames others or the circumstances	Attributes failure to not having put in enough effort or preparation, or having used ineffective strategies
Strategies	Increases effort, tries new things, asks for help from others	"Learned helplessness" or tries to persevere with the same (ineffective) study strategy
Feedback	Avoids feedback, acts defensively	Seeks out feedback
Results	Persistence, overcomes initial challenges, finds ways around it	Loses interest and withdraws in response to challenges, self-sabotage

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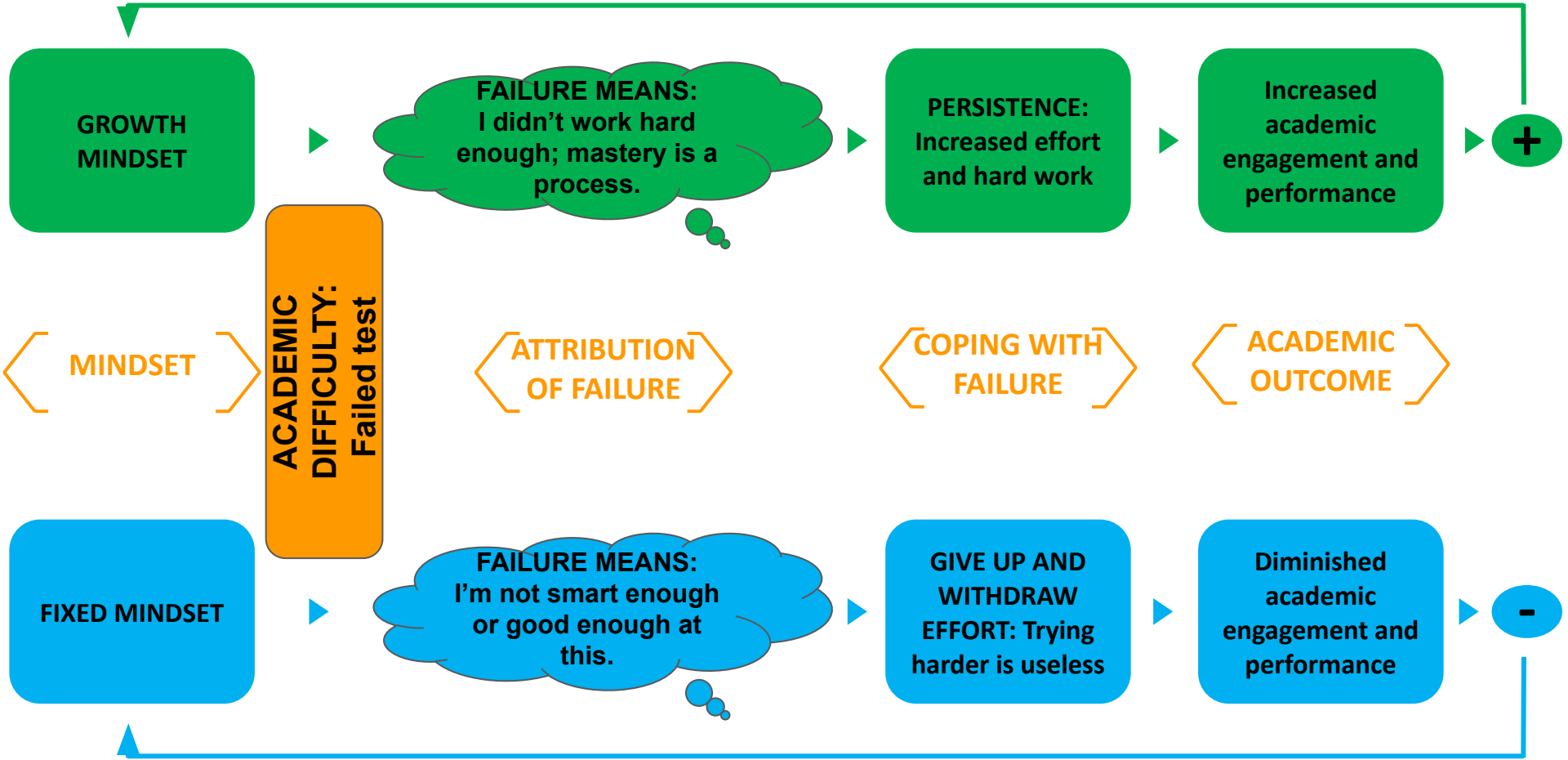
“Do people with [growth] mindset believe that anyone can be anything, that anyone with proper motivation or education can become Einstein or Beethoven?

No, but they believe that a person’s ***true potential is unknown*** *(and unknowable); that it’s impossible to foresee what can be accomplished with years of passion, toil, and training.”*

-Carol Dweck

Why does having a **growth mindset** matter?

Why mindsets matter



- University-wide survey (Indiana?)
- 150 STEM faculty surveyed (out of 468 responded)
  - 7 semesters
  - 634 courses
  - 15,466 students

How do you think the Growth mindset teachers speak or behave differently in their class than their Fixed colleagues?

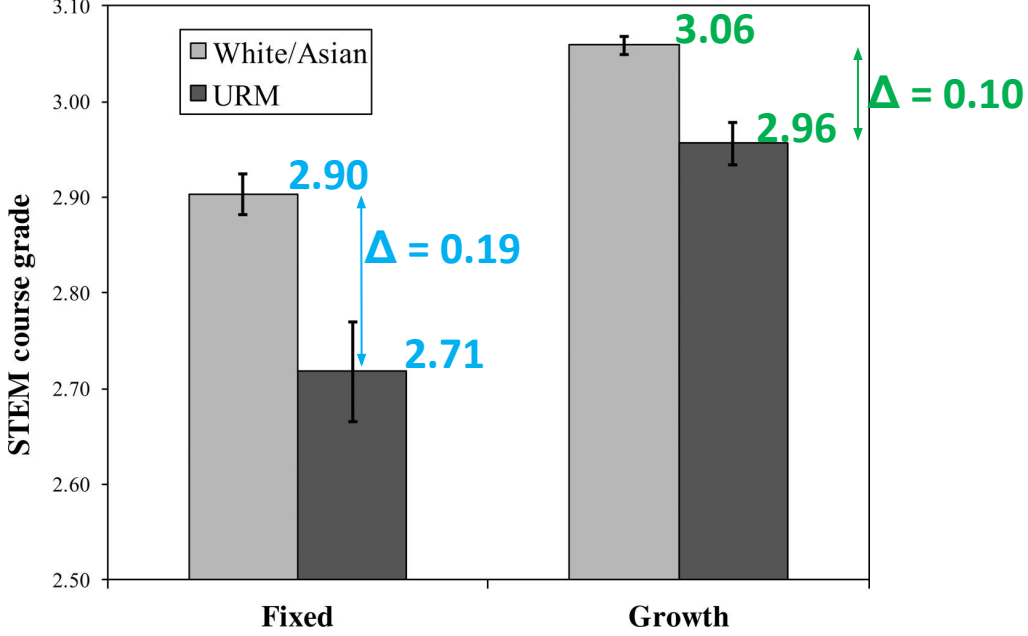


Fig. 1 Faculty mindset beliefs predict the racial achievement gap in STEM courses.
Predicted values are computed from the interaction between faculty mindset beliefs (fixed = −1 SD, growth = +1 SD) and students' URM (Black, Hispanic, Native American) status. Error bars represent ±1 SE.

- Faculty asked (**1- strongly agree**; **6- strongly disagree**):
  - "To be honest, students have a certain amount of intelligence, and they really can't do much to change it."
  - "Your intelligence is something about you that you can't change very much."

Canning et al. "STEM faculty who believe ability is fixed have larger racial achievement gaps and inspire less student motivation in their classes." *Sci Adv.* 20194.

Which of these quotes do you think was said by a Growth mindset prof? Which of these were said by a Fixed mindset prof?

"Sometimes you have to not push them through it but lead them through the forest a couple of steps ahead the first time. (…) You're guiding them. (…) And then the hope is that they do this and learn from that. But then they have to be able to try to go through the forest on their own (…)."

"[I]t's about learning how to solve their own problems or the problems they encounter, so teaching for me is enablement. (…) Enabling an individual to encounter new problems and self-solve them. That's teaching to me."

"I provide them with all of the basic information that they need to learn the material, and there are many complaints because they say the exams are at a much higher level, but that's their job."

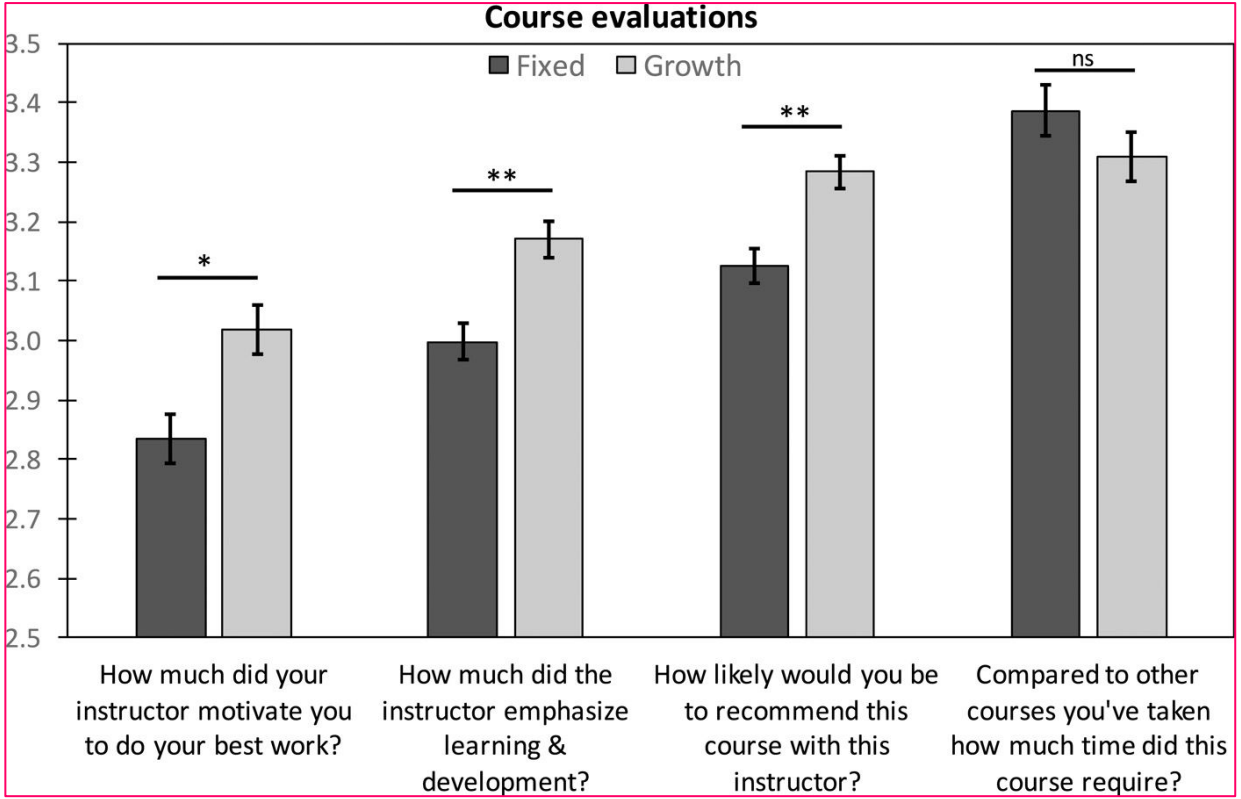
"Fundamentally, [teaching is] changing someone's understanding of the world by making it deeper and in-line with the scholarship of what is rigorously true according to our scientific methods."

"But it's not that important for you to understand how those facts were arrived at or those systems were developed. You just need to learn them. And in that case I think it's important for people to be presented with those systems."

"[Y]ou can't really teach people. You can facilitate that, but they have to do it. And so I see my place as more of a facilitator now. (…) I would want them (…) to still remember the core principles that were taught in the course…"

Why do faculty with fixed mindsets have worse learning outcomes?

Student evals:



Canning et al. "STEM faculty who believe ability is fixed have larger racial achievement gaps and inspire less student motivation in their classes." *Sci Adv.* 20194.

Question:

In general, do people in [your discipline] believe that the raw, innate talent is the most important factor for success in your discipline, and motivation and sustained effort are secondary.

Answer to yourself on a 7-pt scale:

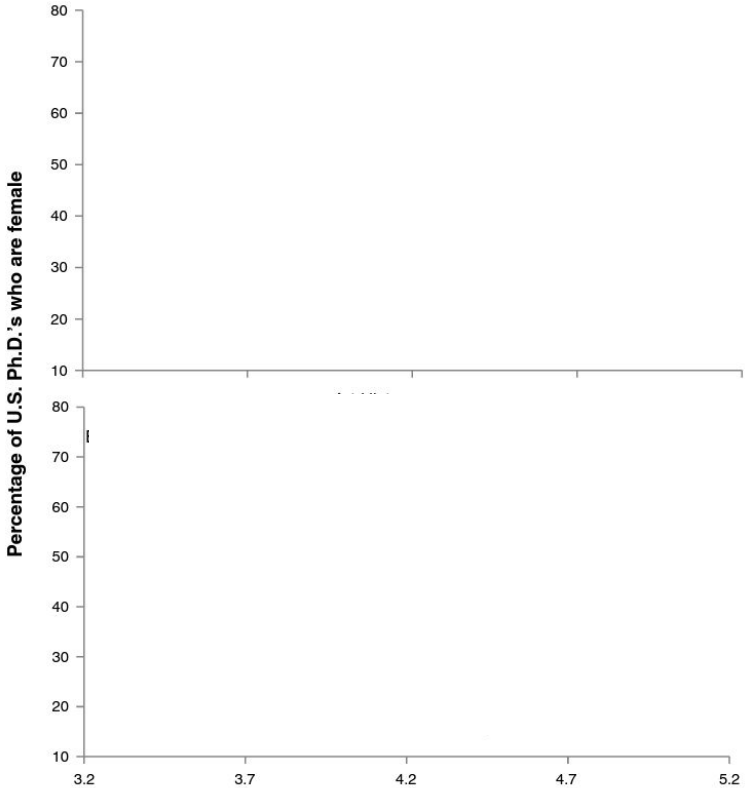
1= strongly **disagree** that innate, unteachable talent is the most important factor

7= strongly **agree** that innate, unteachable talent is the most important factor

(Leslie SJ, *et al*. "Expectations of brilliance underlie gender distributions across academic disciplines." *Science*. 2015 Jan 16; 347(6219): 262-5.)

Expectations of brilliance underlie gender distributions across academic disciplines

% of U.S. Ph.D.'s who are female (2011)



n= 1820 survey respondents
(faculty, post-docs, grad students)

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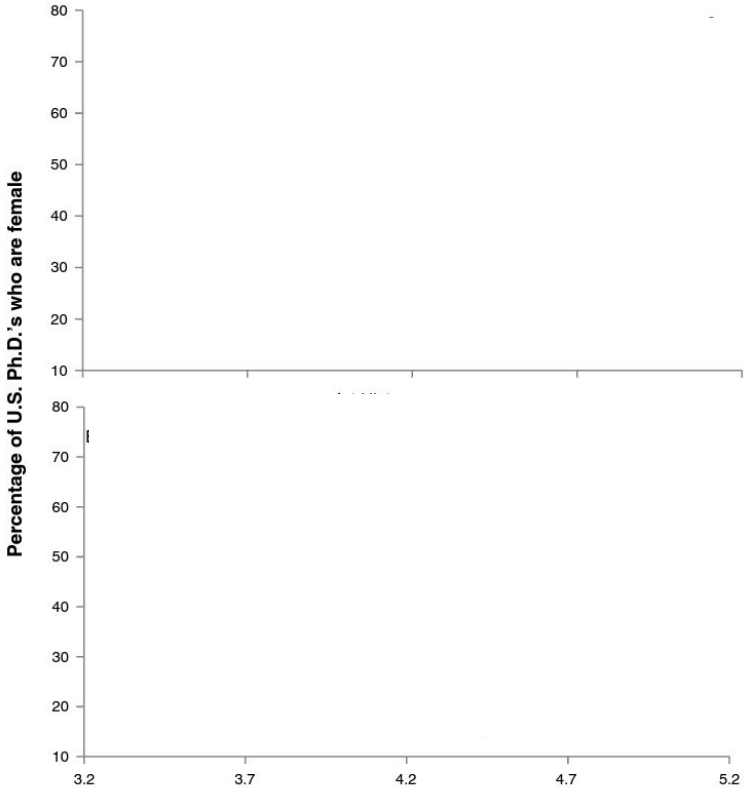

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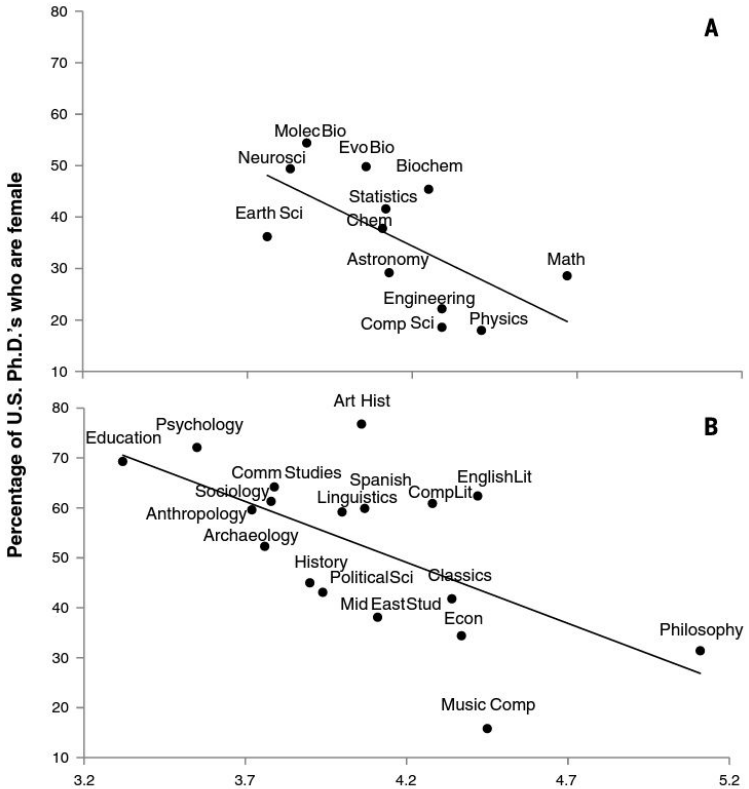

STEM

SocSci/Hum

n= 1820 survey respondents (faculty, post-docs, grad students)

not the most imp. factor **(growth)**

How does your field see brilliance?

most imp. factor **(fixed)**

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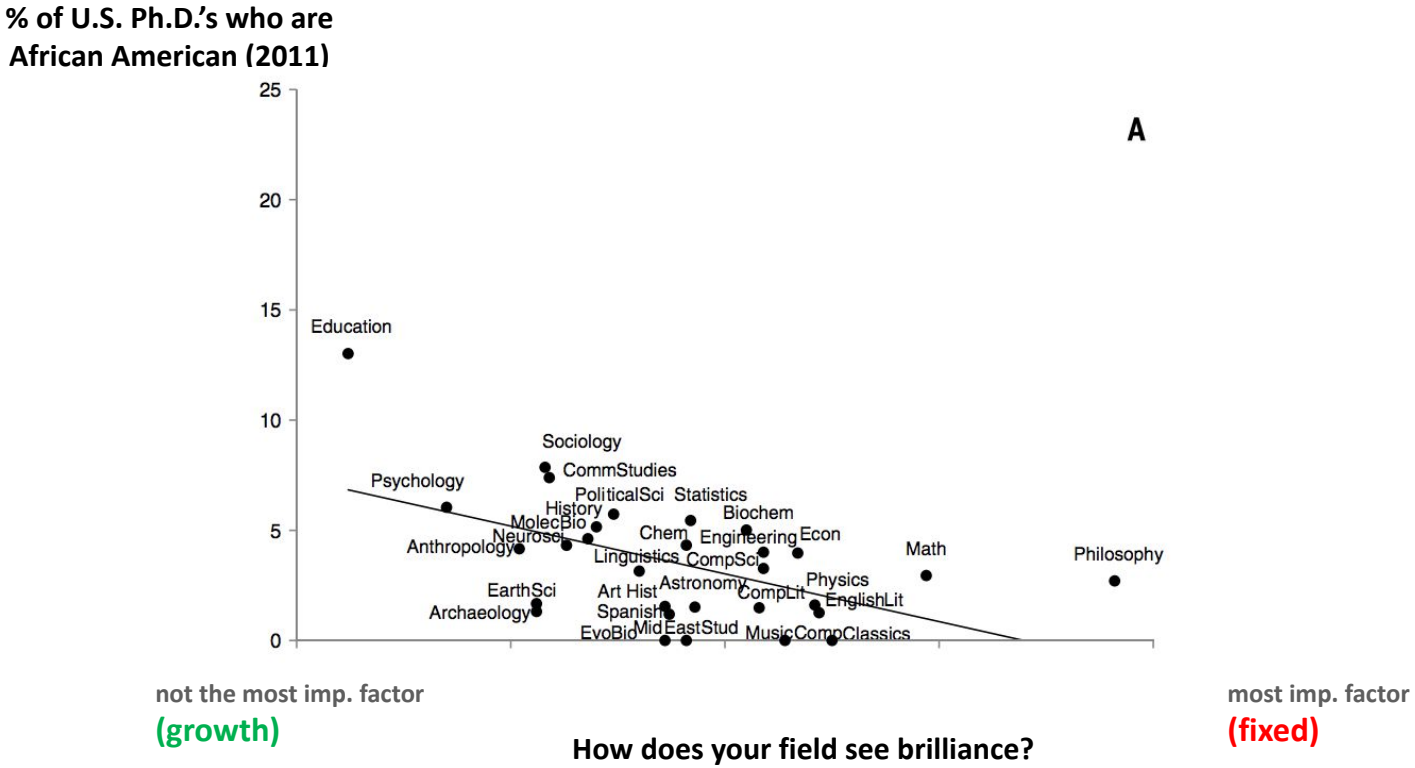

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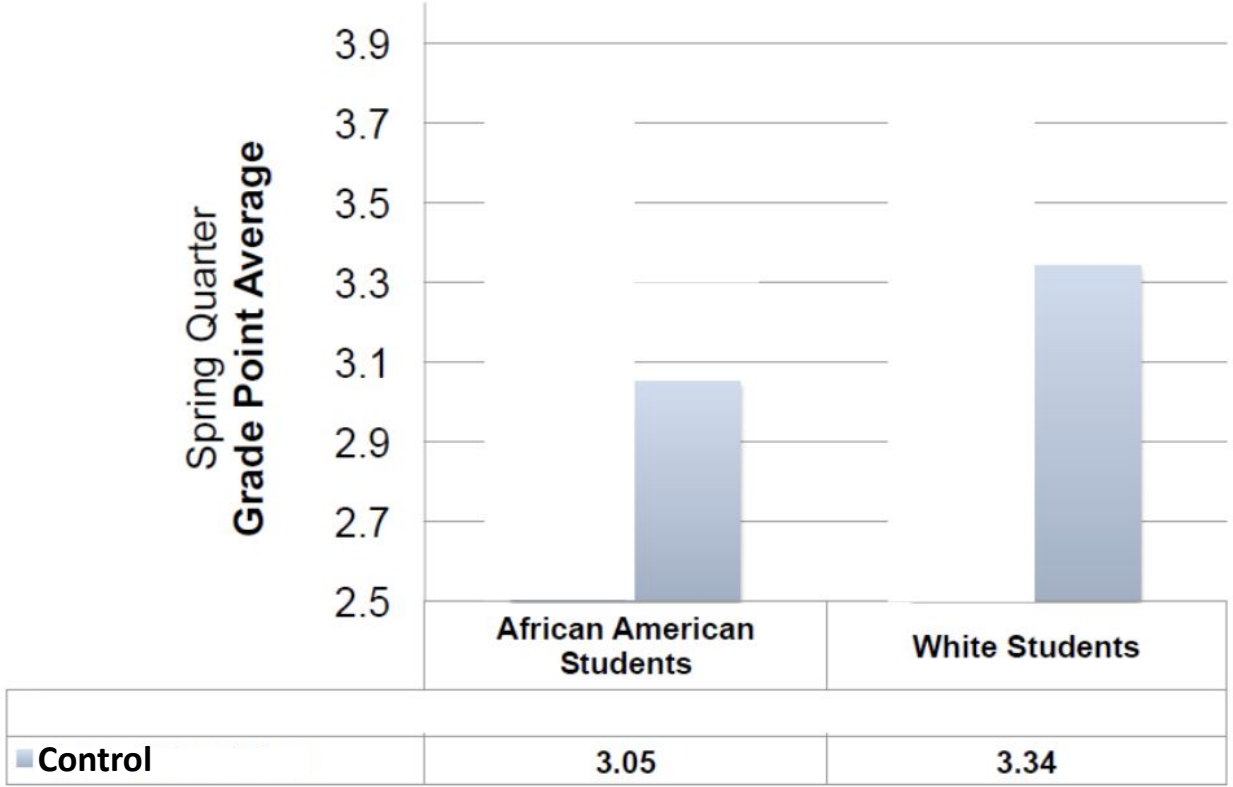
Growth Mindset Intervention

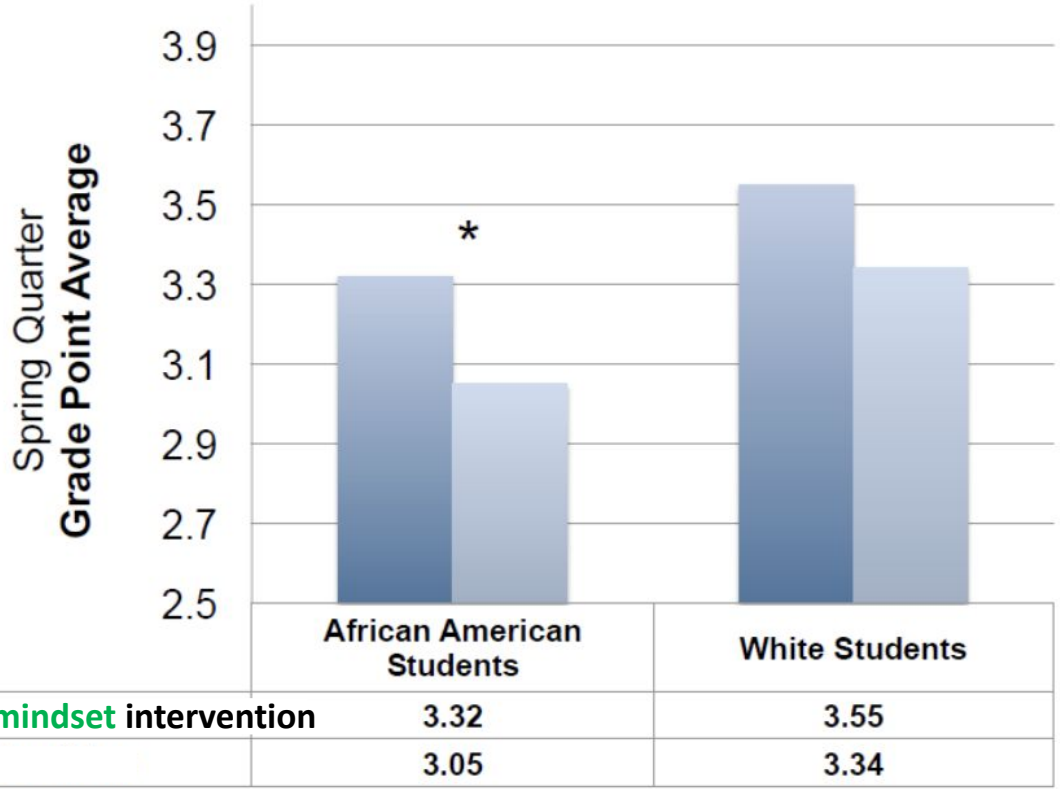


Aronson, Joshua, Carrie B. Fried, and Catherine Good. "Reducing the Effects of Stereotype Threat on African American College Students by Shaping Theories of Intelligence." Journal of experimental social psychology 38.2 (2002): 113–125.

Growth Mindset Intervention

Growth mindset intervention:

- College students were pen pal mentors to a struggling middle school student
- **GM** college students were asked to help the middle school student see intelligence as a capacity that can grow “like a muscle”.



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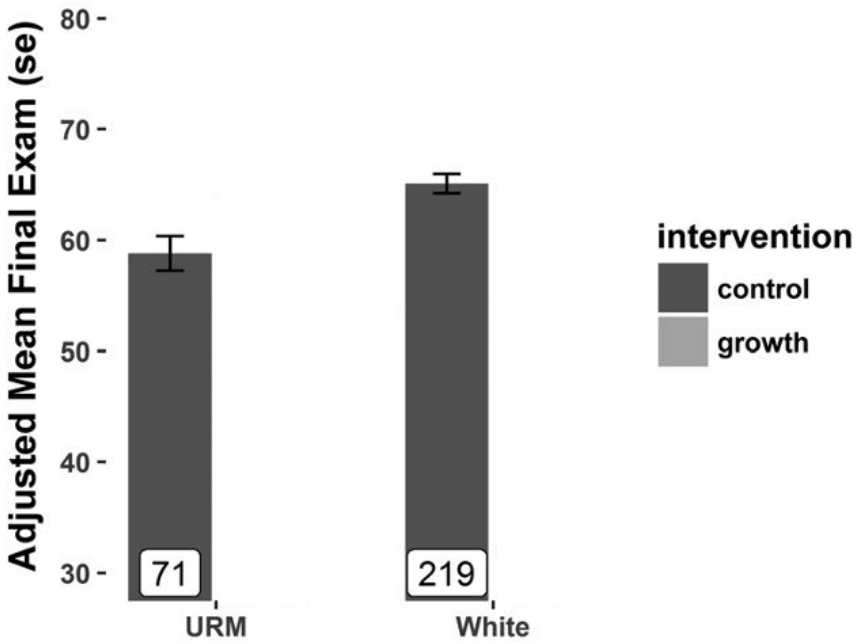
Growth vs Fixed Mindsets in Chemistry Class

Wash U., St. Louis.

Three-part online intervention:

1. Students read a short article on **growth mindset** as part of a hw assignment early in the semester.
2. Students were asked to reflect about how having a **growth mindset** will help them prepare for their **second midterm**.
3. Students were asked to reflect about how having a **growth mindset** will help them prepare for their **final exam**.



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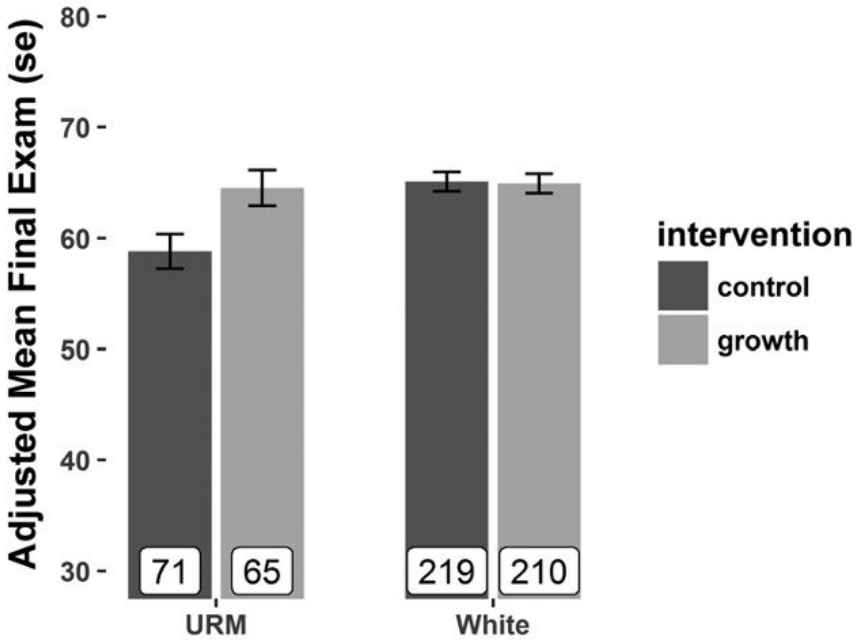

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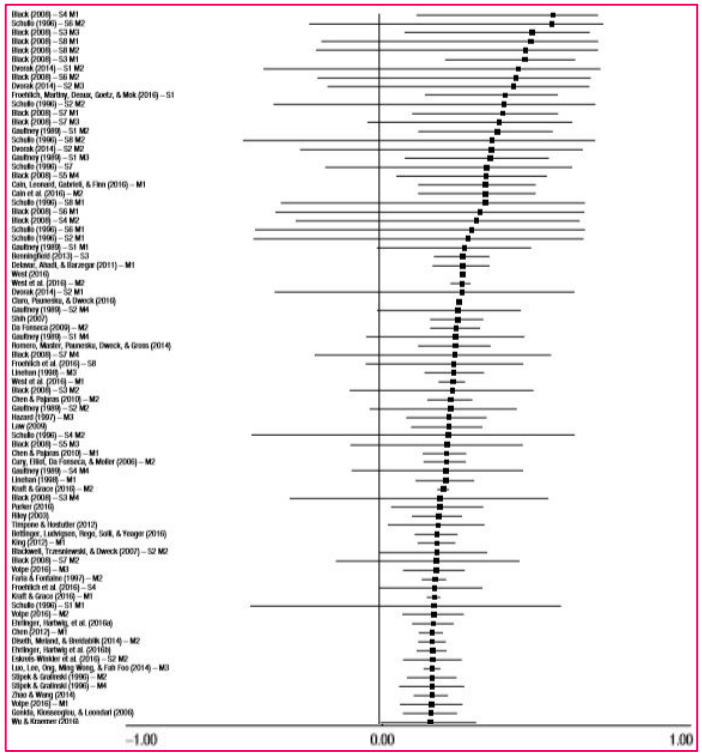
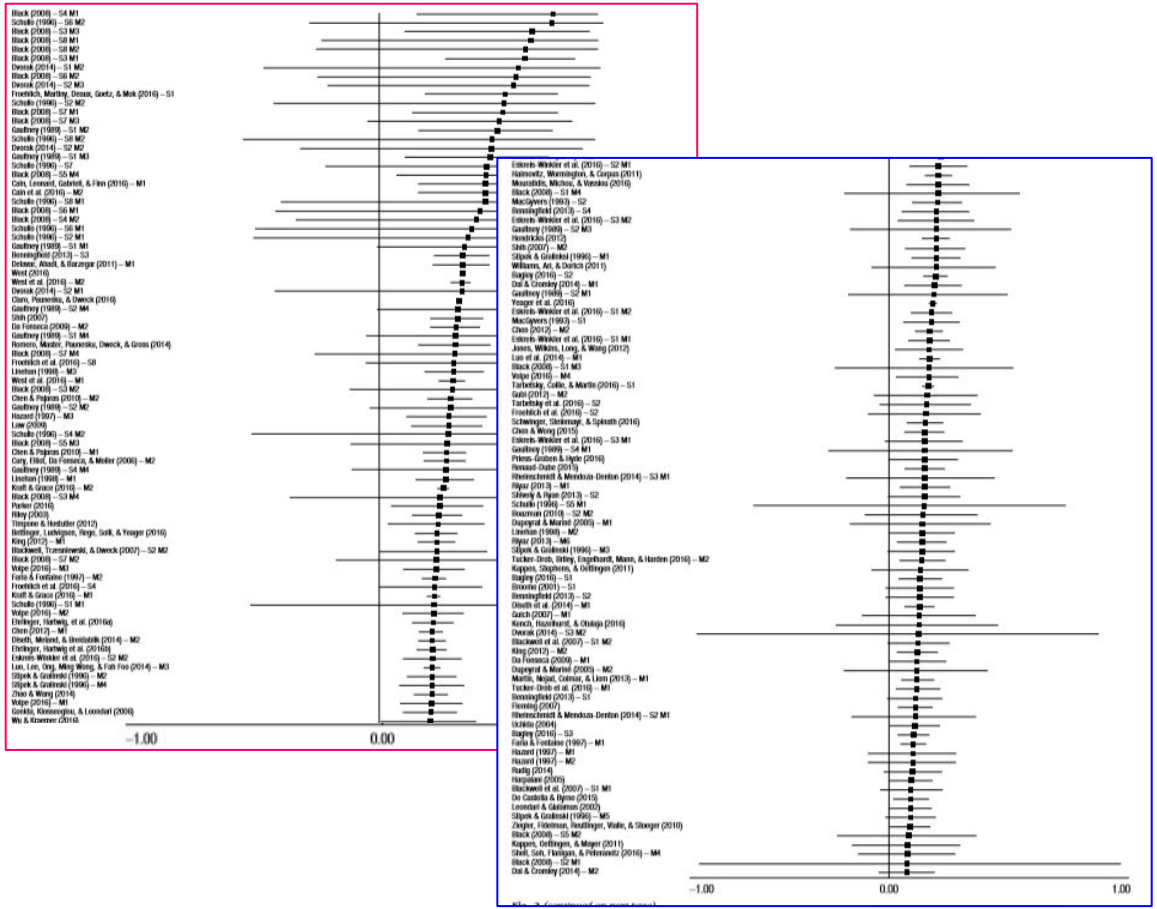


- 300+ studies
- Heterogeneous effects
- Overall positive significant impact

Sisk, Victoria F. *et al*. "To What Extent and Under Which Circumstances Are Growth Mind-Sets Important to Academic Achievement? Two Meta-Analyses." *Psychological science* 29.4 (2018): 549–571.



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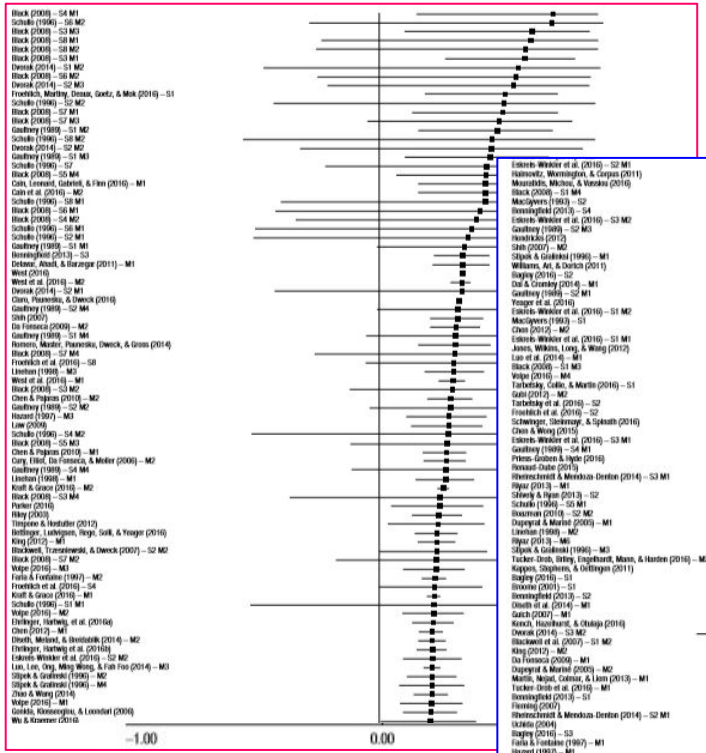

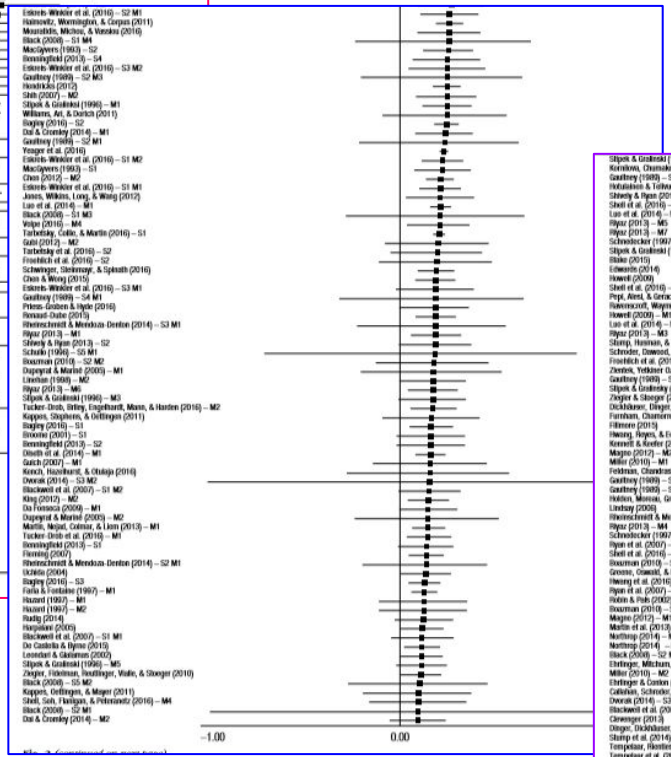

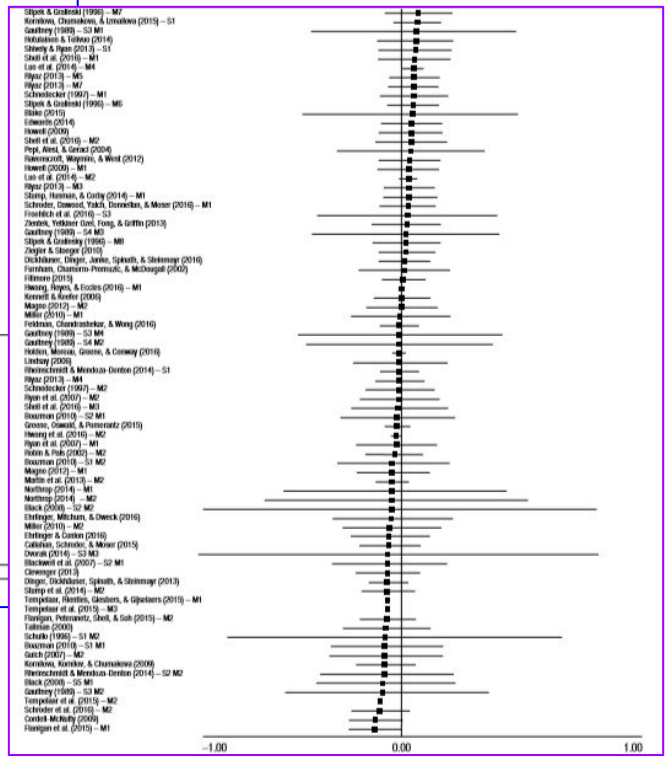

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Motivating questions for Yeager *et al*., 2019

- Where does this heterogeneity come from?
  - Who benefits most from **growth mindset trainings**?
  - What **conditions** most effectively support the adoption of a growth mindset?

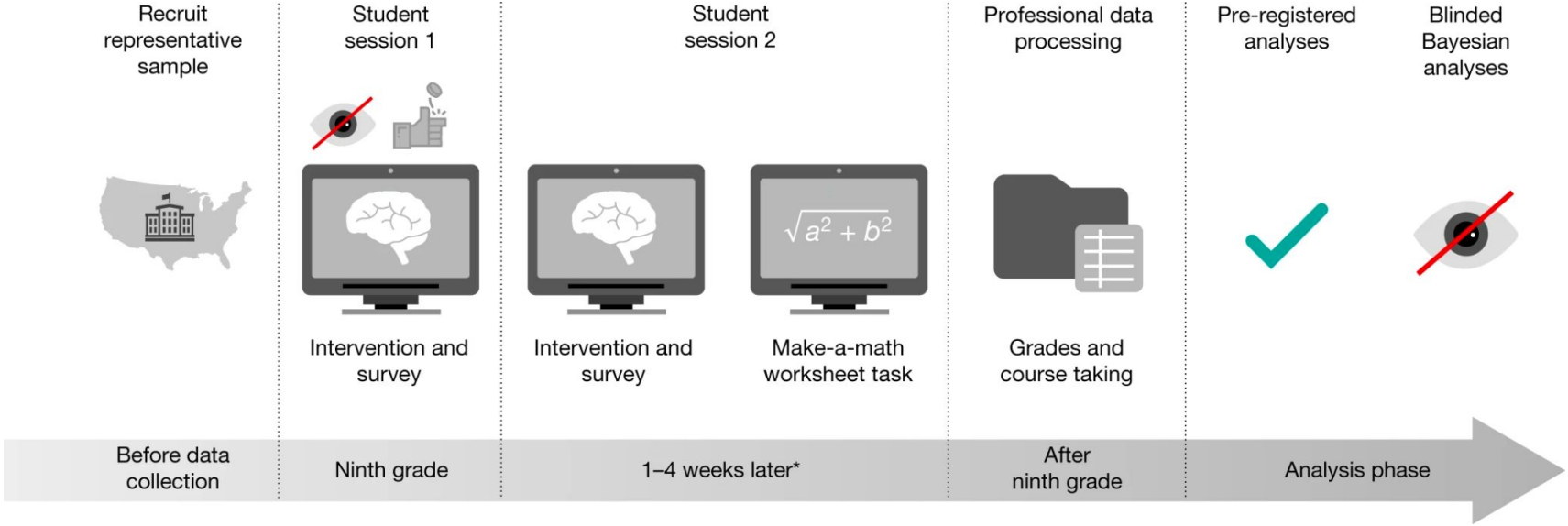
- → Random sample of regular US public high schools makes findings generalizable to US population of regular public high schools

- Regular US public high schools
  - Which kinds of students…
  - Which kinds of classrooms…
  - Which kinds of schools…
  - …benefit most from an online growth mindset training

Yeager DS, *et al*. "A national experiment reveals where a growth mindset improves achievement." *Nature*. 2019 Sep;573(7774):364-369.

“PERTS”: Project for Education Research that Scales

A growth mindset intervention that can be delivered at scale (no instructor training/variability)



65 schools
+12,000 students:
Geographic, demographic, school performance representation

25 min

25 min

Challenge -seeking behavior

-Hired two independent data collection companies to recruit schools and collect the data
-Pre-registered analysis
-Blinded Bayesian analysis (machine learning) corroboration

Yeager DS, *et al*. “A national experiment reveals where a growth mindset improves achievement.” *Nature*. 2019 Sep;573(7774):364-369.

Session 1: Baseline survey and first intervention session
Week 2-5 of fall semester

Participating students sign into study website…

Baseline survey:
- Demographic measures
- Psychometric measures

Double-blind student-level randomization to intervention or control

Growth mindset intervention:
- Read article on scientific evidence for neural plasticity
- Complete writing exercises to internalize article's lessons

Control condition:
- Read article on localization of brain functions
- Complete writing exercises to summarize article's lessons

Session 2: Second intervention session and follow-up survey
Week 5-10 of fall semester

Participating students sign into study website…

Growth mindset intervention:
- Learn more about how students/celebrities have put a growth mindset into practice
- Complete writing exercises

Control condition:
- Learn about how scientists have studied the brain
- Complete writing exercises to summarize article's lessons

Post-test survey:
- Mindset manipulation checks
- "Make-a-math-worksheet" task
- Fidelity measures

Follow-up: Monitoring academic records to assess whether….
- Previously low-performing students earn higher core subject GPAs
- Previously low-performing students are less likely to show D/F averages
- D/F averages in general are reduced

Yeager DS, *et al*. "A national experiment reveals where a growth mindset improves achievement." *Nature*. 2019 Sep;573(7774):364-369.

Study overview

- 9th graders (transitionary period, maximal impact)

- Hypothesis: lower-achieving students will benefit the most from growth mindset interventions

  - A growth mindset is most relevant for students who are confronting challenges

  - Impact can be measured in terms of grades (GPA)
    - "Core GPA" = math, science, English, and social studies

Revised intervention framing

1. **Strategies**, not just "**hard work**": Hard word was previously defined as the opposite of "raw ability"
   - But, working harder without effective learning strategies doesn't improve learning
   - Ex: "Sometimes people want to learn something challenging, and they try hard. But they get stuck. That's when they need to try new strategies– new ways to approach the problem."
2. Support **communal, interdependent values**
   - "*You* can grow *your* intelligence" may have emphasized independence too much
   - Goal: to remove stigma around asking for help
   - Ex: "People tell us that they are excited to learn about a growth mindset because it helps them achieve the goals that matter to them ***and to people they care about***. They use the mindset to learn in school so ***they can give back to the community and make a difference in the world later***."
3. Aligning **peer norms**
   - Ex: "People everywhere are working to become smarter. They are starting to understand that struggling and learning are what put them on a path to where they want to go."
4. Leverage **adolescent resistance**, growth mindset as a response to adult control
   - Include this quote from an upper-class student: "I hate how people put you in a box and say 'you're smart at this' or 'not smart at that.' After this program, I realized the truth about labels: they're made up… Now I do not let other people box me in… It's up to me to put in the work to strengthen my brain."

(Yeager *et al*., 2016)

Revised intervention framing: "Indirect" rather than "Direct" Framing

- Direct ("this will help you.")
  - "Why does getting smarter matter? Because when people get smarter, they become more capable of doing the things they care about. Not only can they earn higher grades and get better jobs, they can have a bigger impact on the world and on the people they care about. In this program, you'll learn what science says about the brain and about making it smarter."

- **Indirect ("this will help others.")**
  - "Students do a great job explaining ideas to their peers because they see the world in similar ways. On the following pages, you will read some scientific findings about the human brain. *We would like your help to explain this information in more personal ways that students will be able to understand. We'll use what we learn to help us improve the way we talk about these ideas with students in the future.*"

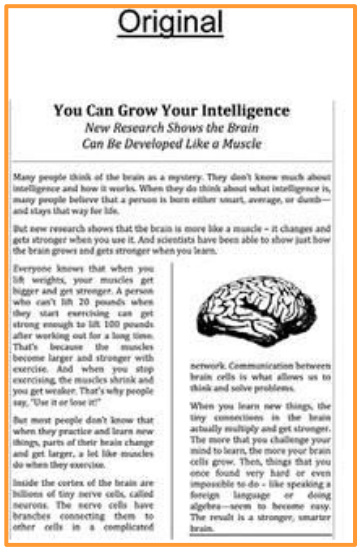
(Yeager *et al*., 2016)

Revised intervention (Yeager *et al*., 2016)

Original intervention: 3-part structure

1. Read “You Can Grow Your Intelligence” (4 pgs.)
   - Your brain can get smarter the more it is challenged, like a muscle, because of phenomena like neuroplasticity.
2. Describe a personal experience of learning something
3. Write a letter to a future student who is struggling and may feel “dumb.” (“Saying is believing” exercise)

Original



You Can Grow Your Intelligence

New Research Shows the Brain Can Be Developed Like a Muscle

Many people think of the brain as a mystery. They don't know much about intelligence and how it works. When they do think about what intelligence is, many people believe that a person is born either smart, average, or dumb—and stays that way for life.

But new research shows that the brain is more like a muscle – it changes and gets stronger when you use it. And scientists have been able to show just how the brain grows and gets stronger when you learn.

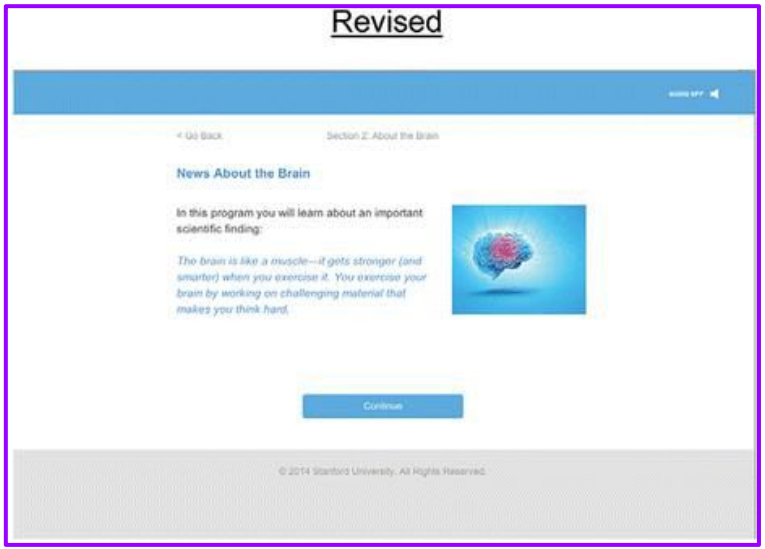
Everyone knows that when you lift weights, your muscles get bigger and get stronger. A person who can't lift 20 pounds when they start exercising can get strong enough to lift 100 pounds after working out for a long time. That's because the muscles become larger and stronger with exercise. And when you stop exercising, the muscles shrink and you get weaker. That's why people say, "Use it or lose it!"

But most people don't know that when they practice and learn new things, parts of their brain change and get larger, a lot like muscles do when they exercise.

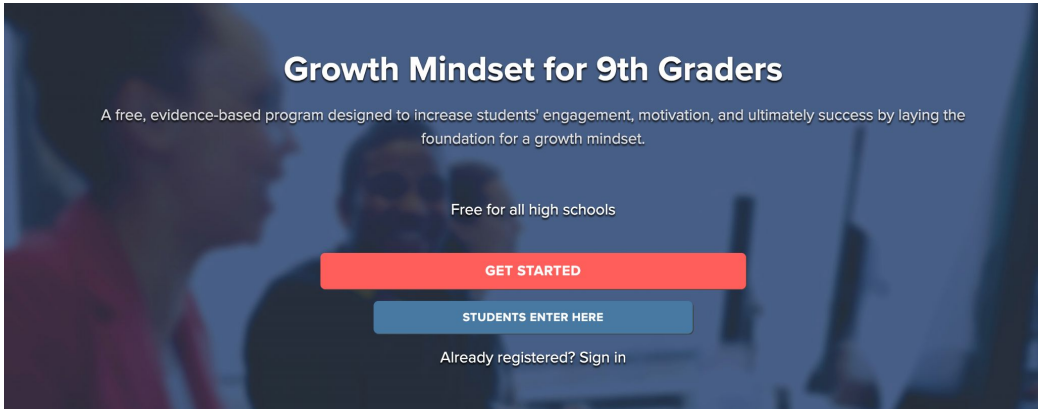
Inside the cortex of the brain are billions of tiny nerve cells, called neurons. The nerve cells have branches connecting them to other cells in a complicated network. Communication between brain cells is what allows us to think and solve problems.

When you learn new things, the tiny connections in the brain actually multiply and get stronger. The more that you challenge your mind to learn, the more your brain cells grow. Then, things that you once found very hard or even impossible to do – like speaking a foreign language or doing algebra—seem to become easy. The result is a stronger, smarter brain.

Revised



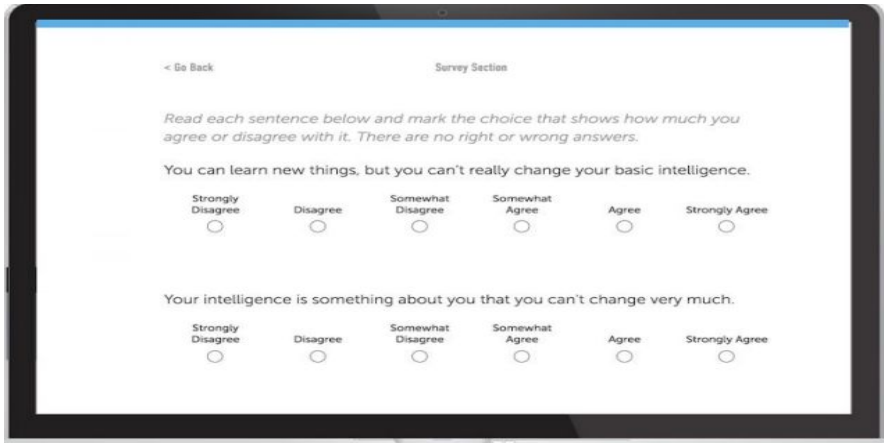
https://www.perts.net/orientation/hg

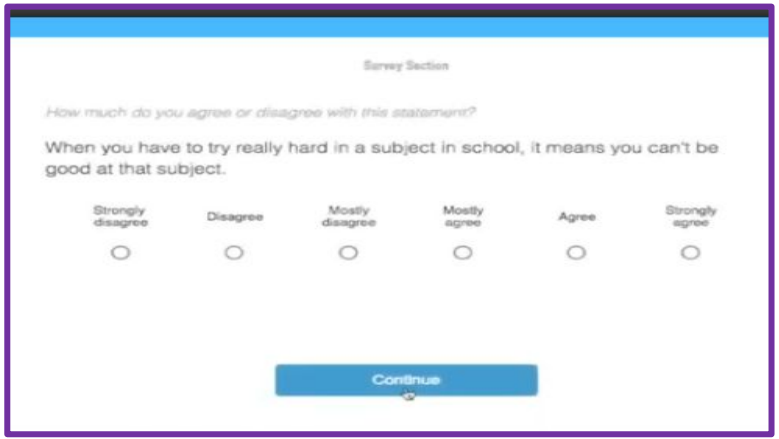


https://www.perts.net/orientation/cg

and https://mindsetscholarsnetwork.org/

- Two 25-min online sessions, about 3 weeks apart
- <u>Session 1</u> (25 Minutes):
    1. Students a quick survey assessing their mindsets and related attitudes and about their school environment.
    2. Students complete the first part of the interactive growth mindset activity about neural plasticity, strategies for growing their intelligence, and stories from other students.
    3. Students then complete writing exercises where they are asked to help us explain the concept to other students





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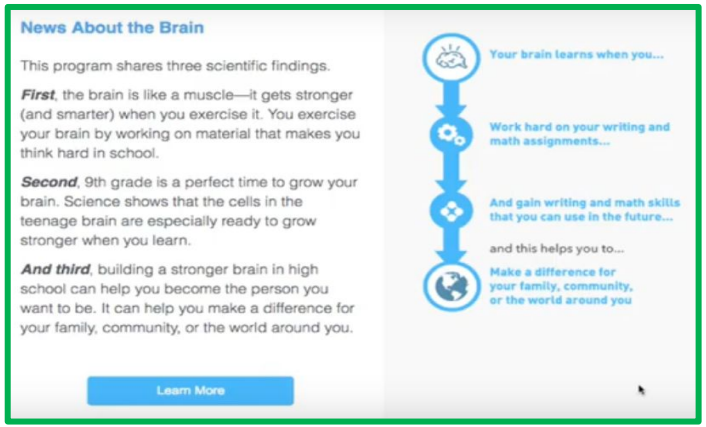
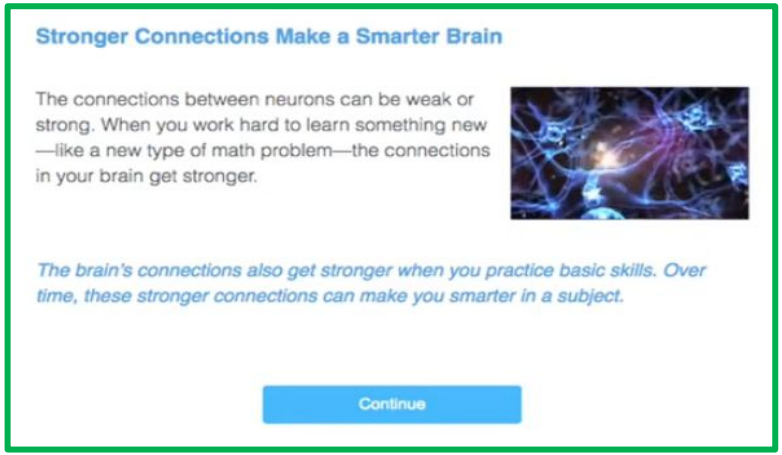
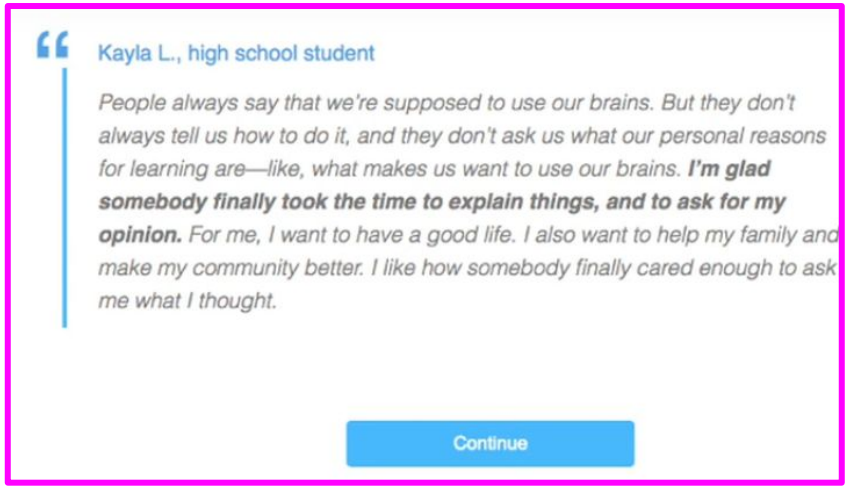




Not just about working hard (a common oversimplification)

- Two 25-min online sessions, about 3 weeks apart
- <u>Session 1</u> (25 Minutes):
    1. Students a quick survey assessing their mindsets and related attitudes and about their school environment.
    2. Students complete the first part of the interactive growth mindset activity about neural plasticity, strategies for growing their intelligence, and stories from other students.
    3. Students then complete writing exercises where they are asked to help us explain the concept to other students



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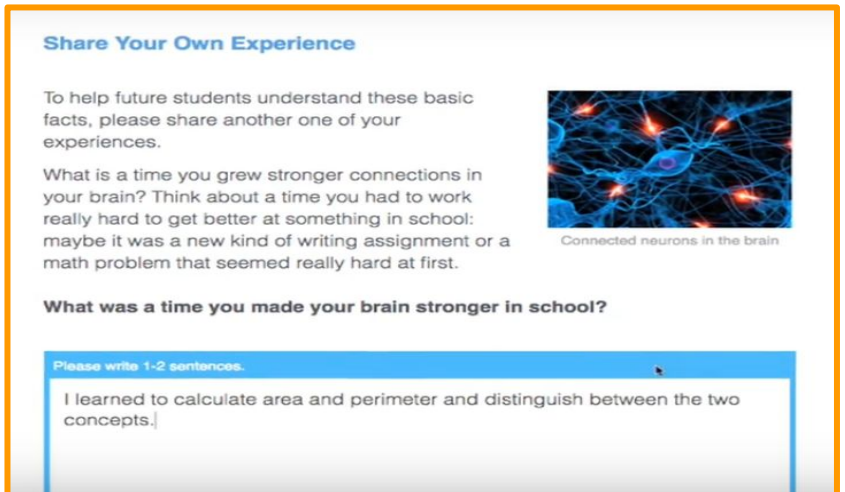
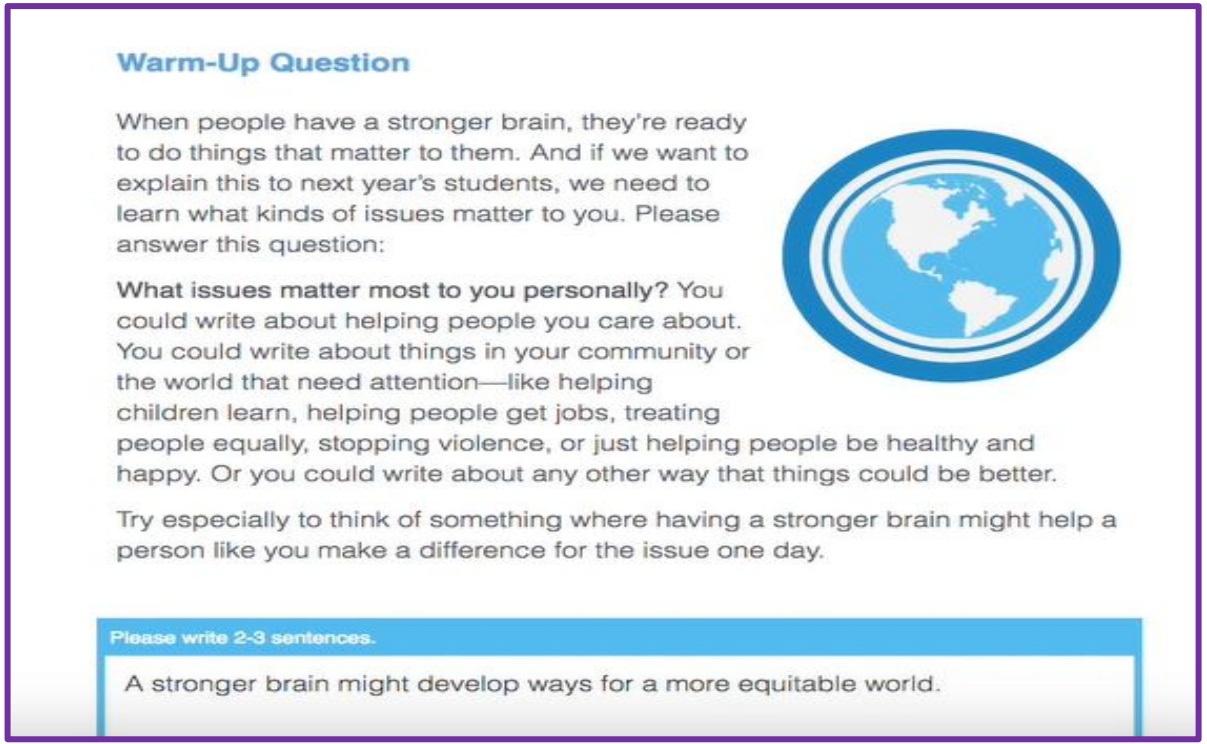


Session 2 (25 min): Reinforce and Extend

- Reminder of lessons from Session 2
- Community values- motivate changing their mindset
- Read responses from other students



Warm-Up Question

When people have a stronger brain, they're ready to do things that matter to them. And if we want to explain this to next year's students, we need to learn what kinds of issues matter to you. Please answer this question:

What issues matter most to you personally? You could write about helping people you care about. You could write about things in your community or the world that need attention—like helping children learn, helping people get jobs, treating people equally, stopping violence, or just helping people be healthy and happy. Or you could write about any other way that things could be better.

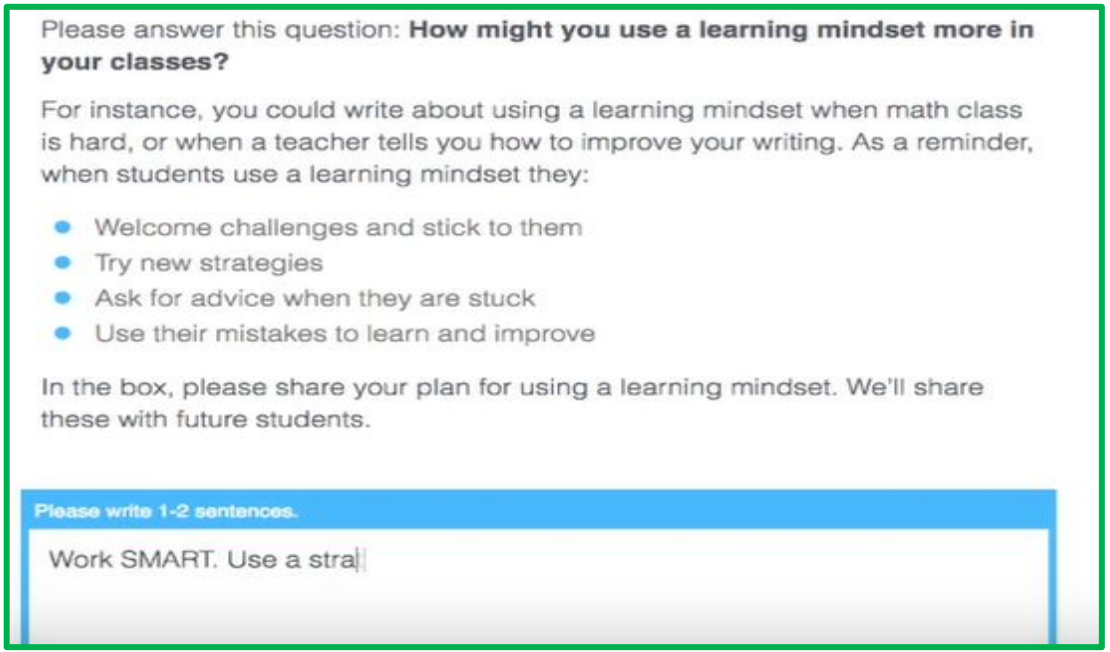
Try especially to think of something where having a stronger brain might help a person like you make a difference for the issue one day.

Please write 2-3 sentences.

A stronger brain might develop ways for a more equitable world.

Synthesize it into a Plan

- Students asked to synthesize ideas and apply them to their own life



Overall results

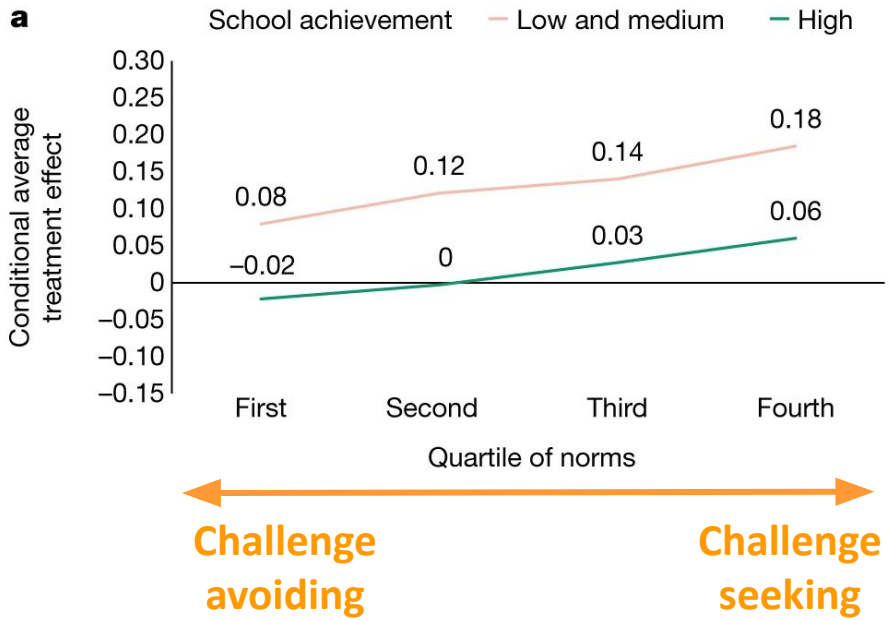
Extended Data Table 1 | Growth mindset effects were of a similar magnitude across subject areas

	Growth mindset intervention effect				
Outcome	*B*	95% CI	*t*(46)	*p*	*n*
	Lower-achieving students (*pre-registered group of interest*)				
Fixed mindset	-0.381	[-0.456, -0.301]	-10.141	<.001	5651
Core course GPA	0.101	[0.04, 0.16]	3.508	.001	6315
Math GPA	0.086	[-0.01, 0.18]	1.827	.074	5900
Science GPA	0.124	[0.07, 0.18]	4.220	.000	5834
English GPA	0.105	[0.02, 0.19]	2.464	.018	6096
Social Studies GPA	0.094	[0.02, 0.17]	2.401	.020	4800
	Students overall				
Fixed mindset	-0.420	[-0.425, -0.337]	-18.686	<.001	11351
Core course GPA	0.052	[0.03, 0.08]	3.796	<.001	12486
Math GPA	0.063	[0.03, 0.01]	3.556	.001	11539
Science GPA	0.072	[0.04, 0.10]	4.811	<.001	11585
English GPA	0.042	[-0.01, 0.09]	1.767	.084	12045
Social Studies GPA	0.037	[0.00, 0.07]	2.022	.049	9899

- The GM intervention decreased fixed-mindedness in students overall and lower-achieving students
- Lower-achieving students had the biggest impact in their grades

Yeager DS, *et al*. Nature. 2019

Further breakdown:



"Make-a-math" worksheet:

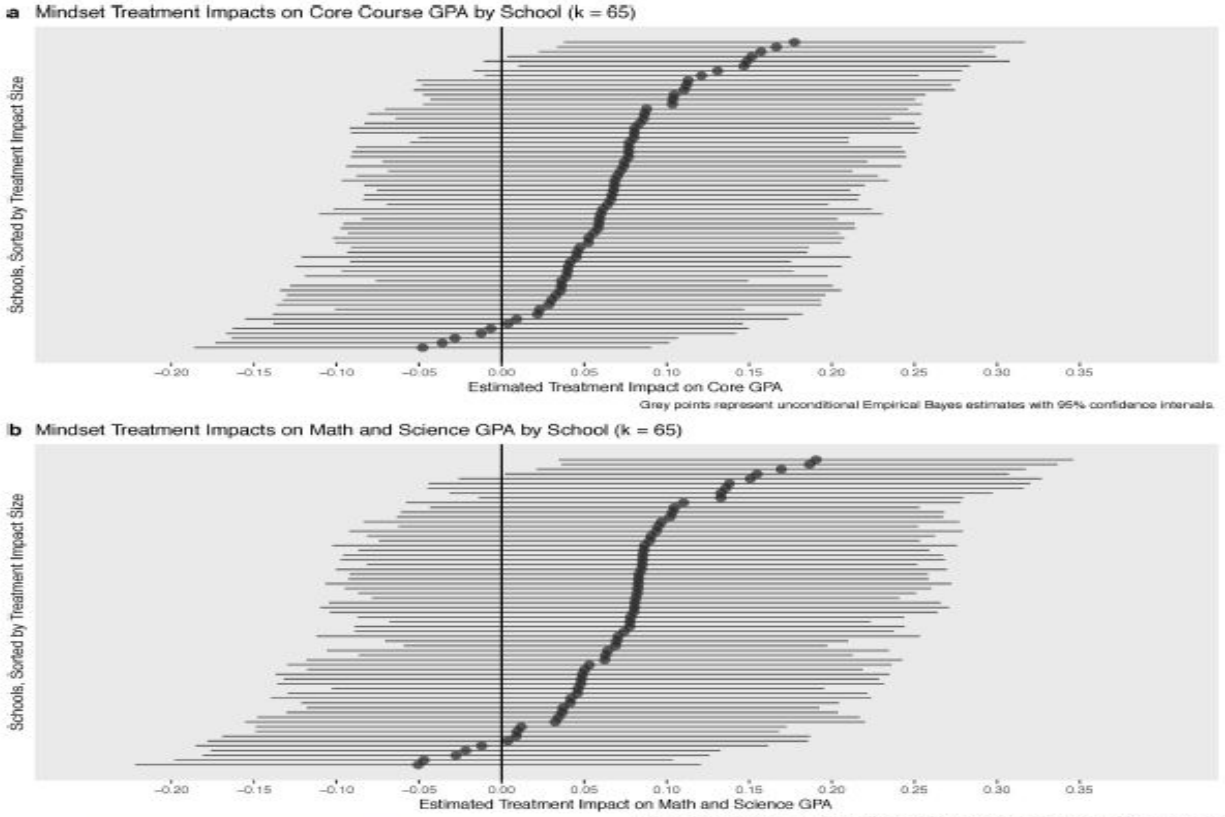
Students chose from math problems that were described either as *challenging and offering the chance to learn a lot* or *as easy and not leading to much learning*.

- CATE: "Conditional Average Treatment Effect" for grades

→ **How can we help our students cultivate supportive, challenge-seeking norms?**

Yeager DS, *et al*. Nature. 2019

Per school, GM effect is almost always positive



How can we help our students develop a **growth mindset**?

Design strategies that promote a growth mindset in your students

1. Destigmatize mistakes and challenges
2. Optimize feedback giving (you) and receiving (your students)
3. Challenge the notion that learning does not require struggle.
4. Communicate that abilities can grow.

Work with your neighbors for 5-7 min:

- Discuss how the provided strategies for your **assigned category** promotes students' growth mindset.
- Come up with specific strategies for your category to encourage a growth mindset in your students.
- Be prepared to share out to the group. (Person whose last name is earliest in the alphabet.)

1. Destigmatize mistakes & challenges

Using examples of others who have struggled

Journal of Educational Psychology

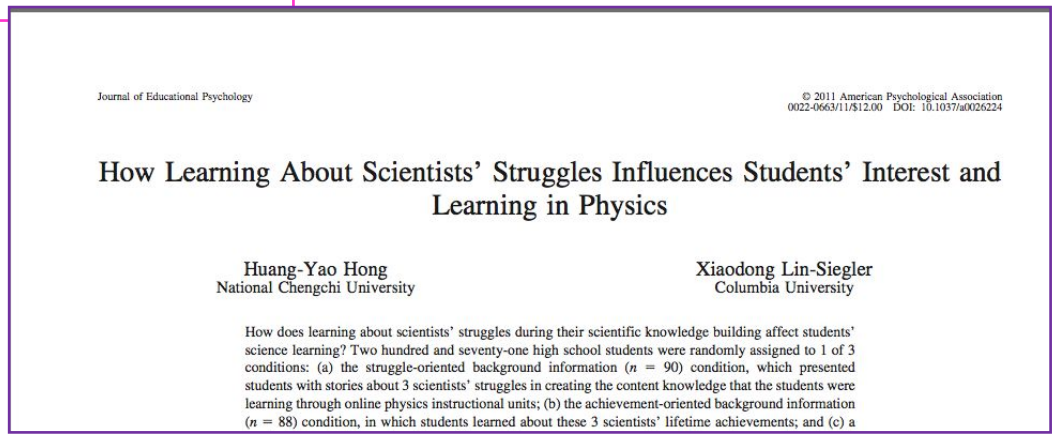
0022-0663/16/$12.00 http://dx.doi.org/10.1037/edu0000092

Even Einstein Struggled: Effects of Learning About Great Scientists' Struggles on High School Students' Motivation to Learn Science

Xiaodong Lin-Siegler and Janet N. Ahn
Teachers College, Columbia University

Jondou Chen
University of Washington

Fu-Fen Anny Fang and Myra Luna-Lucero



Journal of Educational Psychology

0022-0663/11/$12.00 DOI: 10.1037/a0026224

How Learning About Scientists' Struggles Influences Students' Interest and Learning in Physics

Huang-Yao Hong
National Chengchi University

Xiaodong Lin-Siegler
Columbia University

How does learning about scientists' struggles during their scientific knowledge building affect students' science learning? Two hundred and seventy-one high school students were randomly assigned to 1 of 3 conditions: (a) the struggle-oriented background information (n = 90) condition, which presented students with stories about 3 scientists' struggles in creating the content knowledge that the students were learning through online physics instructional units; (b) the achievement-oriented background information (n = 88) condition, in which students learned about these 3 scientists' lifetime achievements; and (c) a

1. Destigmatize mistakes & challenges

Using examples of others who have struggled

Fail> Inspiring resilience

https://www.youtube.com/channel/UC1Z9a0Pdxa4vF3O9_HofRBw

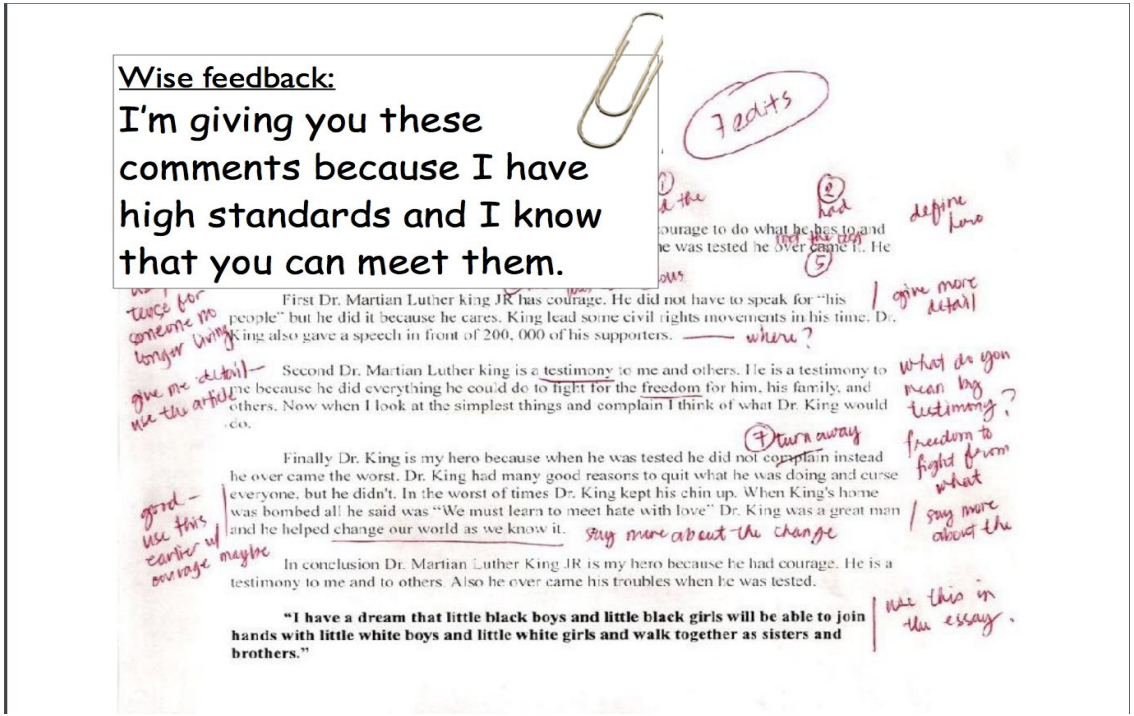
2. Optimize feedback giving (you) & receiving (your students)

Cathy Drennan's TA Training Bootcamp
http://drennan.mit.edu/education/education-interests/teacher-and-mentor-training/

2. Optimize feedback giving (you) & receiving (your students)

Wise criticism

high standards + suggestions for improvement



Yeager, Purdie-Vaughns, et al. (2014)

Gregory Walton

Assurance and Wise Feedback

*Convey respect for students as individuals, rather than judging them in light of a negative stereotype. Use feedback primarily as a mechanism to **help** students improve.*

Give "wise" feedback to encourage students:

- Feedback reflects teachers' high standards
- Feedback confirms the belief that the student can achieve those high standards
- Feedback provides concrete guidance for student improvement

Yeager *et al.* (2014). *Journal of Experimental Psychology*, 143, 804.

2. Optimize feedback giving (you) & receiving (your students)

Teach students how to handle & learn from feedback

A. Dismantle distortions:

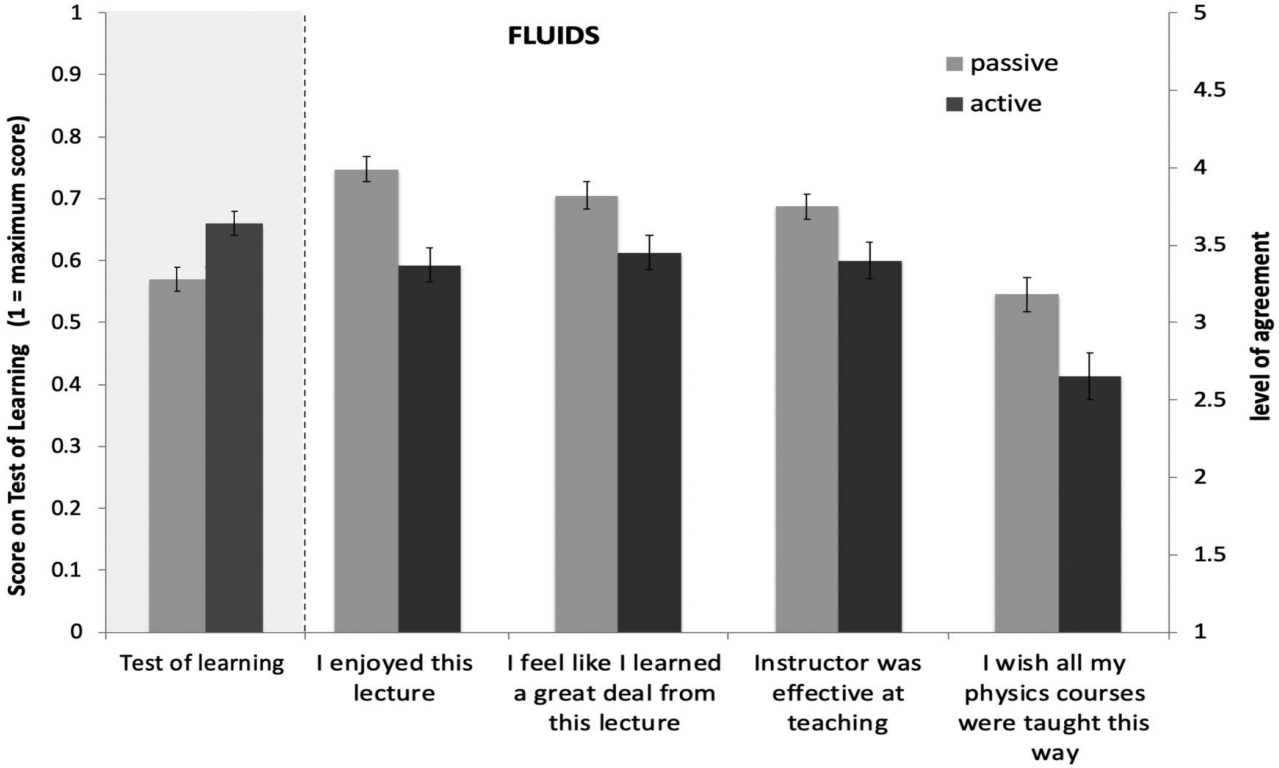
contain the story

What *is* this about?	**What *isn't* this about?**
Whether I might have the qualifications the internship program/fellowship is looking for.	Whether I might not get to work in this company or a good company in the future.

- change your vantage point:
  - imagine you're an observer/friend
  - look back from the future

B. When critical feedback is provided —> **lean into taking a coaching approach**

3. Challenge the notion that learning does not require struggle.



"Illusion of Knowing"

Deslauriers L, McCarty L, *et al*. PNAS 2019;116:39:19251-19257

3. Challenge the notion that learning does not require struggle.

"Desirable difficulties"

Retrieval practice:

- **encouraging students to test themselves rather than review problems/content while studying**
- **implementing weekly classroom quizzes**

Space & interleave practice:

- **interleaving problem types rather than practicing solving same type of problems**

4. Communicate that abilities can grow.

Teaching students about neuroplasticity

How Learning About Scientists' Struggles Influences Students' Interest and Learning in Physics

Huang-Yao Hong
National Chengchi University

Xiaodong Lin-Siegler
Columbia University

Psychological Science OnlineFirst, published on April 10, 2015 as doi:10.1177/0956797615575017

Research Article

Mind-Set Interventions Are a Scalable Treatment for Academic Underachievement

David Paunesku[1], Gregory M. Walton[1], Carissa Romero[1], Eric N. Smith[1], David S. Yeager[2], and Carol S. Dweck[1]

[1]Stanford University and [2]University of Texas, Austin

Abstract

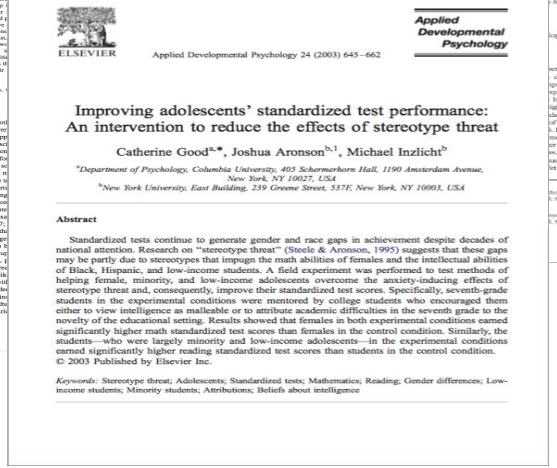
The efficacy of academic mind-set interventions has been demonstrated by small-scale, proof-of-concept interventions, generally delivered in person in one school at a time. Whether this approach could be a practical way to raise school achievement on a large scale remains unknown. We therefore delivered brief growth-mind-set and sense-of-purpose interventions through online modules to 1,594 students in 13 geographically diverse high schools. Both interventions [both were predicted to be lik of dropping out of high averages in core academic r 6.4 percentage points. We

lopment

performance in U.S. high drop out of high school unprepared for either college equently suffer poorer job higher incarceration rates igh school (Dianda, 2008). identified improvement in of the highest domestic pri- Department of Education, ms have been tried, includ- er training, accountability es, and curricula, often at uccess (e.g., Fullan, 2001; let no major reform has

Psychology, Stanford University, Stanford, CA 94305

Psychology, Stanford University, Stanford, CA 94305



ELSEVIER

Applied Developmental Psychology 24 (2003) 645–662

Applied Developmental Psychology

Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat

Catherine Good[a,*], Joshua Aronson[b,1], Michael Inzlicht[b]

[a]Department of Psychology, Columbia University, 405 Schermerhorn Hall, 1190 Amsterdam Avenue, New York, NY 10027, USA

[b]New York University, East Building, 239 Greene Street, 537F, New York, NY 10003, USA

Abstract

Standardized tests continue to generate gender and race gaps in achievement despite decades of national attention. Research on "stereotype threat" (Steele & Aronson, 1995) suggests that these gaps may be partly due to stereotypes that impugn the math abilities of females and the intellectual abilities of Black, Hispanic, and low-income students. A field experiment was performed to test methods of helping female, minority, and low-income adolescents overcome the anxiety-inducing effects of stereotype threat and, consequently, improve their standardized test scores. Specifically, seventh-grade students in the experimental conditions were mentored by college students who encouraged them either to view intelligence as malleable or to attribute academic difficulties in the seventh grade to the novelty of the educational setting. Results showed that females in both experimental conditions earned significantly higher math standardized test scores than females in the control condition. Similarly, the students—who were largely minority and low-income adolescents—in the experimental conditions earned significantly higher reading standardized test scores than students in the control condition.

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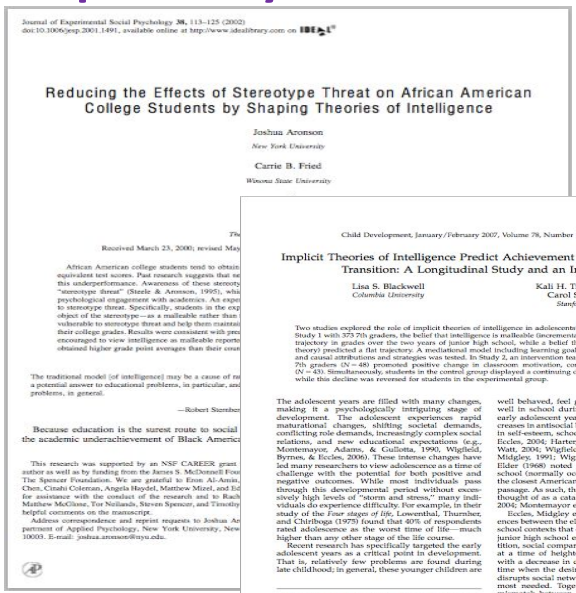
Keywords: Stereotype threat; Adolescents; Standardized tests; Mathematics; Reading; Gender differences; Low-income students; Minority students; Attributions; Beliefs about intelligence



Journal of Experimental Social Psychology 38, 113–125 (2002)
doi:10.1006/jesp.2001.1491, available online at http://www.idealibrary.com on IDEAL

Reducing the Effects of Stereotype Threat on African American College Students by Shaping Theories of Intelligence

Joshua Aronson
New York University

Carrie B. Fried
Winona State University

Received March 23, 2000; revised May

African American college students tend to obtain equivalent test scores. Past research suggests that ne this underperformance. Awareness of these stereoty "stereotype threat" (Steele & Aronson, 1995), whi psychological engagement with academics. An expe to stereotype threat. Specifically, students in the exp object of the stereotype—as a malleable rather than vulnerable to stereotype threat and help them maintai their college grades. Results were consistent with pre encouraged to view intelligence as malleable reporte obtained higher grade point averages than their cour

The traditional model [of intelligence] may be a cause of ra a potential answer to educational problems, in particular, an problems, in general.

—Robert Sternber

Because education is the surest route to social the academic underachievement of Black America

This research was supported by an NSF CAREER grant author as well as by funding from the James S. McDonnell Fou The Spencer Foundation. We are grateful to Enos Al-Amin, Chen, Cinahi Coleman, Angela Haydel, Matthew Mizel, and Ed for assistance with the conduct of the research and to Rach Matthew McGlone, Tor Neilands, Steven Spencer, and Timothy helpful comments on the manuscript.

Address correspondence and reprint requests to Joshua Ar partment of Applied Psychology, New York University, New 10003. E-mail: joshua.aronson@nyu.edu.

Child Development, January/February 2007, Volume 78, Number 1, Pages 246–263

Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: A Longitudinal Study and an Intervention

Lisa S. Blackwell
Columbia University

Kali H. Trzesniewski and Carol Sorich Dweck
Stanford University

Two studies explored the role of implicit theories of intelligence in adolescents' mathematics achievement. In Study 1 with 373 7th graders, the belief that intelligence is malleable (incremental theory) predicted an upward trajectory in grades over the two years of junior high school, while a belief that intelligence is fixed (entity theory) predicted a flat trajectory. A mediational model including learning goals, positive beliefs about effort, and causal attributions and strategies was tested. In Study 2, an intervention teaching an incremental theory to 7th graders ($N = 48$) promoted positive change in classroom motivation, compared with a control group ($N = 43$). Simultaneously, students in the control group displayed a continuing downward trajectory in grades, while this decline was reversed for students in the experimental group.

The adolescent years are filled with many changes, making it a psychologically intriguing stage of development. The adolescent experiences rapid maturational changes, shifting societal demands, conflicting role demands, increasingly complex social relations, and new educational expectations (e.g., Montemayor, Adams, & Gullotta, 1990; Wigfield, Byrnes, & Eccles, 2006). These intense changes have led many researchers to view adolescence as a time of challenge with the potential for both positive and negative outcomes. While most individuals pass through this developmental period without excessively high levels of "storm and stress," many individuals do experience difficulty. For example, in their study of the *Four stages of life*, Lowenthal, Thurnher, and Chiriboga (1975) found that 40% of respondents rated adolescence as the worst time of life—much higher than any other stage of the life course.

Recent research has specifically targeted the early adolescent years as a critical point in development. That is, relatively few problems are found during late childhood; in general, these younger children are well behaved, feel good about themselves, and do well in school during those years. In contrast, the early adolescent years are marked by normative increases in antisocial behavior and normative declines in self-esteem, school engagement, and grades (e.g., Eccles, 2004; Harter, 1998; Simmons & Blyth, 1987; Watt, 2006; Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991; Wigfield, Eccles, & Pintrich, 1996). Elder (1968) noted that the entry into junior high school (normally occurring at age 12 or 13) may be the closest American society comes to a formal rite of passage. As such, the junior high transition has been thought of as a catalyst for future problems (Eccles, 2004; Montemayor et al., 1990; Wigfield et al., 2006).

Eccles, Midgley et al. (1993) found several differences between the elementary school and junior high school contexts that could account for this effect. The junior high school environment emphasizes competition, social comparison, and ability self-assessment at a time of heightened self-focus; it is associated with a decrease in decision making and choice at a time when the desire for control is growing; and it disrupts social networks and support when they are most needed. Together, these changes point to a mismatch between the adolescent's needs and the environment they are thrown into—one common result of which is disengagement from school (Eccles, Wigfield, Midgley, & Reuman, 1993; Eccles, 2004; Entwisle, 1990).

How students negotiate these changes has major implications for their academic futures. Sadly, in the face of these challenges, many students (including

This research was funded by grants from the William T. Grant Foundation and the Spencer Foundation. The authors are grateful to Dr. Morton Slater, founder of the Gateway Schools program; to the students, teachers, and principals of the Queens Gateway Secondary and Life Sciences Secondary Schools for their cooperation in this research; and to the undergraduate students of Columbia University who assisted in conducting our studies. Finally, we thank Steve Raudenbush for his advice on key statistical analyses.

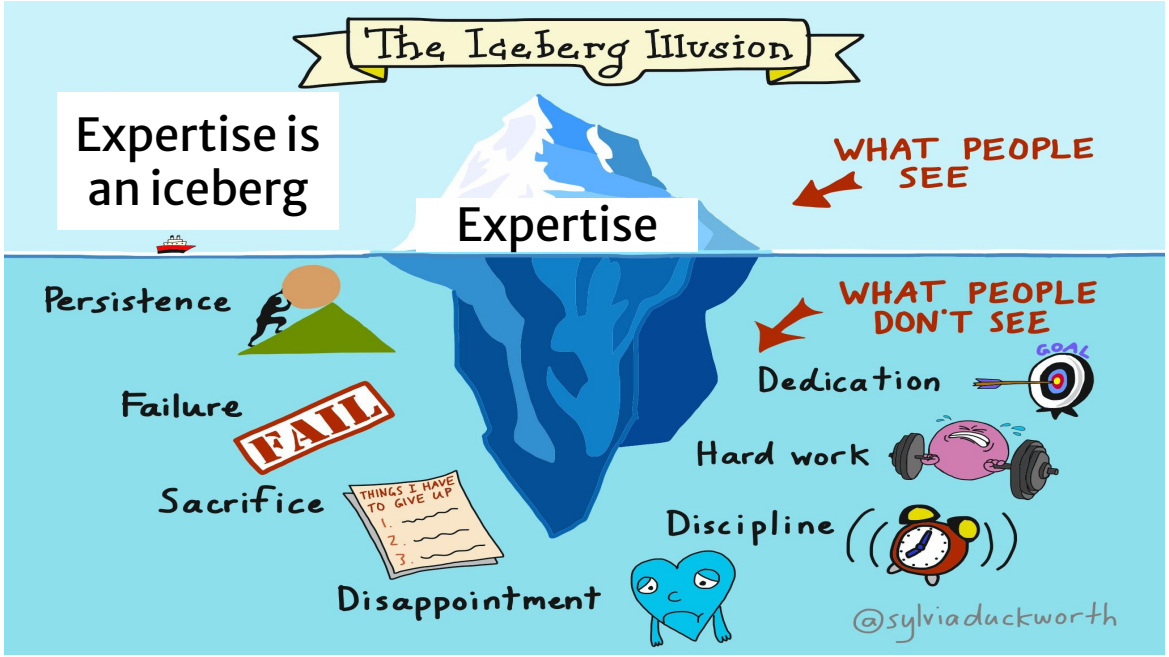
Correspondence concerning this article should be addressed to Carol S. Dweck, Department of Psychology, Stanford University, Stanford, CA 94305. Electronic mail may be sent to dweck@psych.stanford.edu.

 0009-3920/2007/7801-0014

What are other ways to communicate that abilities can grow and expand provided the right experiences?

4. Communicate that abilities can grow.

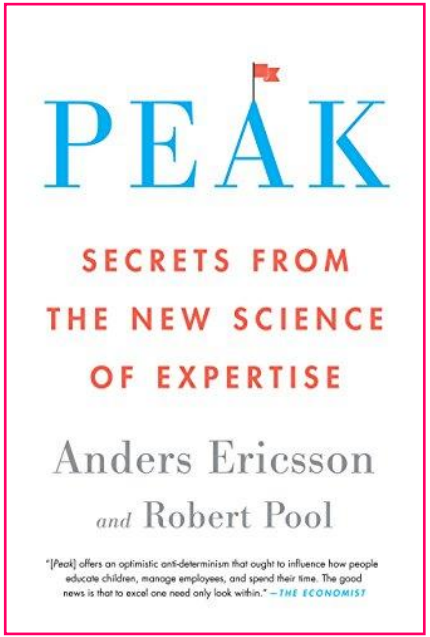
Explain how expertise is acquired



4. Communicate that abilities can grow.

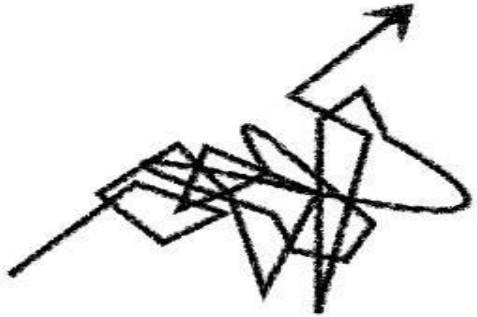
Explain how expertise is acquired

Deliberate practice: activity that one engages in with the purpose of improving performance.



Mastery

what people think it looks like



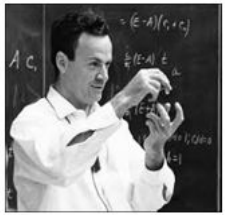
what it **actually** looks like

Image from Daniel Gibson

The Nature of Science, and of LPSA

- Questions and Problems

"Know how to solve every problem that has been solved" – Richard Feynman



Richard Feynman

- Collaboration and Solidarity

"If I have seen further it is by standing on the shoulders of giants." – Isaac Newton

Prof. John Johnson (Astro 16)

- You!

"We look at science as something very elite, which only a few people can learn. That's just not true." - Mae Jemison

Mae Jemison (Astronaut)

- Normalizing struggle and challenges
- Motivate students to support one another
- Set high expectations

Strategies to promote a growth mindset in your students

1. Destigmatize mistakes and challenges

2. Optimize feedback giving (you) and receiving (your students)

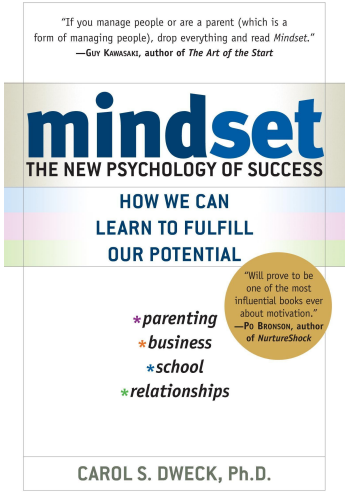
3. Challenge the notion that learning does not require struggle.

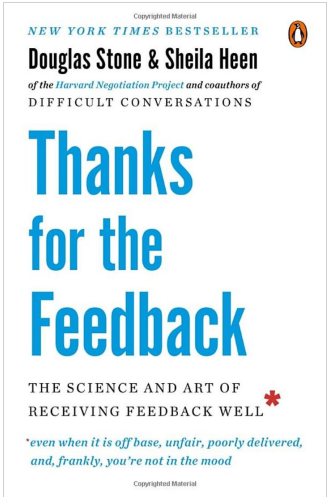
4. Communicate that abilities can grow.

5. Continue on your own mindset journey

Resources

- Mindset Scholars Network: http://mindsetscholarsnetwork.org/
- Project for Education Research That Scales: https://www.perts.net/
- Quick intro: Carol Dweck's TED talk
- More in-depth resources:





Guiding principles we can use

1. Offer Process praise instead of person praise
    - Process praise emphasizes student effort and strategy use student resilience
    - Person praise ties their performance to their sense of self-worth making a mistake implies they are not smart

2. Skill- Teach strategies for successfully taking on challenging tasks that extend the frontiers of students' current ability.

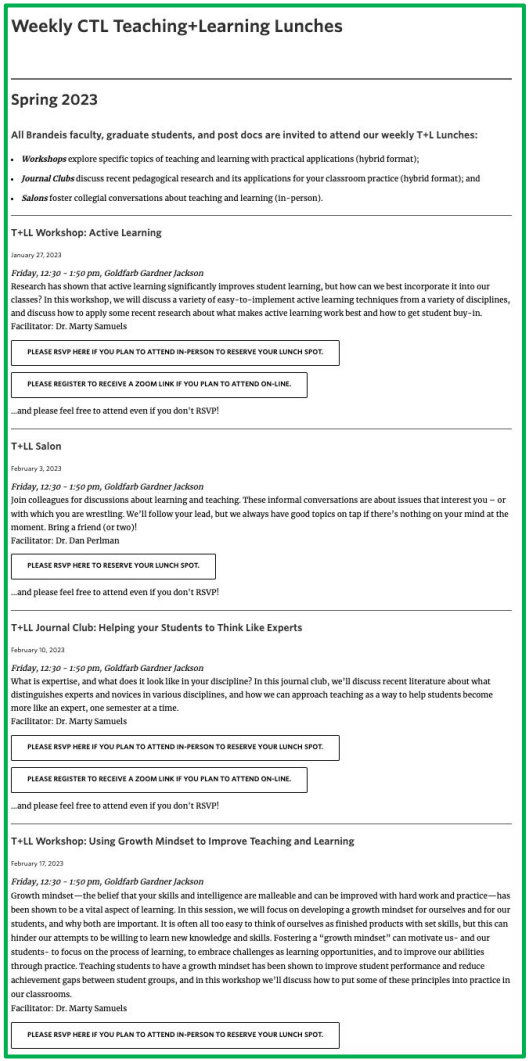
3. Resilience- Create a culture of high expectations and safety that enables students to be resilient academic risk takers.
    - Convey confidence that your students can meet high expectations, and help them not get too down when they are challenged.
    - Making challenging oneself the norm.
    - Teach students to support each other.

4. Assessment- Teach students the real value of assessments and how they can be used for improvement.
    - teach students how to use tests to identify areas for growth and learn from mistakes
    - Help students use homework and tests to identify where they are in their learning, and where they need to be.
    - Encourage revisions so they can develop mastery

Thank you!

Stay in touch and let us know how we can help!

- Farber 2
- ctl@brandeis.edu
- msamuels@brandeis.edu
- CTL Events page
- Keep an eye out for our CTL Newsletter!



Weekly CTL Teaching+Learning Lunches

Spring 2023

All Brandeis faculty, graduate students, and post docs are invited to attend our weekly T+L Lunches:

- ***Workshops*** explore specific topics of teaching and learning with practical applications (hybrid format);
- ***Journal Clubs*** discuss recent pedagogical research and its applications for your classroom practice (hybrid format); and
- ***Salons*** foster collegial conversations about teaching and learning (in-person).

T+LL Workshop: Active Learning

January 27, 2023

Friday, 12:30 - 1:50 pm, Goldfarb Gardner Jackson
Research has shown that active learning significantly improves student learning, but how can we best incorporate it into our classes? In this workshop, we will discuss a variety of easy-to-implement active learning techniques from a variety of disciplines, and discuss how to apply some recent research about what makes active learning work best and how to get student buy-in.
Facilitator: Dr. Marty Samuels

PLEASE RSVP HERE IF YOU PLAN TO ATTEND IN-PERSON TO RESERVE YOUR LUNCH SPOT.

PLEASE REGISTER TO RECEIVE A ZOOM LINK IF YOU PLAN TO ATTEND ON-LINE.

...and please feel free to attend even if you don't RSVP!

T+LL Salon

February 3, 2023

Friday, 12:30 - 1:50 pm, Goldfarb Gardner Jackson
Join colleagues for discussions about learning and teaching. These informal conversations are about issues that interest you – or with which you are wrestling. We'll follow your lead, but we always have good topics on tap if there's nothing on your mind at the moment. Bring a friend (or two)!
Facilitator: Dr. Dan Perlman

PLEASE RSVP HERE TO RESERVE YOUR LUNCH SPOT.

...and please feel free to attend even if you don't RSVP!

T+LL Journal Club: Helping your Students to Think Like Experts

February 10, 2023

Friday, 12:30 - 1:50 pm, Goldfarb Gardner Jackson
What is expertise, and what does it look like in your discipline? In this journal club, we'll discuss recent literature about what distinguishes experts and novices in various disciplines, and how we can approach teaching as a way to help students become more like an expert, one semester at a time.
Facilitator: Dr. Marty Samuels

PLEASE RSVP HERE IF YOU PLAN TO ATTEND IN-PERSON TO RESERVE YOUR LUNCH SPOT.

PLEASE REGISTER TO RECEIVE A ZOOM LINK IF YOU PLAN TO ATTEND ON-LINE.

...and please feel free to attend even if you don't RSVP!

T+LL Workshop: Using Growth Mindset to Improve Teaching and Learning

February 17, 2023

Friday, 12:30 - 1:50 pm, Goldfarb Gardner Jackson
Growth mindset—the belief that your skills and intelligence are malleable and can be improved with hard work and practice—has been shown to be a vital aspect of learning. In this session, we will focus on developing a growth mindset for ourselves and for our students, and why both are important. It is often all too easy to think of ourselves as finished products with set skills, but this can hinder our attempts to be willing to learn new knowledge and skills. Fostering a "growth mindset" can motivate us- and our students- to focus on the process of learning, to embrace challenges as learning opportunities, and to improve our abilities through practice. Teaching students to have a growth mindset has been shown to improve student performance and reduce achievement gaps between student groups, and in this workshop we'll discuss how to put some of these principles into practice in our classrooms.
Facilitator: Dr. Marty Samuels

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Opening reflection activity

Think about something in your academic past that you think measured you. For example:

- a test score
- not getting an internship
- a meeting where you research work was ripped to shreds
- a disparaging comment from a professor/advisor

1. Write down (on one side of index card):

   the scenario in question and how it made you feel about your own abilities.

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1. Write down (on one side of index card):

   the scenario in question and how it made you feel about your own abilities.

2. Re-examine your experience of failure. Answer (on the other side of index card):

   What can I learn from that experience? How can I use it as a basis for growth?