Considerations for the Use of Psychological Interventions to Address Educational Inequality

David S. Yeager
University of Texas at Austin

www.mindsetscholarsnetwork.org

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Collaborators: Carol Dweck, Greg Walton, Barbara Schneider, Beth Tipton, Rob Crosnoe, Chandra Muller, Paul Hanselman, Chris Hulleman, Tim Wilson, Ron Ferguson, ICF International, Dave Pauneksu, and more.
Imagine you’re a 9th grader...

Easy A, don’t learn anything new

63%

Possible lower grade, but learn a lot

37%

National Mindset Study, N=15,852
Two Learning Mindsets

- **Growth mindset** (Dweck, 2006)
  - The idea that “smartness” is **not a fixed entity**, but has the potential to **grow and develop** under the right conditions, with the right support.

- **Purpose for learning** (Yeager et al., 2014)
  - The idea that you work hard and learn in school in order to **gain skills** that you can use to **have a positive effect on the world around you** and also **have an enjoyable and fulfilling life**.

- **Both mindsets:**
  - Associated with greater challenge-seeking and persistence in the face of difficulty, frustration, or boredom.

Also see: Garcia & Cohen (2012); Yeager & Walton (2011); Yeager, Paunesku, Walton & Dweck (2013)
How can a program teach a growth mindset and purpose for learning?

• Self-administered, programs delivered via the internet in two proctored, in-school, 45-minute sessions
  • Does not matter which class they complete it in

• Now possible due to advances in the psychology of persuasion

• No software, no training of staff, no cost to use the program
  • Main commitment is the logistics of proctoring the session
"UT Mindset" Article

As you read the 4-page scientific article below, try to think about how it relates to your life.

***Please read each page slowly and carefully***

When you are done reading, we will ask you to remember what you read. So please pay close attention. (and, just to remind you, the "Next" button will appear after you have had time to read carefully)

You Can Grow Your Brain

*New Research Shows the Brain Can Be Developed Like a Muscle*

Many people think of the brain as a mystery. We don’t often think about what intelligence is or how it works. And when you do think about what intelligence is, you might think that a person is born either smart, average, or dumb—either “good at school” or not—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. 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 you 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 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 the muscles do. This is true even for adults or older teenagers. So it’s not true that some people are stuck being “not smart.” You can improve your abilities a lot, as long as you practice and use good strategies.

Inside the outside layer of the brain—called the cortex—are billions of tiny nerve cells, called neurons, that communicate with each other via tiny gaps filled with a chemical called synapsis.
Orientation Website

Pre-Orientation Requirements

Welcome, David Scott Yeager

Please see this webpage for additional information about freshman orientation including tests.

You must now complete the following requirements

While most of the modules are brief, some will take extra time and attention, so please plan time to complete these requirements, and can reference the materials at any time. You must check in at orientation. You will not be allowed to register for classes until you have completed.

Required Completion

1. How to Prepare for Click here to view the video presentation
### Orientation Website

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>7. Meningococcal Vaccine Requirement</strong></td>
<td><a href="#">Click here</a> to read the Meningococcal Vaccine Requirement information</td>
</tr>
<tr>
<td><strong>8. The &quot;UT Mindset&quot;</strong></td>
<td>Click here to hear about social and academic life at UT from current Sophomores, Juniors and Seniors, and to provide your opinions about the transition to UT. Set aside 30-45 minutes of time to complete this survey carefully and privately before clicking the link. Please do not press the &quot;back&quot; button in your browser during the &quot;UT Mindset&quot; activity.</td>
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<tr>
<td><strong>9. University of Texas Honor Code</strong></td>
<td><a href="#">Click here</a> to download the University of Texas Honor Code</td>
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Maintaining Full-Time Enrollment
(N=2,463 African Americans, Latinos, First-Gen. White and Asian students)

81% 82% 86% 81% 84%
75%
77% 79% 81% 83% 85% 87% 89% 91% 93% 95%

2011 2012 Randomized Control 2012 Randomized Mindset 2013 2014 Non-randomized treatment

Continuing-Gen White and Asian Students: 90%
51% gap reduction

Yeager, Walton, et al. (in press), PNAS
Considerations for Scale

1. Suitability of intervention materials

2. Heterogeneity of intervention effects

3. Feasibility of national dissemination

\{ Pilots \\
National Mindset Study \}
1. Re-designing Materials to be Suitable for 9th Grade

- User-centered design
  - One-on-one
  - 3-5 students
  - 25 students

- A/B testing
  - Rapid randomized experiments
  - Qualtrics panel (teens); Mturk (adults), etc.

Yeager et al. (2016), Journal of Educational Psychology
HMW make friends in college
HMW create some failure experiences
HMW take advantage of freedom
HMW simulate real college
HMW teach self-actualize

Teambuilding exercises
Had to fail a class
Activities w/ built-in failing (prototyping)
Homework drafts FFF B+
Awards for "good" failures
Professors model failure
Tryout for something
Teachers fail everyday—real grade is how you respond
Challenge others to try something
Watch reality TV—how they respond
Share risk w/ others

Assessment
Feedback
Attribution
Intentional rejection

planned failures
52 churches
out-of-comfort zone
User-Centered Design

• Include quotes from admired adults and celebrities;
• Include more and more diverse writing exercises;
• Weave purposes for *why* one should grow one’s brain together with statements that one *could* grow one’s brain;
• Use bullet points instead of paragraphs;
• Reduce the amount of information on each page;
• Show actual data from past scientific research in figures rather than summarize them generically (because it felt more respectful);
• Change examples that appear less relevant to high school students (e.g., replacing a study about rats growing their brains with a summary of science about teenagers’ brains), and more.

Yeager et al. (2016), *Journal of Educational Psychology*
A/B Tests

• Rapid randomized experiments involving N=3,004

• Tested seemingly minor variations:
  • Should you tell people it’s supposed to help them? (no)
  • Which examples should you use? (ones about teens)
  • Should you try to refute the “fixed mindset” view? (no)
## A/B Tests

<table>
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<th>A/B Study</th>
<th>N</th>
<th>Manipulation and coding</th>
<th>Effect on pre-post mindset Δ</th>
<th>β=</th>
<th>p=</th>
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<td>Celebrity endorsements = 1 vs. Not=0</td>
<td>0.273</td>
<td>0.073</td>
<td></td>
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</table>
Revised Intervention
Welcome back!

Thank you for joining us again. As you may remember, last time we discussed three big ideas.

1. People can **make their brains stronger** when they take on difficult work.
2. The teenage years are a **time when the cells in the brain are ready to grow**.
3. And when the brain grows stronger, it allows you to **achieve goals that matter to you and the people you care about**.

We'll share some more about these ideas today. But, remember, this program still needs your input so that it can be more powerful for next year's 9th grade students.
Harnessing Adolescent Injustice Concerns

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.
Here's an exercise that will help us explain this idea better next year.

Imagine putting yourself into a brain scanner. Picture your brain “lighting up” when it’s learning from a mistake. Think about the neurons growing and connecting, making a stronger brain.

Now imagine someone in the brain scanner who is not using a learning mindset. This person is ignoring their mistakes and their brain is not “lighting up.”

What could you say to this person? How could you encourage them to use a learning mindset to strengthen their brain?

For instance, you could tell them:

- People often make mistakes when they’re learning something new
- These mistakes give your brain a chance to “light up” and form new connections.

Neurons in the brain learning from mistakes
Source Credibility

Listen to Michelle Obama

Michelle Obama, First Lady of the United States

"So I want you all to understand that those moments when you’re feeling anxious or insecure, those moments when you’re not sure you can reach that next level—those are the moments when you shape yourself into who you want to be, alright. That’s actually proven by science and research that shows that when you think hard about something or you struggle to solve a problem—whether it’s math or science, or a problem in life—your brain is actually growing. You’re actually becoming smarter because of that struggle. So embrace it. Relish those moments. Those are the moments when you’ve got
Maya A., high school student

“Last week in class, I learned a valuable lesson. I learned that, with a little self-discipline and a learning mindset, I can achieve heights that I honestly didn't think were in my reach. I owe it all to Mr. Trimmer. He told us stories of people doing impressive things, like getting fit from exercise, and passing a previously failed class. At first, I thought it was a waste of time, and that some people were just born smart, that they have it in their genes. Mr. Trimmer challenged us to use learning mindsets for the week and look for a change. So I did, reluctantly. That week, I didn't miss any homework, a struggle for me. I was amazed, could he have been right? Since then, I've only improved.”
“Saying-is-Believing”

Please answer this question: How might you use a learning mindset more in your classes?

For instance, you could write about using a learning mindset when math class is hard, or when a teacher tells you how to improve your writing. As a reminder, when students use a learning mindset they:

- Welcome challenges and stick to them
- Try new strategies
- Ask for advice when they are stuck
- Use their mistakes to learn and improve

In the box, please share your plan for using a learning mindset. We'll share these with future students.
Session 1: Baseline survey and first intervention session
Week 2-5 of fall semester

Participating students sign into study website...

Each student completes 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 internalize article’s lessons
**Session 1: Baseline survey and first intervention session**
Week 2-5 of fall semester

Participating students sign into study website...

Each student completes baseline survey:
- Demographic measures
- Psychometric measures

**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 internalize 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:**
- Initial-change outcomes
- Fidelity measures

**Control condition:**

**Follow-up: Monitoring students’ objective academic outcomes**

Participating students’ academic records will be gathered to determine 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
% Earning D/F Averages (Pilot)

10 public high schools (N=3,676); 95% student response rate

• Effect for all students: 4 percentage point reduction, $p<.001$

• Effect for students of color whose parents do not have a college degree, attending schools with low/medium PSATs

  • Control: 39% with D/F averages

  • Mindset treatment: 30% with D/F averages, $p<.001$

Pre-registration: osf.io/aerpt

Yeager et al. (2016), *Journal of Educational Psychology*
2. Heterogeneity of Effect Sizes
National Mindset Study

PI: David Yeager; Co-Is: Muller; Crosnoe; Schneider; Walton; Dweck; Collaborator: Beth Tipton

- National probability sample randomized experiment in 9th grade
- Schools selected among ~12,000 “Regular U.S. public schools”
  - Low grade 9
  - More than 50 9th graders
  - Non-charter, non-public, non-specialty school
- Stratified by school achievement and racial composition
  - Selected 138 schools; 76 (55%) participated
    - In addition: 7 schools over-sampled from Houston ISD
  - Within schools, 93% of students participated
  - 94% of math teachers completed a survey
- Student surveys and random assignment to mindset program vs. control
“Goldilocks” Moderation?
Cf. Miller ... Duncan (2014), *Child Development*
Creating a School Achievement Variable

School Quality

- PSAT math ('11-'13)
  - 7.6
  - $\varepsilon_1 .98$

- PSAT reading ('11-'13)
  - 8
  - $\varepsilon_2 .94$

- AP Eng score ('13-'14)
  - 3.8
  - $\varepsilon_3 .22$

- % students taking AP Calc/AB ('13-'14)
  - 0.42
  - $\varepsilon_4 .97 .23$

- AP Calc/AB score ('13-'14)
  - 2.5
  - $\varepsilon_5 .03 .03$

- Greatschools (2014)
  - 2.5
  - $\varepsilon_6 .42$

- NAEP math % proficient ('11, '13)
  - 5.3
  - $\varepsilon_7 .97$
Ideal stratum allocations for estimation of average treatment impact

Ideal stratum allocations based for comparing effect sizes within strata

Balanced designs have more power
School Achievement and Minority Composition Are Confounded

$r = .60$
<table>
<thead>
<tr>
<th>School achievement</th>
<th>Low</th>
<th>Med</th>
<th>Med</th>
<th>High</th>
<th>High</th>
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<tr>
<td>Minority %</td>
<td>Low/High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Population</td>
<td>25%</td>
<td>27%</td>
<td>23%</td>
<td>20%</td>
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<tr>
<td>Proportional (out of 75)</td>
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<td>20</td>
<td>17</td>
<td>15</td>
<td>4</td>
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<tr>
<td>Best for Stratum Contrasts (out of 75)</td>
<td>15</td>
<td>15</td>
<td>15</td>
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</tr>
<tr>
<td>Compromise (out of 75)</td>
<td>15</td>
<td>17</td>
<td>17</td>
<td>11</td>
<td>15</td>
</tr>
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</table>
Immediate Treatment Effects
% with Fixed Mindset:
% saying you can’t change how smart you are

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Mindset program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>43%</td>
<td>31%</td>
</tr>
</tbody>
</table>

ES=.29, N = 15,852, P<.001
Self-Transcendent Purpose:
Saying your goal is to learn to make a difference in the world

Control Mindset program

ES=.13, N = 15,852, P<.001
Challenge-Seeking in Math:
% Choosing “Possible lower grade, but may learn a lot”

Control: 37%
Mindset program: 49%

ES = .24, N = 15,852, P < .001
“Make-a-Worksheet”

Create Your Own Math Worksheet

What kind of math worksheet would you prefer?

We are interested in what kinds of problems high school math students prefer to work on. On the next few pages, we would like you to create your own math worksheet. If there is time, at the end of the session you will have the opportunity to answer these math problems.

On the next few pages there are problems from 4 different math chapters. Choose between 2 and 6 problems for each chapter.

You can choose from problems that are...

Very challenging but you might learn a lot
Somewhat challenging and you might learn a medium amount
Not very challenging and you probably won’t learn very much

Do not try to answer the math problems. Just click on the problems you'd like to try later if there's time.

Click the button below to start creating your personal math worksheet.

[Button: Make a Math Worksheet]

Linear Equations: Chapter 3 of 4

Click anywhere on the problems below to select them. Pick at least 2 and up to 6 problems.

Remember, do not try to answer the problems. Just choose ones you might like to do later if there's time.

[Blank box]

Somewhat challenging problem
The equation \( y = \frac{1}{13} x - 4 \) has a y-intercept of \((0, -4)\).
Rearrange the equation to express x in terms of y.

\[ x = \]

What is the equation’s x-intercept? \((\_\_\_, \_\_\_)\)

[Blank box]

Very challenging problem
The equation \( y = \frac{1}{6} \sqrt{3x} + 1 \) has a y-intercept of \((0, 1)\).
Rearrange the equation to express y in terms of x.

\[ y = \]

What is the equation’s x-intercept? \((\_\_\_, \_\_\_)\)

[Blank box]

Somewhat challenging problem
Vanessa is 4 years older than Kevin. Vanessa and Kevin first met 3 years ago. Eight years ago, Vanessa was 3 times as old as Kevin.

\( \)
“Make-a-Worksheet” Choices:
Choosing “Easy” or “Hard” Math

Control Mindset program

ES=.23, N = 15,852, P<.001
3. Feasibility of National Dissemination

(aka, avoiding the Sesame Street Effect)
3. Feasibility of National Dissemination

• Uptake: Is school non-response related to school achievement level?
  • No, \( t(138)=0.69, p=.49 \)
  • Decision to not participate unassociated with school achievement

• Uptake: Is student response rate related to school achievement level?
  • Not really: Three lowest-quality schools in sample had low response rates
  • All other schools, \( r(73) = .03, p=.80 \)

• Effectiveness: Are school-average treatment effect sizes related to school achievement levels?
  • Not really: Three lowest-quality schools had lower effect sizes
  • All other schools: \( r(73) = -.09, p=.46 \)
Analyze Our Mindset Data!

• With funding from Raikes Foundation, we are accelerating the availability of the pilot and National Mindset Study data
  
  Email: dyeager@utexas.edu

• Student level:
  • Attitudes, traits, beliefs, behaviors
  • Ratings of teachers
  • Grades, discipline, attendance, 10th grade course-taking
  • Twin data: identical and fraternal twins

• Math Teacher level:
  • Attitudes, traits, beliefs, hypothetical behaviors
  • Video-based assessment of math pedagogical content knowledge
  • IQ test
  • Measure of implicit bias against black and latino students

• School level:
  • CEPA data?