

# Supplementary Materials for National Study of Learning Mindsets

*Authors Blinded*

2019

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# 1 Introduction

## 1.1 Version Date

This document was compiled on 2019-07-04 13:53:24.

## 1.2 Main Text

This file compiles supplementary information related to the following manuscript:

*How Can We Inspire Nations of Learners? Evidence from Growth Mindset Interventions Conducted in Two Countries*

Authors blinded

## 1.3 Overview

Here is a summary of the information contained in this document:

### 1.3.1 US Study

Section 2 provides additional detail about data collection procedures in the US study. It also provides screenshots of the treatment content. Figure titles explain the psychological goal of the depicted screens.

Section 3 assesses the impact of school non-response on the representativeness of the recruited schools in the US study. These analyses demonstrate several facts. First, they show that there was no meaningful non-response relevant to average student test scores. Second, larger schools, usually in urban districts, were less likely to participate. Accordingly, participating schools had fewer Hispanic/Latino or Black/African-American students, because students of color are more likely to attend urban district schools.

Section 4 reports experimental balance and attrition in the US study. It shows that, at the student level, random assignment was effective (i.e. control students were no different from treatment students). It furthermore shows that attrition from Time 1 to Time 2 was no different by condition.

Section 5 uses data collected in the US study to assess different methods for coding and analyzing the primary dependent measure in the study—the “make-a-worksheet” task. As noted in the text, the pre-registered coding was to take the difference score between the number of hard and easy problems. Here, we present five alternatives that lead to the same conclusion: the number of hard items only, the number of easy items only, categorical variable indicating whether a person chose more hard than easy, an average of all items chosen (coding them such that 1 = easy, 2 = medium, 3 = hard), and a sum of all items chosen (coding them 1, 2, or 3 as above).

The analyses in Section 5 lead to several conclusions. First, student choices on the task show person- and school-level predictive validity regardless of how the data are analyzed. That is, creating more challenging worksheets, however categorized, was associated with saying, hypothetically, that they would choose a hard math homework assignment, and choosing to be in harder math classes (both advanced math and AP test-taking), net of student prior performance. Second, the growth mindset treatment increased challenge-seeking on the task regardless of how the data were analyzed, whether analyses included student-level covariates or not. Section 5 includes several data visualizations that may be useful for future researchers who wish to justify the validity of the task in studies that test novel hypotheses.

Section 6 reports regression tables that test the primary hypotheses in the paper for the US study. These show that progressively adding covariates to the treatment effect models produces the same conclusion (a significant effect of treatment on behavior and beliefs); if anything, adding covariates strengthens the size of

the coefficients and reduces the standard errors associated with them. Section 6 reports the exact pre-specified models (from the syntax posted on OSF prior to receipt of the data) and also the minor modifications made to some variables in the paper. These support the same conclusion.

Section 7 reports key results for the US study when using survey weights.

### **1.3.2 Norway Study**

Section 8 reports details of the sample in the Norway study.

Section 9 reports experimental balance in the Norway study.

Section 10 reports information about the challenge-seeking measures in the Norway study.

Section 11 reports outcome variable characteristics and treatment impact results for the Norway study.

## 2 Details of the Study Procedure and Data Collection in the US Study

A school liaison worked with a member of the data collection firm to select teachers who would devote two class periods non-academic to the study. There was no restriction on type of class, and often non-academic subjects such as PE or Music were selected. Teachers brought their student to the school's computer lab during normal class time and read a brief script explaining that students were about to participate in a study. The study was described as a part of a research project exploring the transition to high school. Students then signed into the research website and were randomized by the web server to a growth mindset condition or a "brain basics" control condition. Every person involved in the study was blind to condition assignment throughout the study (indeed, there was no way for a school staff person or research team member to access that information).

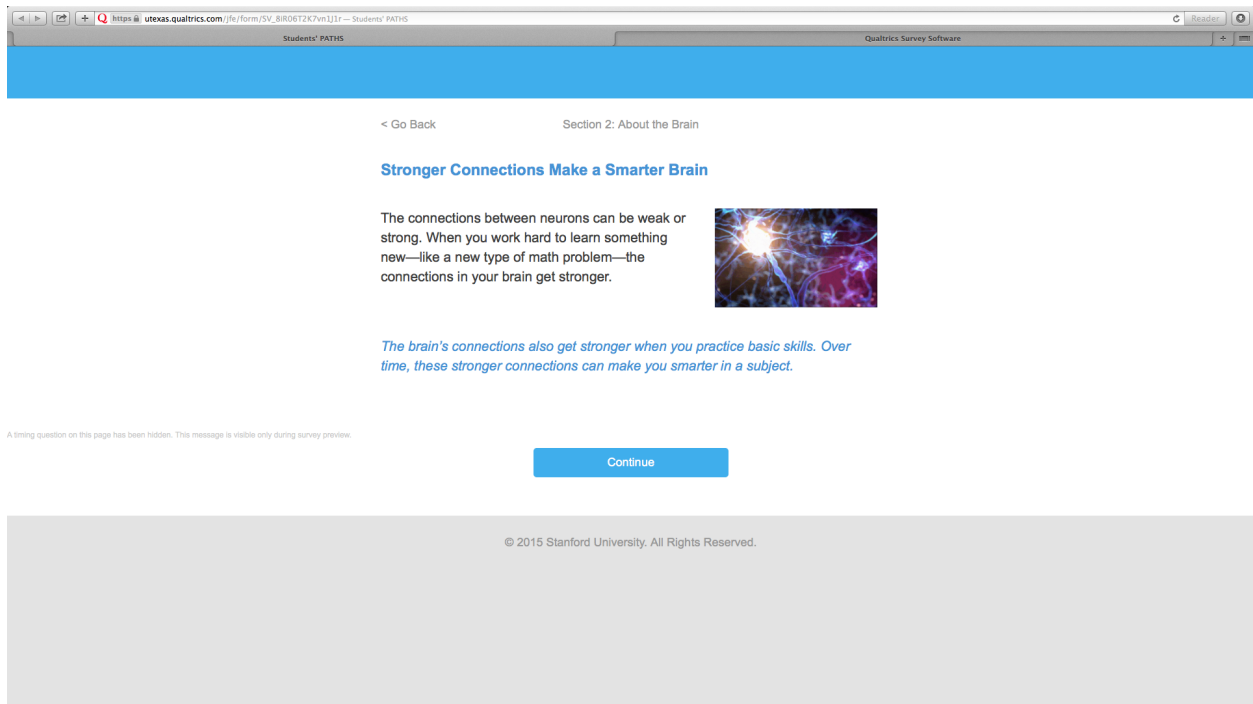
Students in the growth mindset condition: (1) were presented with information about neural plasticity that emphasized how brain functions can improve when one confronts new challenges and practices more difficult ways of thinking, (2) completed writing exercises designed to help students understand and internalize the intervention message by applying the message to their own life and restating the message for a future student. For examples of the intervention materials and student writing, see below.

Students in the control condition, like those in the treatment condition, read a brief article about the brain and answer reflective questions. However, they did not learn about the brain's malleability. Instead, they learn about basic brain functions and their localization, for example, the key functions associated with each cortical lobe. The experimental conditions were designed to look very similar so that students' instructors would remain blind to their condition assignment, and to discourage students from comparing their materials.

The mindset interventions consisted of two 30-minute sessions ("Time 1" and "Time 2"). In most schools (71% of participants), the mindset activities were targeted to the start of school year. The median implementation date for Time 1 for this group was 2015-09-17. In remaining schools, the sessions were targeted to the beginning of the second semester. The median Time 1 implementation date for this group was 2016-01-25. Time 2 was completed more on average 24 days after Time 1, with a standard deviation of 15.

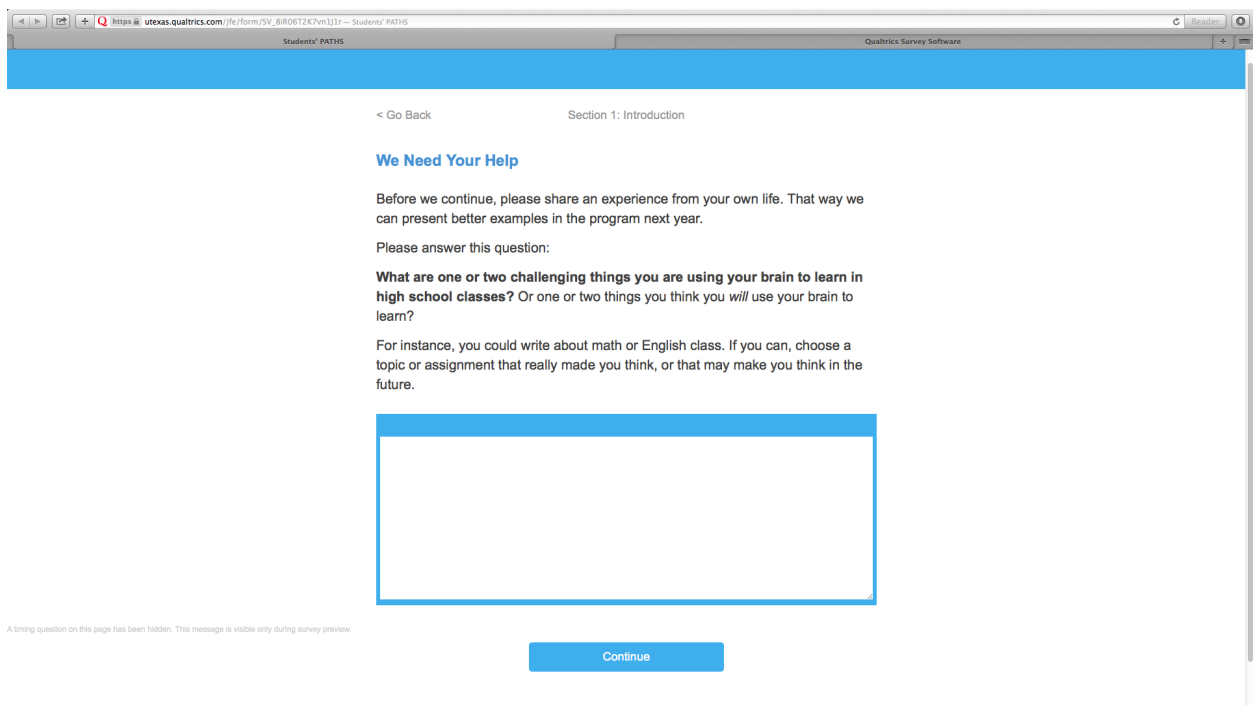
## 2.1 Illustrative Screenshots from the Treatment

### 2.1.1 Students are presented with information about the malleability of the brain



The screenshot shows a web browser window with the URL [https://utexas.qualtrics.com/jfe/form/SV\\_8R06T2K7vnl1J1r](https://utexas.qualtrics.com/jfe/form/SV_8R06T2K7vnl1J1r). The page title is "Students' PATHS" and the software is "Qualtrics Survey Software". The page content includes a navigation bar with "< Go Back" and "Section 2: About the Brain". The main heading is "Stronger Connections Make a Smarter Brain". Below this, there is a paragraph: "The connections between neurons can be weak or strong. When you work hard to learn something new—like a new type of math problem—the connections in your brain get stronger." To the right of this text is an image of a brain with glowing neural connections. Below the image is a blue italicized text: "The brain's connections also get stronger when you practice basic skills. Over time, these stronger connections can make you smarter in a subject." At the bottom of the page, there is a small message: "A timing question on this page has been hidden. This message is visible only during survey preview." and a blue "Continue" button. A footer at the bottom of the page reads "© 2015 Stanford University. All Rights Reserved."




### 2.1.2 Students are asked for their help in communicating these ideas to others as a means of bringing them into the story and including them in the narrative



The screenshot shows a web browser window with the URL [https://utexas.qualtrics.com/jfe/form/SV\\_8R06T2K7vnl1J1r](https://utexas.qualtrics.com/jfe/form/SV_8R06T2K7vnl1J1r). The page title is "Students' PATHS" and the software is "Qualtrics Survey Software". The page content includes a navigation bar with "< Go Back" and "Section 1: Introduction". The main heading is "We Need Your Help". Below this, there is a paragraph: "Before we continue, please share an experience from your own life. That way we can present better examples in the program next year." This is followed by "Please answer this question:" and a bolded question: "What are one or two challenging things you are using your brain to learn in high school classes? Or one or two things you think you will use your brain to learn?". Below the question is another paragraph: "For instance, you could write about math or English class. If you can, choose a topic or assignment that really made you think, or that may make you think in the future." Below this text is a large blue-bordered text input area. At the bottom of the page, there is a small message: "A timing question on this page has been hidden. This message is visible only during survey preview." and a blue "Continue" button.

### 2.1.3 The message is that effort is not enough - you also need strategies to overcome challenges and develop your skills

The screenshot shows a web browser window with the URL [https://utexas.qualtrics.com/jfe/form/SV\\_8R0672K7m1J1r](https://utexas.qualtrics.com/jfe/form/SV_8R0672K7m1J1r). The page title is "Students' PATHS" and the software is "Qualtrics Survey Software". The page content includes a navigation link "< Go Back", a section title "Section 4: Strategies", and a sub-heading "It's Not Just About Effort: Use the Right Strategies". The text explains that sometimes people get stuck and need new strategies. It then asks, "Which ones have you ever done before?" and "Select all that apply." Below this are three options, each with an icon and a description:

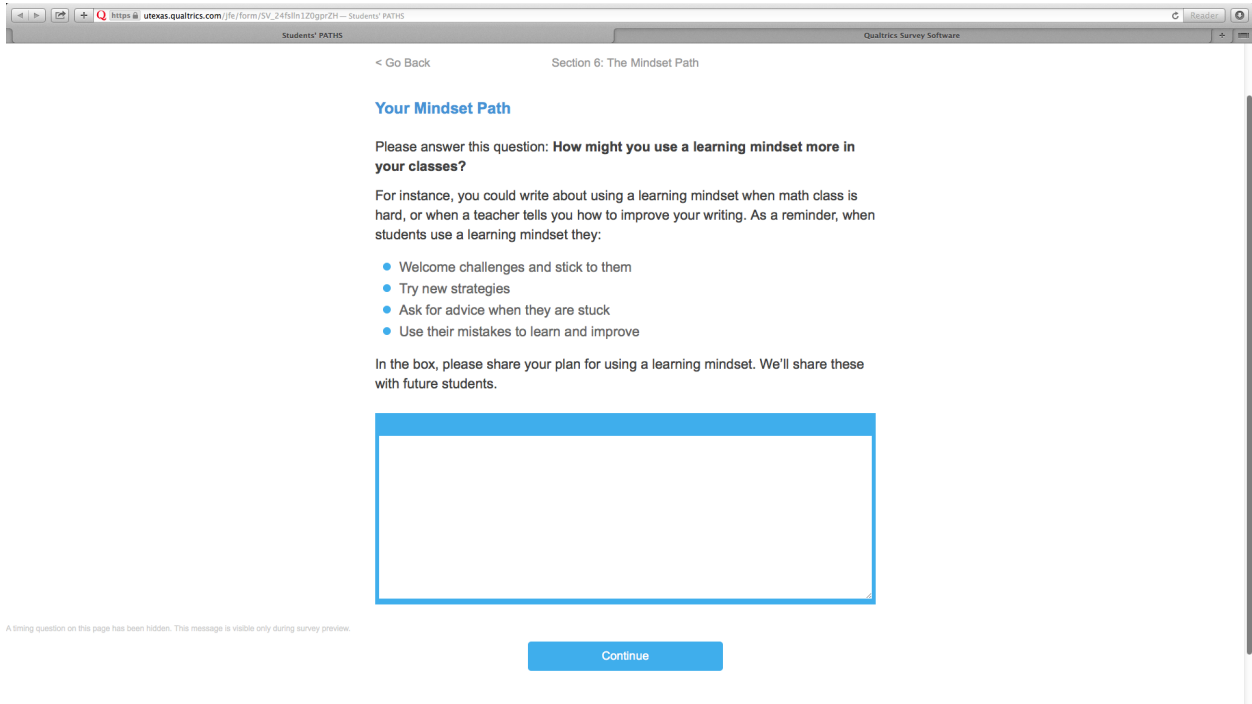
-  Ask a student who knows how to do the problem for ideas
-  Ask your teacher for suggestions about how to get un-stuck
-  Step back and try a new approach on the problem

At the bottom of the page, there is a copyright notice: "© 2015 Stanford University. All Rights Reserved."

### 2.1.4 Materials convey that teenage years are a special time that students can leverage to their advantage.

The screenshot shows a web browser window with the URL [https://utexas.qualtrics.com/jfe/form/SV\\_8R0672K7m1J1r](https://utexas.qualtrics.com/jfe/form/SV_8R0672K7m1J1r). The page title is "Students' PATHS" and the software is "Qualtrics Survey Software". The page content includes a navigation link "< Go Back", a section title "Section 3: Getting Smarter", and a sub-heading "The Teenage Brain Can Become Much Stronger—If You Know How to Make It Happen". The text explains that the brain can get stronger at any age, but there are two times in life when the brain is especially ready to grow: the first is when you are a baby or a very young child, and the second is when you're a teenager. To the right of this text is an image of a human brain with colorful regions. Below the text, there is a paragraph that says: "As you know, teenage hormones do a lot of different things. But you might not know that hormones get your brain ready to learn and get stronger. They prepare the brain to grow when it's challenged. That's why the high school years are a special time when you can grow your intelligence." At the bottom of the page, there is a blue button labeled "Continue" and a copyright notice: "© 2015 Stanford University. All Rights Reserved."

## 2.1.5 Relating growth mindset to their own lives helps students internalize the message by customizing it, and reduces defensive reactions that might emanate from the perception that adults are telling the student what to do



The screenshot shows a web browser window with the URL [https://utexas.qualtrics.com/jfe/form/SV\\_24f5ln120ggrZH](https://utexas.qualtrics.com/jfe/form/SV_24f5ln120ggrZH). The page is titled "Section 6: The Mindset Path" and contains the following text:

**Your Mindset Path**

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:

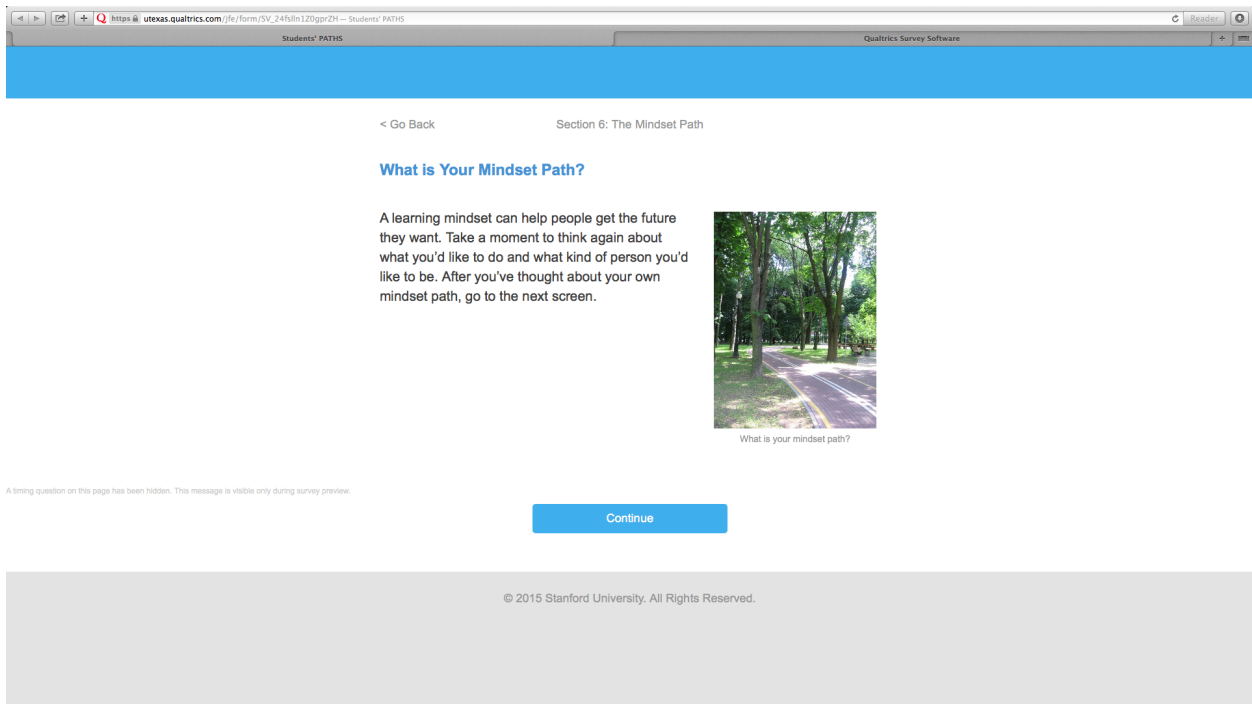
- Welcome challenges and stick to them
- Try new strategies
- Ask for advice when they are stuck
- Use their mistakes to learn and improve

In the box, please share your plan for using a learning mindset. We'll share these with future students.

Below the text is a large, empty rectangular box with a blue border, intended for the student's response. At the bottom of the page is a blue "Continue" button.

A timing question on this page has been hidden. This message is visible only during survey preview.

## 2.1.6 Students are encouraged to see the value of applying a growth mindset to their own lives



The screenshot shows a web browser window with the URL [https://utexas.qualtrics.com/jfe/form/SV\\_24f5ln120ggrZH](https://utexas.qualtrics.com/jfe/form/SV_24f5ln120ggrZH). The page is titled "Section 6: The Mindset Path" and contains the following text:

**What is Your Mindset Path?**

A learning mindset can help people get the future they want. Take a moment to think again about what you'd like to do and what kind of person you'd like to be. After you've thought about your own mindset path, go to the next screen.

Below the text is a photograph of a paved path winding through a lush green park with many trees. Below the photograph is the text "What is your mindset path?". At the bottom of the page is a blue "Continue" button.

A timing question on this page has been hidden. This message is visible only during survey preview.

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## 2.1.7 Student testimonials help communicate that we're in touch with how other students think, and that they're not alone in their concerns about school

< Go Back Section 1: Introduction

**“** Kayla L., high school student

*People always say that we're supposed to use our brains. But they don't always tell us how to do it, and they don't ask us what our personal reasons for learning are—like, what makes us want to use our brains. I'm glad somebody finally took the time to explain things, and to ask for my opinion. For me, I want to have a good life. I also want to help my family and make my community better. I like how somebody finally cared enough to ask me what I thought.*

A timing question on this page has been hidden. This message is visible only during survey preview.

Continue

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## 2.1.8 Materials summarize mindset research, as results from national data in Chile

< Go Back Section 3: Mindsets and Learning

**A Learning Mindset Leads to Success in School**

Scientists studied the mindsets of all the 10th graders in Chile, in South America. The students who knew that they could grow their intelligence were 3 times more likely to score in the top 20% of their class. They had learned more. Students who did not know that they could grow their intelligence did worse.

That's why it's so important that you help us show future 9th graders that intelligence can grow.

Source: Claro, Paunesku, and Dweck (in prep)

**Percent of Students Earning Top Scores by Mindset**

Mindset	Percent of Students Earning Top Scores
Fixed Mindset	12%
Growth Mindset	34%

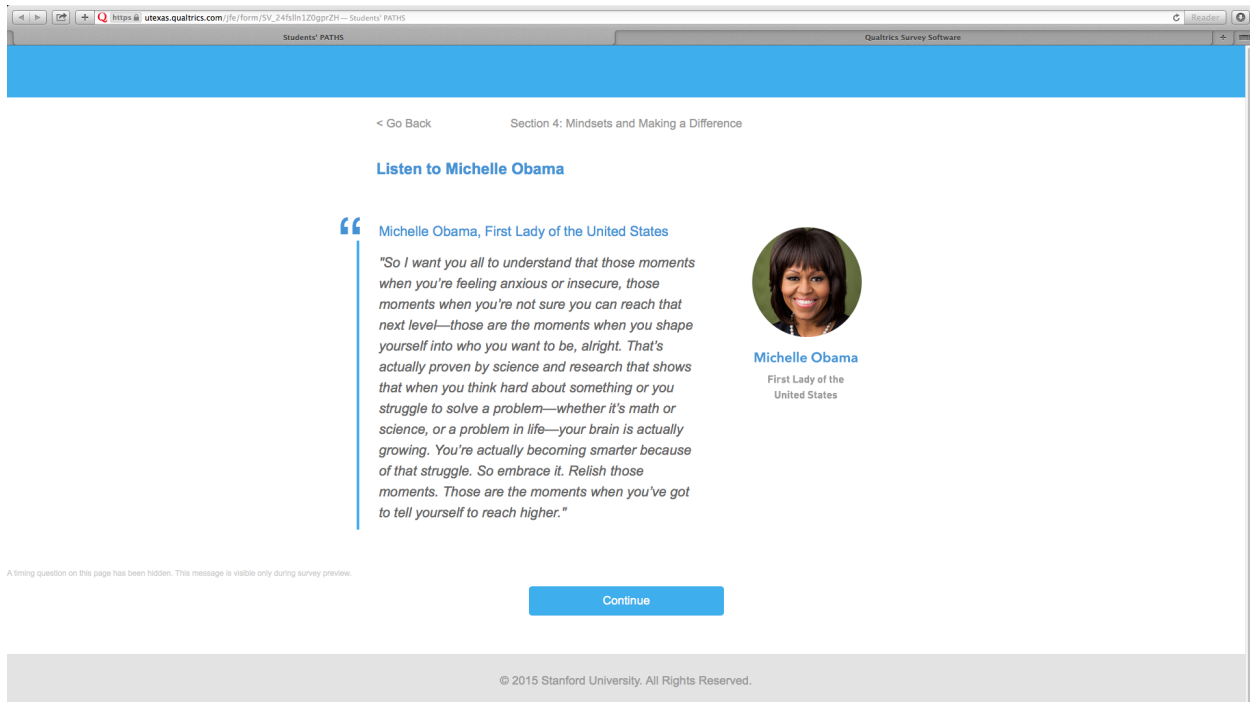
A timing question on this page has been hidden. This message is visible only during survey preview.

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## 2.1.9 Celebrity testimonials - from the likes of technology developers, athletes, and politicians - help communicate that these ideas are not too big for even the most famous people to utilize to their advantage



The screenshot shows a web browser window with the URL `https://utexas.qualtrics.com/jfe/form/SV_24f5ln120grZtH`. The page title is "Students' PATHS" and the software is "Qualtrics Survey Software". The page content includes a navigation link "< Go Back", a section title "Section 4: Mindsets and Making a Difference", and a sub-section header "Listen to Michelle Obama". A quote from Michelle Obama is displayed in a large font, accompanied by a circular portrait of her. Below the quote is a "Continue" button. At the bottom of the page, there is a copyright notice: "© 2015 Stanford University. All Rights Reserved."

< Go Back      Section 4: Mindsets and Making a Difference

### 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 to tell yourself to reach higher."*

**Michelle Obama**  
First Lady of the United States

A timing question on this page has been hidden. This message is visible only during survey preview.

[Continue](#)

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## 2.2 Selected Student Responses

In response to a prompt asking about a time when students had to stretch and grow their brains, students wrote:

A time I made my brain stronger in school is every other day when I go to algebra class. It's not that it's a hard subject for me, it's just that when we first have to learn something new it's difficult at first. But then when we keep working and do practice on it, it becomes easier.

There was a math unit that I really didn't understand and when we took the quiz I got a really bad grade. But I studied more and was able to retake that quiz to get a better score. My brain grew stronger during exams and finals because you need to study in order to pass and learn by doing this your brain gets stronger and smarter.

In math because I couldn't really understand some assignments as much . But I started to help my mom with college algebra so then I stared off again pumped up to do math. Ever since then I have been during real good in that class.

At the end of Time 1, students also wrote what appear to be inspiring notes to future students who may be struggling in their freshman year. For instance, students wrote:

Dear Struggling Student, Don't be afraid to ask for help because once you do you won't regret it. And just because something is hard that doesn't mean you aren't smart.

It will be your first year in high school which means that it will be hard and you will struggle in some of your classes but that doesn't mean you have to give up and not try any different ideas. For example I thought my math was hard when I was a freshmen but after months passing by I started to get better at math so then I started to get higher test scores on my test. So my word to you guys is to not give up and keep trying :)

Don't be afraid or scared to learn. Just know that if you are trying your brain is getting smarter. Just because you don't know how to do it or it's too hard, just ask for help.

At Time 2, students were invited to reflect on issues that mattered most to them personally, and connect their learning to their desire to make a difference on those issues. Ninth grade students wrote passionately about a broad variety of important societal issues. Here are a few examples:

The issues that matter most to me personally are helping people who are less fortunate than us get jobs. Society lately has been very cruel to homeless people are those who do not possess a lot of money. They tell them that they need to get a job, yet how can they get a job when they have no money to get a house, or presentable clothes?

The issues that matter most to me personally would have to be dirty water in other countries. While we have nice somewhat clean water it's horrible that other countries have to drink horrible non sanitized drinking water.

One issue that matters to me is the Syrian refugees. In some refugee camps, they are treated very poorly and don't get enough food and water. Also, there are some people who are stuck in Syria and can't get away, and they are stuck in a war- torn country that they can no longer call home.

### 3 Investigation of Bias in School Sample in the US Study

Of 139 schools randomly selected from the national sampling frame, 76 schools participated. While this represented successful recruitment by the standards of educational research at this scale, it is important to consider whether study schools differ from those that did not participate. We therefore assess the characteristics of participating and non-participating schools.

#### 3.0.1 Characteristics of Non-participating (NP) and Sample (S) Schools

	N (NP)	Mean	SD	N (S)	Mean	SD	t	d	p value
Mean Ach. Test Score	48	0.148	1.057	65	0.102	1.025	0.231	0.046	= 0.818
Mean Math PSAT	58	47.012	5.817	73	47.615	6.079	-0.577	-0.103	= 0.565
Prop. Free/Reduced Lunch	63	0.387	0.271	76	0.373	0.226	0.327	0.06	= 0.744
Prop. Black/Hispanic	63	0.419	0.305	76	0.295	0.275	2.512	0.447	= 0.013
Total Enrollment	63	1541.095	745.592	76	1011.276	716.676	4.244	0.744	< 0.001
Total	63			76					

This table shows that the largest difference between participating and non-participating schools is that sample schools are substantially smaller ( $d = 0.744$ ). This reflects greater difficulty in receiving study approval in large urban districts. Students from negatively stereotyped minority groups (African-American and Hispanic) are also underrepresented in the sample ( $d = 0.447$ ), and schools tend to be higher achieving ( $d = 0.046$ ).

## 4 Experimental Balance and Attrition in the US Study

### 4.1 Effectiveness of Random Assignment

Random assignment was effective in creating comparable groups on observable measures. The mean standardized difference across these measured variables at baseline was 0.014 and the largest difference in absolute value was 0.024.

#### 4.1.1 Characteristics of Treatment (T) and Control (C) Students

	N (C)	Mean	SD	N (T)	Mean	SD	t	d	p value
8th grade grades	8107	4.631	0.884	8058	4.613	0.885	1.272	0.02	= 0.203
Fixed mindset	8111	3.079	1.155	8062	3.051	1.143	1.538	0.024	= 0.124
Meaning in life	8081	3.669	1.062	8028	3.648	1.073	1.233	0.019	= 0.217
Expectancy for success	8089	5.178	1.172	8047	5.155	1.192	1.219	0.019	= 0.223
Interest	8097	2.667	1.141	8048	2.651	1.137	0.897	0.014	= 0.370
Female	7921	49.4%	NA	7731	49.1%	NA	0.206	0.007	= 0.650
Black/Hispanic	7885	37.6%	NA	7700	37.7%	NA	0.004	0.001	= 0.951
Mother with 4-year degree	7847	34.9%	NA	7667	34.6%	NA	0.077	0.004	= 0.781
Total	8124			8075					

### 4.2 Attrition

Among the students randomized to a condition at Time 1, 12.8% did not complete the worksheet task at Time 2, the key measure of challenge-seeking. According to school liaisons, the primary reason for not completing was absence at Time 2. Attrition was similar in the treatment (12.5%) and control (13.1%) groups. Attrition was not differential by condition ( $\chi^2(1)=1.37$ ;  $p = 0.242$ ).

## 5 Details of the Challenge-seeking Worksheet Task in the US Study

In this section, we provide details of the key measure employed in this study, based on the challenge-seeking worksheet task. Students were asked to select specific mathematics problems to work on, including “easy” items and “hard” items which may be challenging but might help students to learn.

Because this is a novel behavioral task, we first document the univariate distributional characteristics of the challenge-seeking measure. We next consider the concurrent validity of this behavioral task with students’ self reported willingness to take on a challenging but potentially rewarding school assignment. Third, we explore the predictive validity of the challenge-seeking measure as a predictor of challenging course-taking.

### 5.1 Alternate Challenge-seeking Measures

There are several plausible alternate codings of the make-a-worksheet task item selections data in addition to the measure described in our pre-specified research plan. We therefore conduct exploratory analyses of six measures in total. In principle, these specifications may emphasize different dimensions of challenge-seeking (e.g., willingness to take on especially challenging problems versus avoiding unchallenging tasks) with different consequences for students, although we find in practice that these alternate specifications tend to be highly correlated with one another (see below).

#### 5.1.1 Summary of Challenge-seeking Measures from Worksheet Task

Variable	mean	sd	min	median	max
1. Worksheet Difference	-0.67	3.78	-8	0.00	8
2. Number of Hard Items	2.98	2.48	0	3.00	8
3. Number of Easy Items	3.64	2.53	0	4.00	8
4. Categorical: Hard < Easy	0.50	NA	0	0.00	1
4. Categorical: Hard = Easy	0.16	NA	0	0.00	1
4. Categorical: Hard > Easy	0.34	NA	0	0.00	1
5. Mean Item Challenge	1.91	0.43	1	1.93	3
6. Challenge Item Sum	19.82	10.61	0	19.00	48

The challenging-seeking measures are constructed as follows:

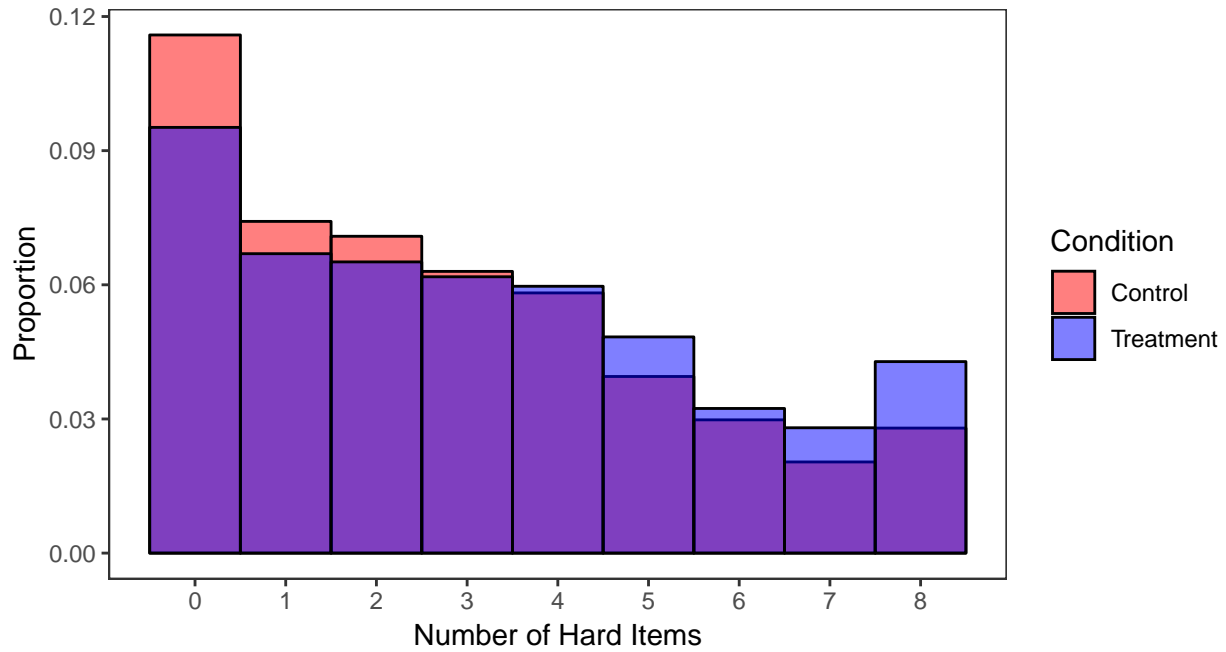
1. **Worksheet Difference:** The pre-registered and main challenge-seeking measure is the difference between the number of most challenging (“Hard”) and least challenges (“Easy”) items selected. This measure incorporates challenge-seeking both in terms of maximizing the former and minimizing the latter.
2. **Number of Hard Items:** The “Hard” challenge measure is a count of the number of most challenging items selected. This is arguably the cleanest measure of students’ willingness to take on difficult but potentially rewarding tasks in school.
3. **Number of Easy Items:** The “Easy” challenge measure is a count of the number of the least challenging items selected. This (reverse-coded) measure is expected to capture challenge-seeking in the sense of avoiding unchallenging but likely unproductive tasks in school (as the “easy” items were described in the worksheet task prompt).
4. **Challenge Categories:** A simplified version of the difference measure collapses students into three groups: those who selected more hard than easy items, those who selected an equal amount, and those who selected fewer hard than easy items.

5. **Mean Item Challenge:** This measure is the mean “challenge” of selected worksheet items where the challenge value is 1 for minimally challenging items, 2 for moderately challenging items, and 3 for the most challenging items. Unlike the the above measures, this one incorporates information about students selection of “medium” items. Note that the mean challenge measure is missing for the students who did not select any items (despite interacting with the worksheet task).
6. **Item Challenge Sum:** The final measure combines information from all selections using the same values as the previous (easy = 1, medium = 2, hard = 3), but calculates the sum of these values. In contrast to the mean challenge measure, this coding assigns the highest challenge-seeking scores to students in part on the raw number of items selected.

Our primary goal in presenting these alternate (non pre-specified) measures from the worksheet task is to explore their implications. We do not seek to compete these specifications against one another, but only to assess whether our conclusions depend on these analytic decisions.

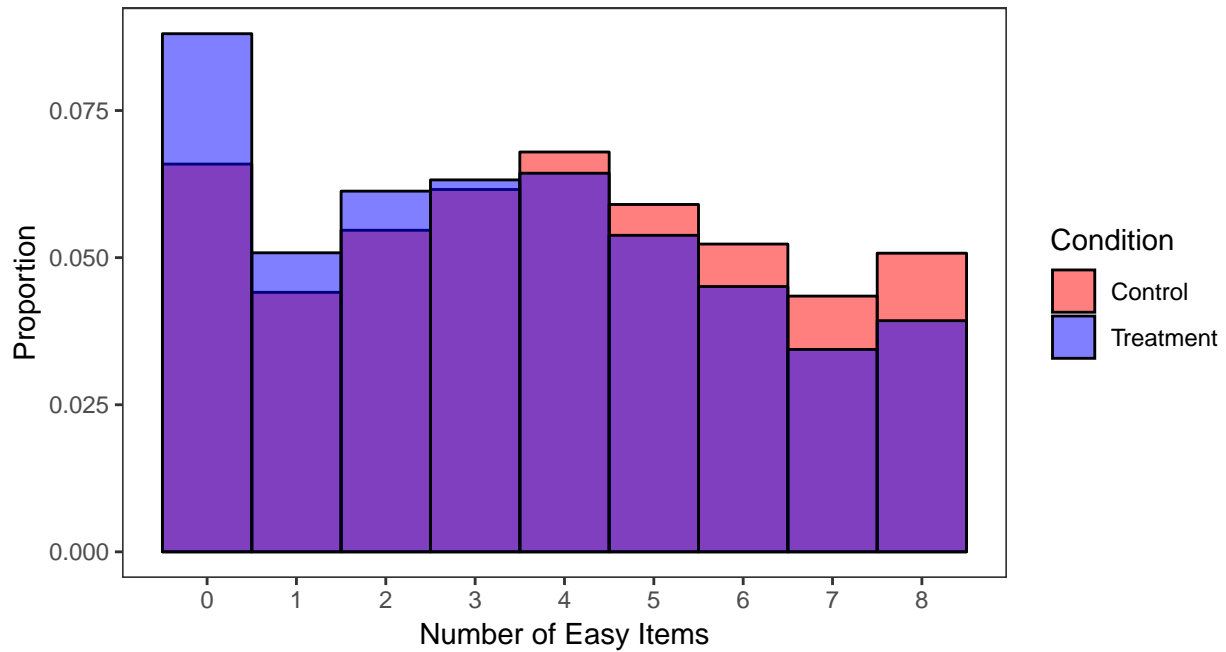
## 5.2 Distribution of Variables

### 5.2.1 Distribution of Number of Hard Items Selected by Condition



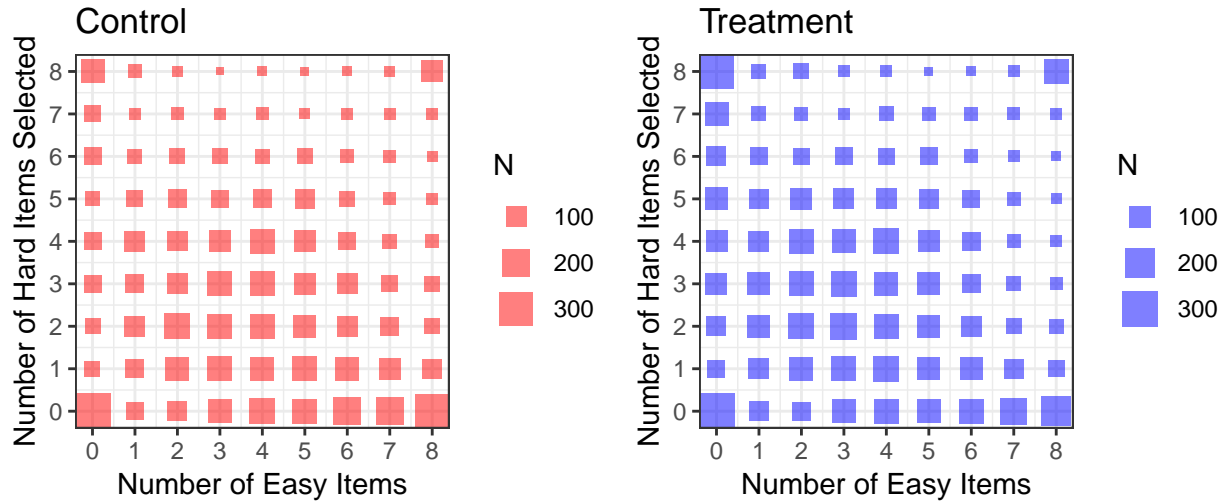
Note: The modal number of hard items is 0 and few students select many hard items.

### 5.2.2 Distribution of Number of Easy items Selected by Condition

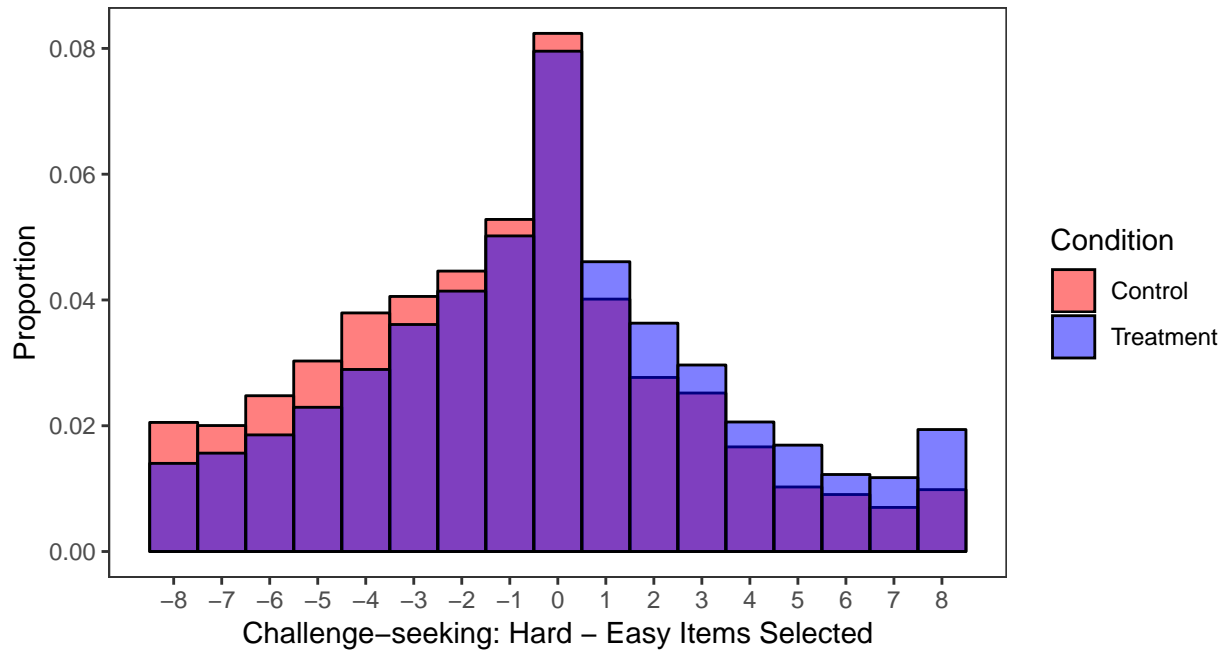


Note: The distribution of the number of easy items is more uniform than hard items.

### 5.2.3 Joint Distribution of Number of Hard and Easy Selections



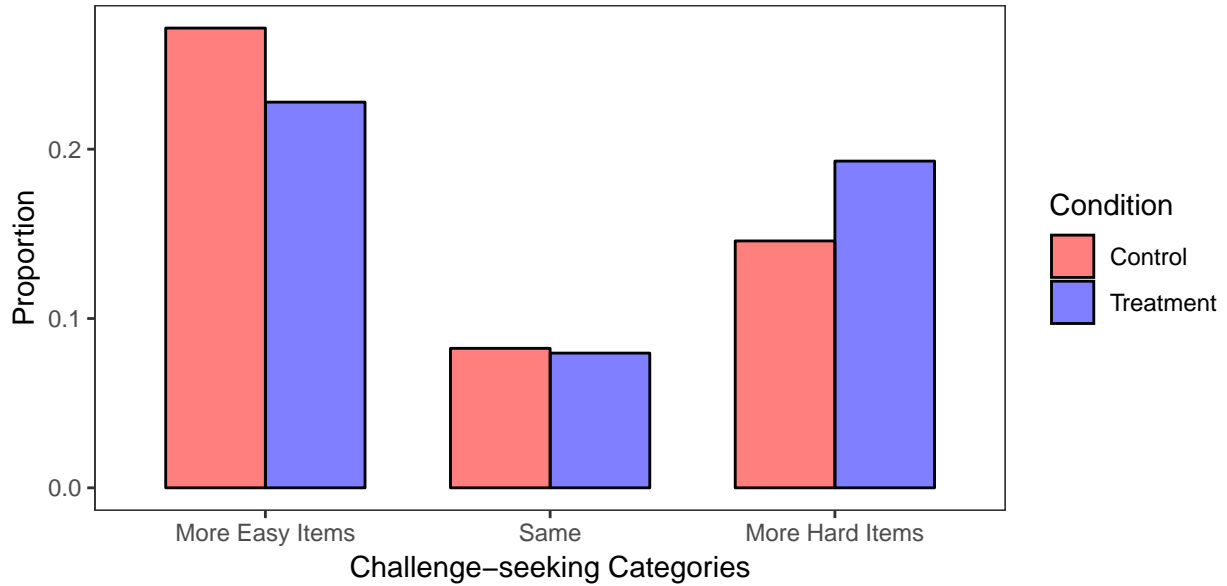
### 5.2.4 Distribution of the (Pre-registered) Worksheet Difference Measure by Condition



Note: This variable is the difference between the number of hard items and the number of easy items selected. It is symmetrically distributed with a clear mode at 0.



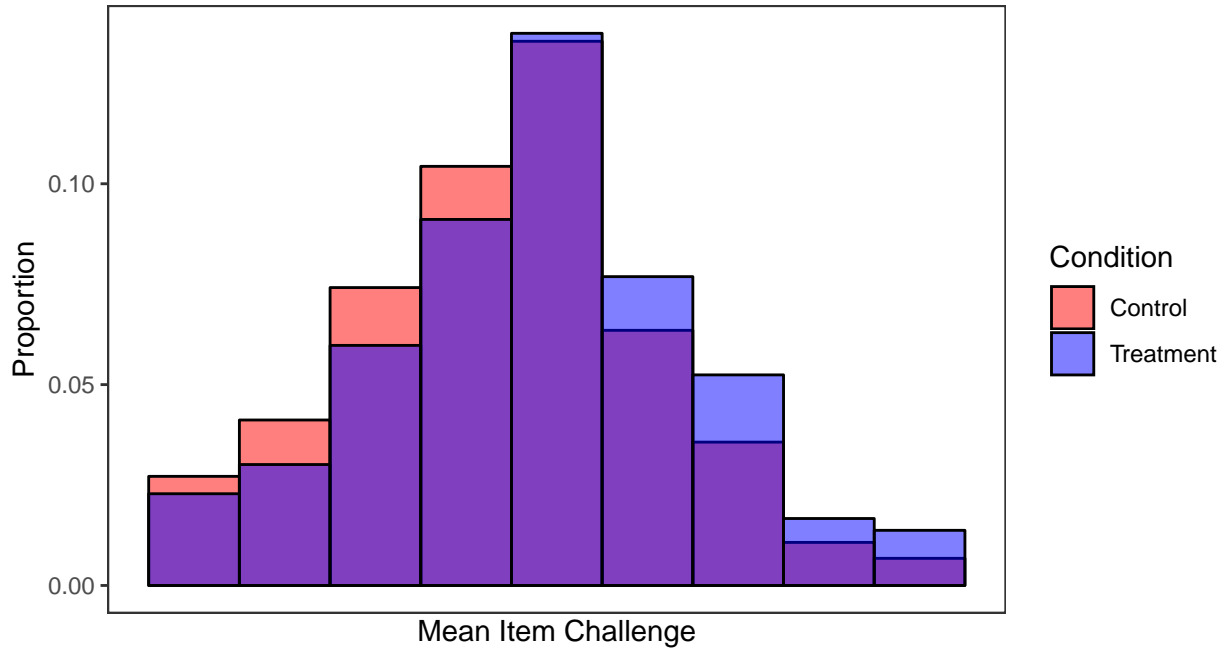
### 5.2.5 Distribution of the Categorical Challenge-seeking Measure by Condition



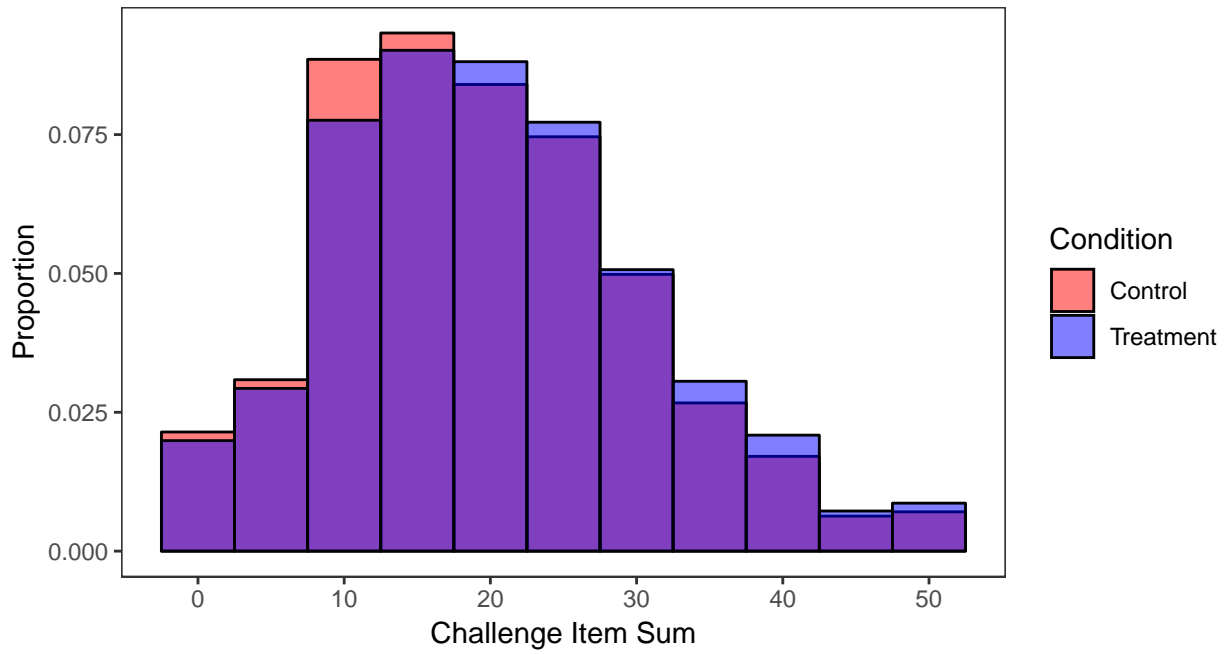
Note: The simpler 3-category version of the difference measure highlights that students tended to select more easy items, gespecially in the absence of the intervention.

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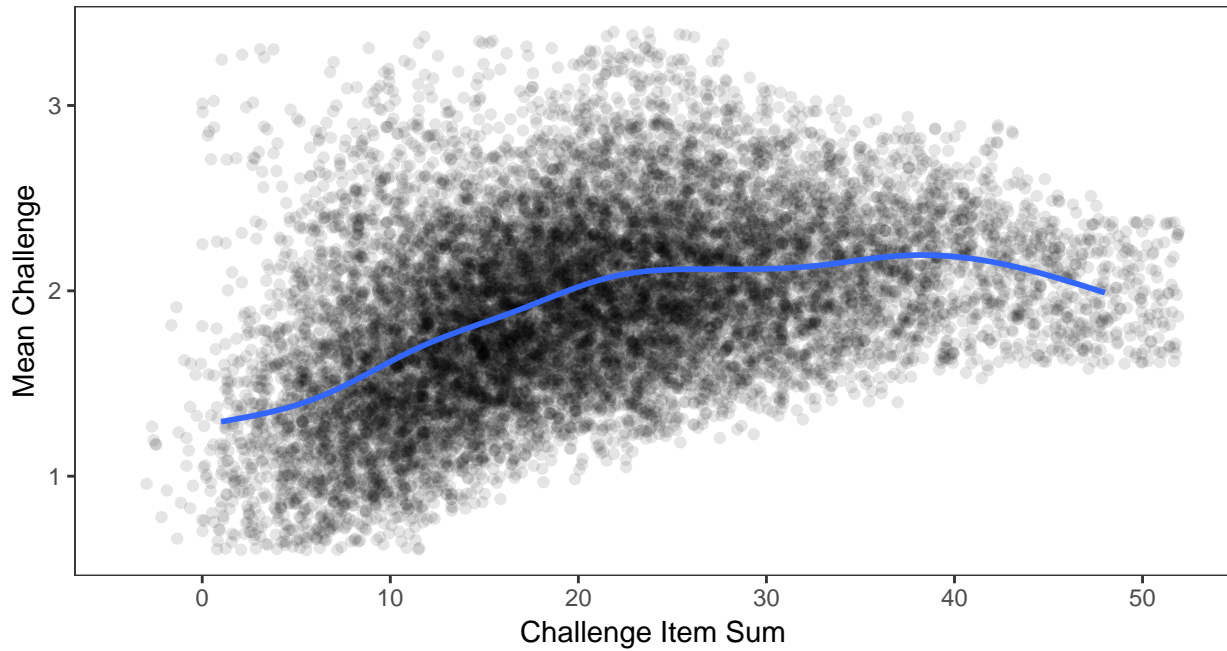
### 5.2.6 Distribution of Mean Challenge Measure by Condition



### 5.2.7 Distribution of Worksheet Items Sum Score by Condition



### 5.2.8 Item Mean Challenge by Sum Score with Non-parametric Fit Line



Notes: Differences between the mean item challenge and challenge sum are related to the number of items selected. For instance, the largest sum scores are only possible when the student selects all types of items, resulting in a “medium” mean item challenge. Nonetheless, there is a positive overall association between mean challenge and the total sum score.

### 5.3 Validity Investigations

To consider aspects of validity of the worksheet task, we focus only on students in the control group.

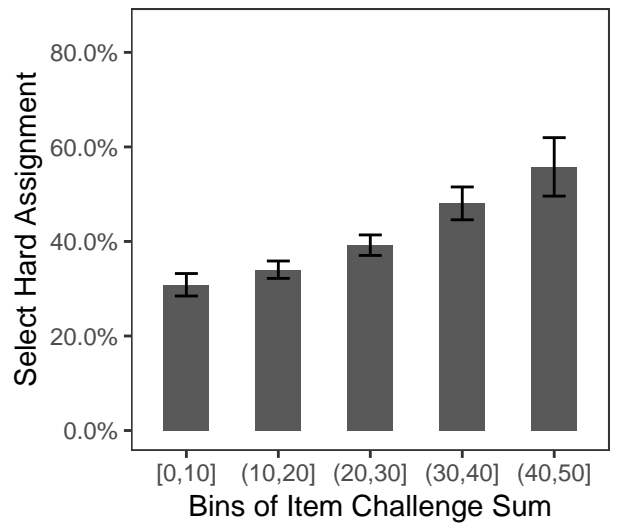
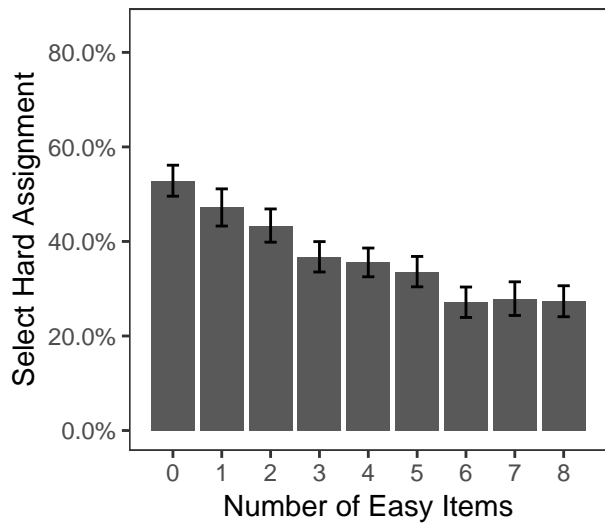
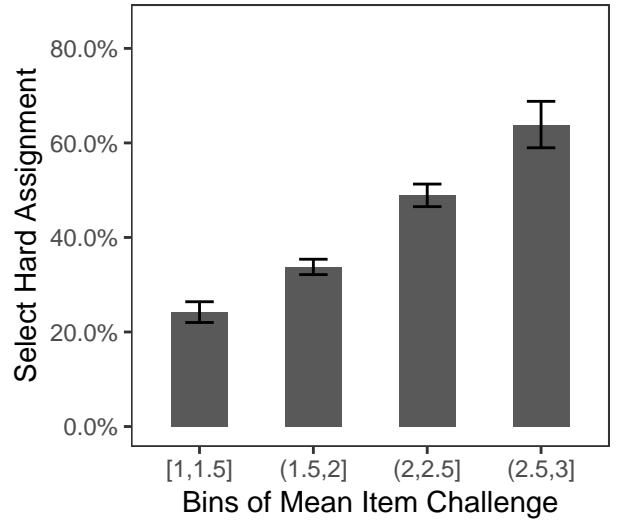
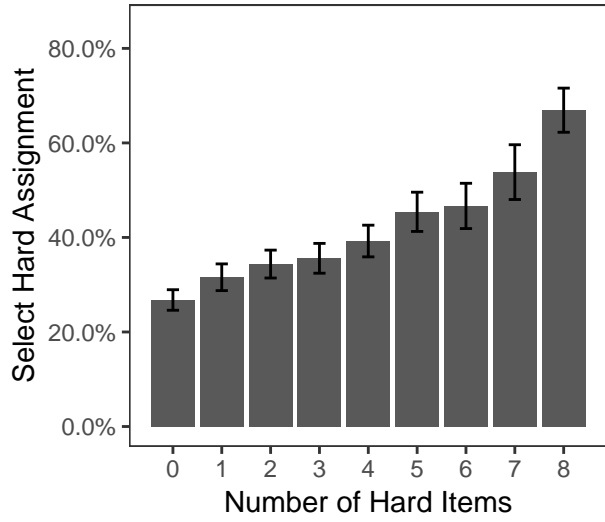
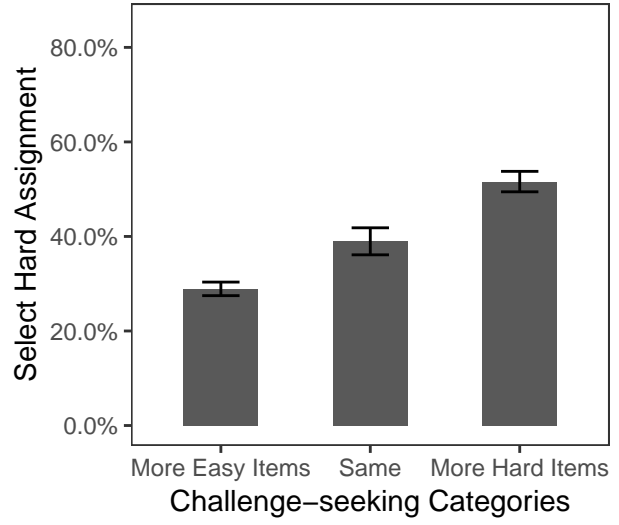
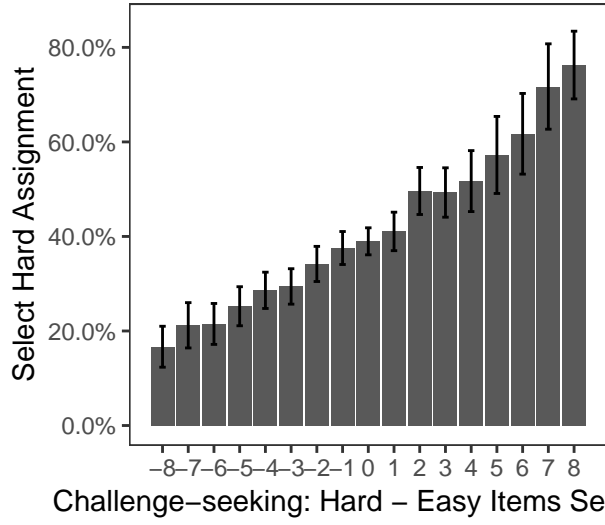
#### 5.3.1 Concurrent Validity: Hypothetical Challenge-seeking Item

One question is whether responses to the behavioral task in the computerized survey setting corresponds to willingness to take on a challenging by potentially rewarding task in another academic setting. To assess such concurrent validity, we asked students to choose between two hypothetical school assignments: an “easy review” or a “hard challenge.”

Among students who selected more hard than easy mathematics problems on the worksheet task, 57.0% chose the harder hypothetical assignment, compared to 32.9% among students who selected more easy items. The difference was significant,  $t(9893) = -26.5$ ,  $p < 0.001$ .

As summarized below, the worksheet task demonstrates concurrent validity with for each coding specification. Students who chose greater hard items and those who chose fewer easy ones were also more likely to choose the hard hypothetical school assignment.

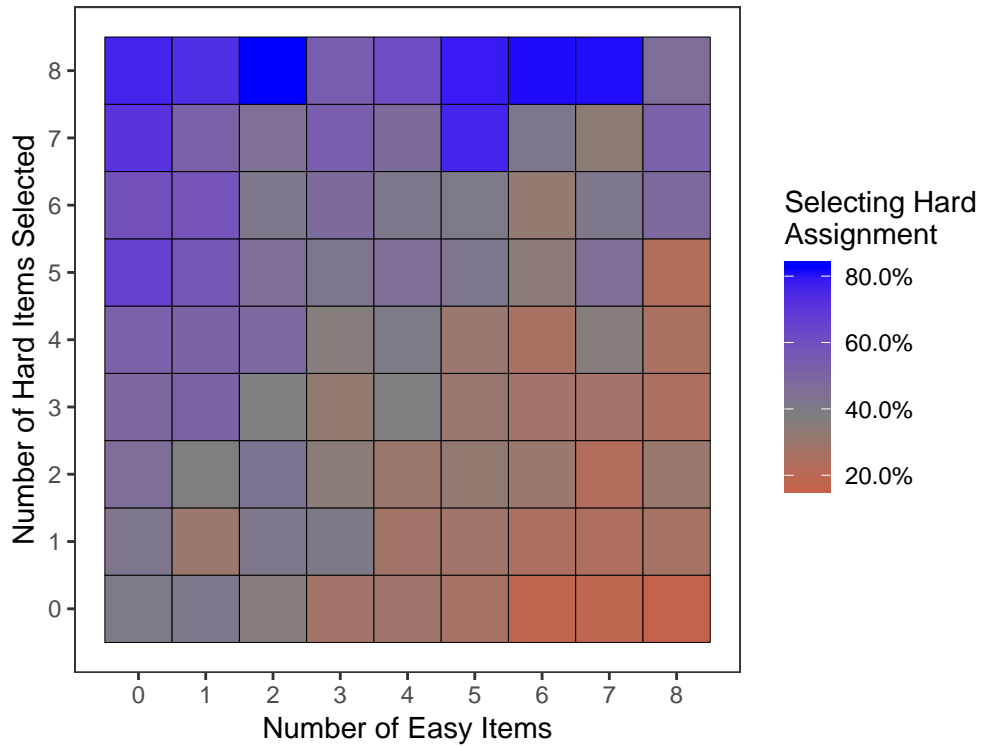
5.3.1.1 Mean Hypothetical Challenge-seeking and 95% Confidence Intervals by Behavioral Task Measures



The associations with hypothetical challenge seeking also highlight value of the combined difference coding of the worksheet task items. Although each coding of the worksheet task is related to hypothetical challenge-seeking in school, it is clear from these figures that the difference specification captures the greatest variability in self-reported challenge-seeking than the constituent or categorical measures.

We also use self-reported hypothetical challenge-seeking to assess whether the simple difference between the number of hard and easy worksheet items is appropriate. Indeed, in the heatmap below, the likelihood of selecting a challenging assignment forms a diagonal gradient, supporting the validity of the measure based on the difference between the two.

### 5.3.1.2 Hypothetical Challenge-seeking by Number of Hard and Easy Selections on the Worksheet Task

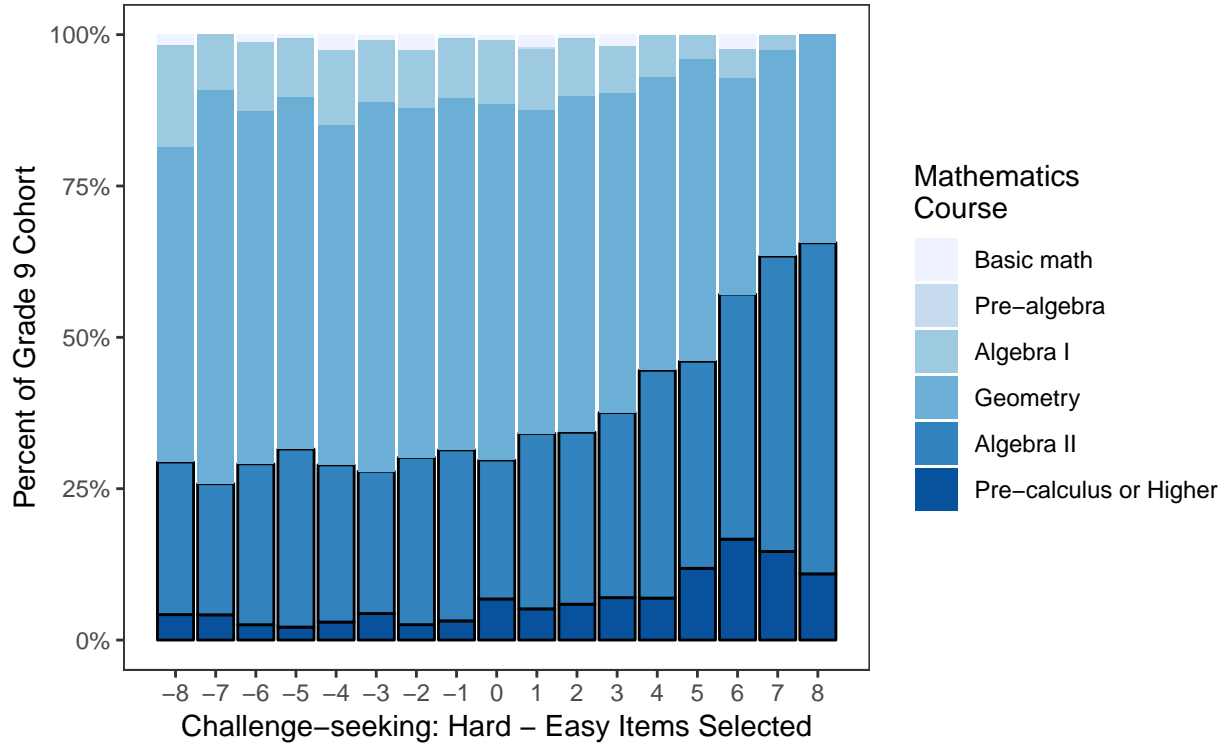


### 5.3.2 Predictive Validity: Grade 10 Advanced Course-taking

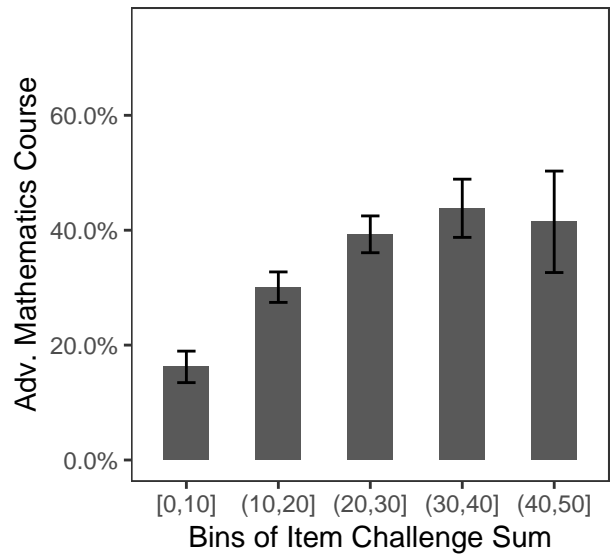
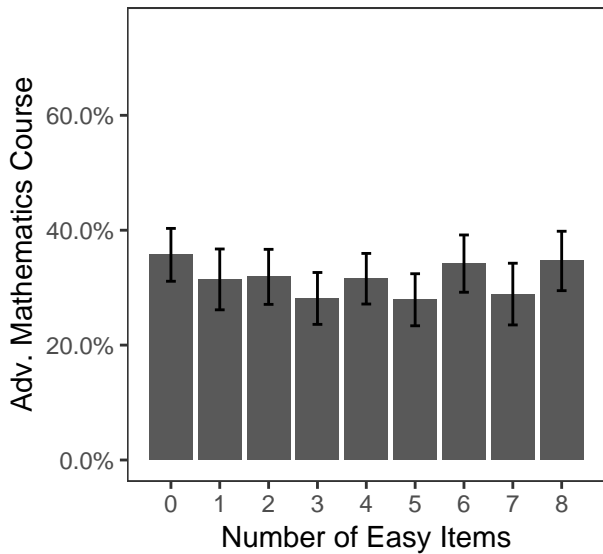
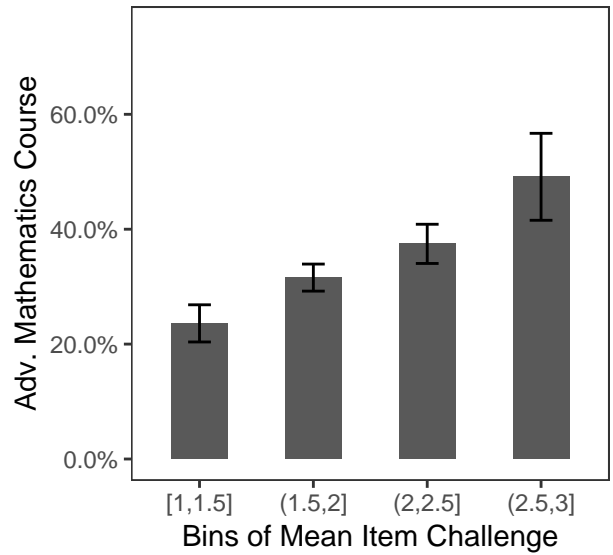
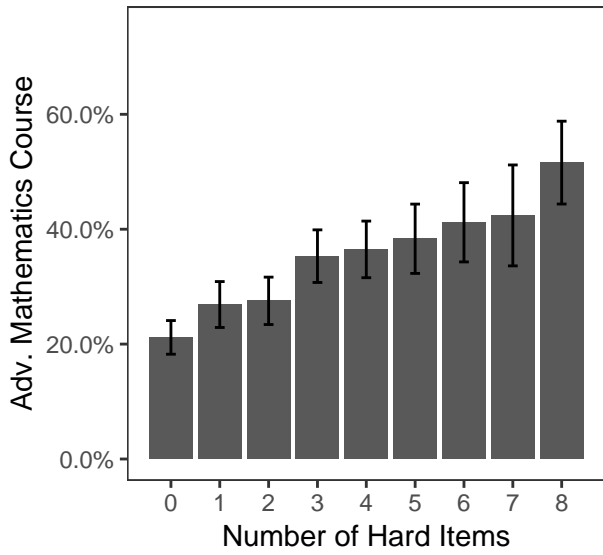
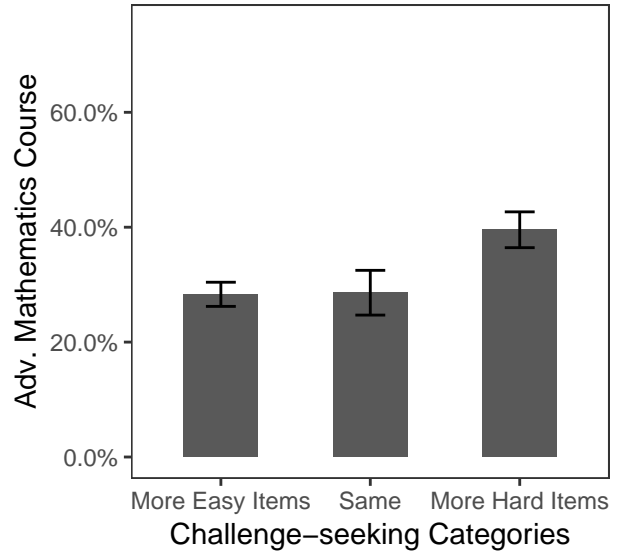
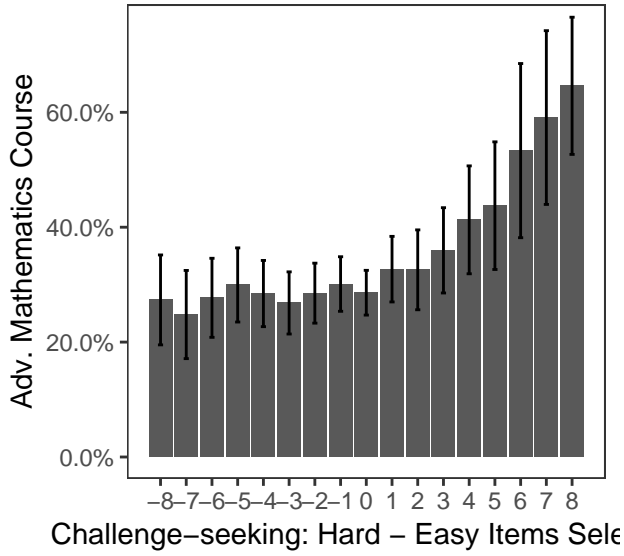
At the individual level, the worksheet behavioral task exhibits predictive validity if greater challenge-seeking is associated with more advanced course-taking, including after accounting for differences in prior academic success. We obtained records of students 10th grade mathematics courses in a subset of schools.

We define advanced mathematics as Algebra II or a higher course, as reflected by the two highest categories in the following figure (represented by bars with outlines).

#### 5.3.2.1 10th Grade Mathematics Level by Pre-registered Challenge-seeking Measure



#### 5.3.2.2 Mean Advanced Course-taking and 95% Confidence Intervals by Challenge-seeking Measures



### 5.3.3 Differences Conditional on 9th Grade Advanced Coursetaking

Among students not taking advanced mathematics in 9th grade (less than Geometry), 13.9% of those who selected hard than easy problems took Algebra II or above in 10th grade, compared to 8.8% for those who selected more easy problems ( $t(2523) = -4.7$ ,  $p < 0.001$ ).

Among students taking advanced mathematics in 9th grade (Geometry or higher), 93.6% of those who selected hard than easy problems took Algebra II or above in 10th grade, compared to 91.7% for those who selected more easy problems ( $t(1484) = -1.4$ ,  $p = 0.176$ ).

### 5.3.4 Predictive Models for Worksheet Difference Measure of Challenge-seeking

We use linear probability models to test whether challenge-seeking measures predict enrollment in an advanced mathematics course in tenth grade among control students in schools that provided this information. We test for bivariate associations and with school fixed effects and controls for grades and 9th grade mathematics level. Note that challenge-seeking variables (except the categorical version) are each standardized to facilitate comparison.

When predicting the full, pre-registered continuous measure of behavior on the worksheet task (total hard problems chosen minus total easy problems; original range -8 to +8, standardized to have sd of 1) controlling for 9th grade mathematics level and grades, worksheet behavior significantly predicted advanced mathematics enrollment in 10th grade ( $b = 0.012$ ;  $SE = 0.005$ ,  $t = 2.537$ ,  $df = 3117$ ,  $p = 0.011$ ).



**5.3.4.1 Estimates and Standard Errors for Linear Probability Models of Grade 9 Advanced Mathematics Course-taking (Worksheet Difference, Number Easy, and Number Hard Challenge-seeking Measures)**

	(1)	(2)	(3)	(4)	(5)	(6)
Worksheet Difference (std)	0.058*** (0.008)	0.012** (0.005)				
Hard Items (std)			0.083*** (0.008)	0.012*** (0.005)		
Easy Items (std)					-0.004 (0.008)	-0.005 (0.004)
Grade 9 Grades: Mostly Ds		0.019 (0.066)		0.021 (0.066)		0.019 (0.066)
Grade 9 Grades: Mostly Cs		0.025 (0.061)		0.027 (0.061)		0.025 (0.061)
Grade 9 Grades: Mostly Bs		0.063 (0.060)		0.064 (0.060)		0.063 (0.060)
Grade 9 Grades: Mostly As		0.165*** (0.061)		0.165*** (0.061)		0.166*** (0.061)
Grade 9 Grades: Grades Missing		0.098 (0.103)		0.109 (0.103)		0.097 (0.103)
Grade 9 Course: Pre-algebra		-0.012 (0.077)		-0.013 (0.077)		-0.016 (0.077)
Grade 9 Course: Algebra I		0.052 (0.071)		0.050 (0.071)		0.050 (0.071)
Grade 9 Course: Geometry		0.864*** (0.071)		0.861*** (0.071)		0.864*** (0.071)
Grade 9 Course: Algebra II		0.613*** (0.075)		0.612*** (0.075)		0.614*** (0.075)
Grade 9 Course: Pre-calculus		0.878*** (0.133)		0.877*** (0.133)		0.889*** (0.133)
Grade 9 Course: Other advanced math		0.032 (0.262)		0.013 (0.262)		0.027 (0.262)
Grade 9 Course: 9th Level Missing		0.178** (0.077)		0.175** (0.077)		0.176** (0.077)
School Fixed Effects	No	Yes	No	Yes	No	Yes
Observations	3,238	3,238	3,238	3,238	3,238	3,238
R <sup>2</sup>	0.015	0.716	0.032	0.716	0.0001	0.715

*Note:*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
std = standardized variable (mean 0, sd 1)

Notes: Omitted category for Grade 9 Grades is “Mostly Fs”. Omitted category for Grade 9 Course is “Basic Math”.

**5.3.4.2 Estimates and Standard Errors for Linear Probability Models of Grade 9 Advanced Mathematics Course-taking (Categorical, Mean Item Challenge, and Challenge Sum Measures)**

	(1)	(2)	(3)	(4)	(5)	(6)
Categorical: Hard = Easy	0.003 (0.023)	0.025** (0.013)				
Categorical: Hard > Easy	0.112*** (0.019)	0.028*** (0.010)				
Mean Item Challenge (std)			0.065*** (0.008)	0.012*** (0.005)		
Item Challenge Sum (std)					0.089*** (0.008)	0.010** (0.005)
Grade 9 Grades: Mostly Ds		0.017 (0.066)		0.018 (0.067)		0.022 (0.066)
Grade 9 Grades: Mostly Cs		0.024 (0.061)		0.017 (0.061)		0.027 (0.061)
Grade 9 Grades: Mostly Bs		0.062 (0.060)		0.058 (0.061)		0.063 (0.060)
Grade 9 Grades: Mostly As		0.164*** (0.061)		0.163*** (0.061)		0.165*** (0.061)
Grade 9 Grades: Grades Missing		0.096 (0.103)		0.046 (0.120)		0.110 (0.103)
Grade 9 Course: Pre-algebra		-0.014 (0.077)		-0.025 (0.080)		-0.015 (0.077)
Grade 9 Course: Algebra I		0.051 (0.071)		0.041 (0.074)		0.048 (0.071)
Grade 9 Course: Geometry		0.864*** (0.071)		0.850*** (0.075)		0.860*** (0.071)
Grade 9 Course: Algebra II		0.612*** (0.075)		0.599*** (0.078)		0.611*** (0.075)
Grade 9 Course: Pre-calculus		0.878*** (0.133)		0.864*** (0.136)		0.883*** (0.133)
Grade 9 Course: Other advanced math		0.031 (0.262)		0.008 (0.265)		0.00002 (0.262)
Grade 9 Course: 9th Level Missing		0.177** (0.077)		0.177** (0.080)		0.172** (0.077)
School Fixed Effects	No	Yes	No	Yes	No	Yes
Observations	3,238	3,238	3,114	3,114	3,238	3,238
R <sup>2</sup>	0.012	0.716	0.019	0.714	0.037	0.715

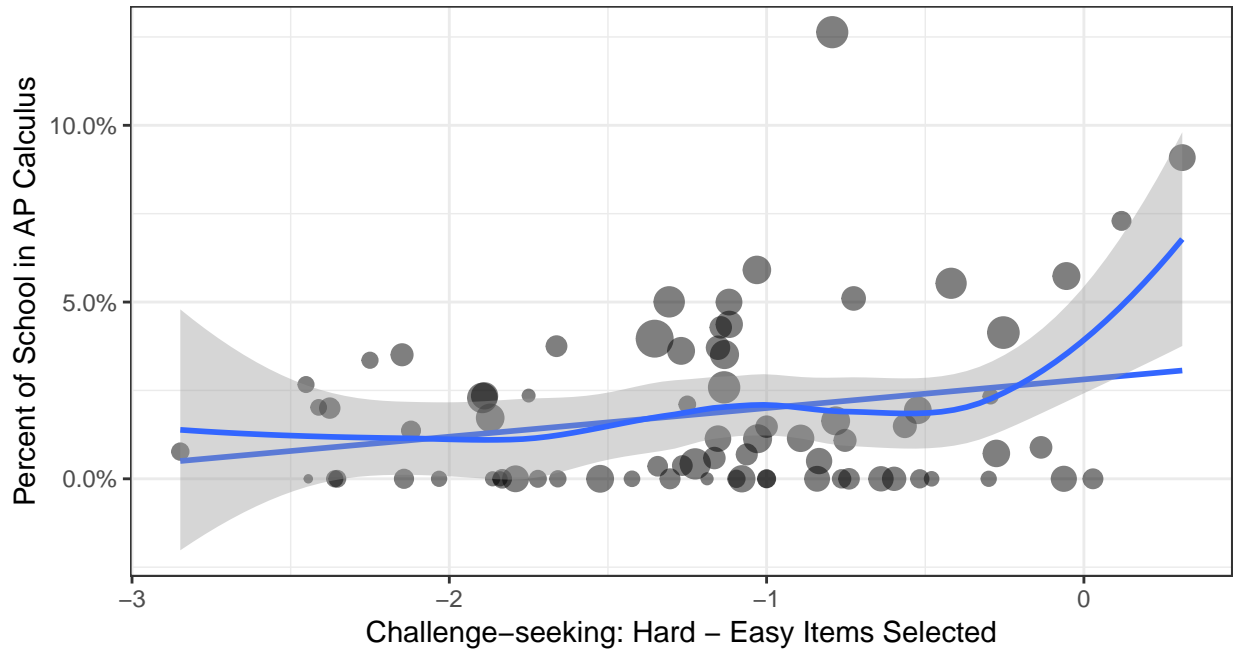
Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
std = standardized variable (mean 0, sd 1)

Notes: Omitted category for categorical challenge-seeking measure is “Hard < Easy”. Omitted category for Grade 9 Grades is “Mostly Fs”. Omitted category for Grade 9 Course is “Basic Math”.

### 5.3.5 Predictive Validity: School Advanced Course-taking

#### 5.3.5.1 School Advanced Course-taking by Mean Pre-registered Challenge-seeking Measure (difference of hard and easy items selected)



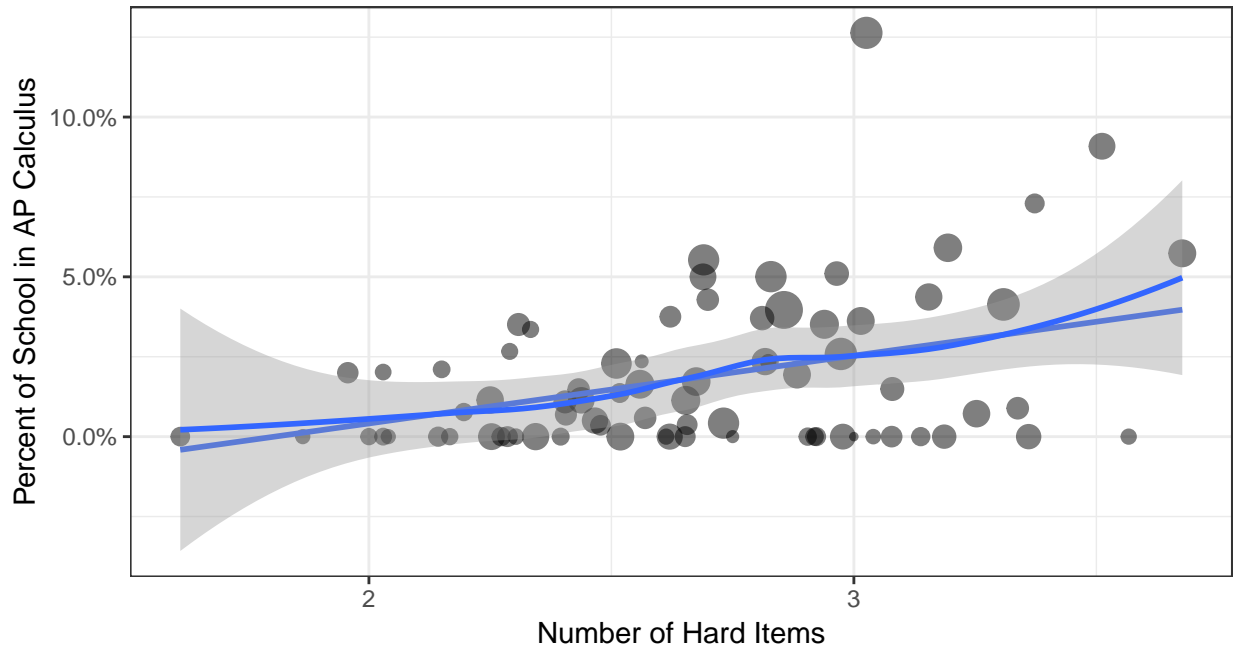
#### 5.3.5.2 Estimates and Standard Errors for Linear Regression Models of School-level AP Calculus Course-taking (Worksheet Difference Challenge-seeking Measure)

	(1)	(2)
Mean Challenge-seeking (std)	0.006** (0.003)	0.006** (0.003)
Mean Standardized Test Score (std)		0.010*** (0.003)
Test Missing Indicator		0.014** (0.007)
Mean Mathematics PSAT (std)		0.003 (0.003)
PSAT Missing Indicator		-0.023* (0.012)
Proportion Black/Hispanic (std)		0.002 (0.003)
Constant	0.018*** (0.003)	0.016*** (0.003)
Observations	76	76
R <sup>2</sup>	0.057	0.310

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
std = standardized variable (mean 0, sd 1)

### 5.3.5.3 School Advanced Course-taking by Mean Number of Hard Items Selected



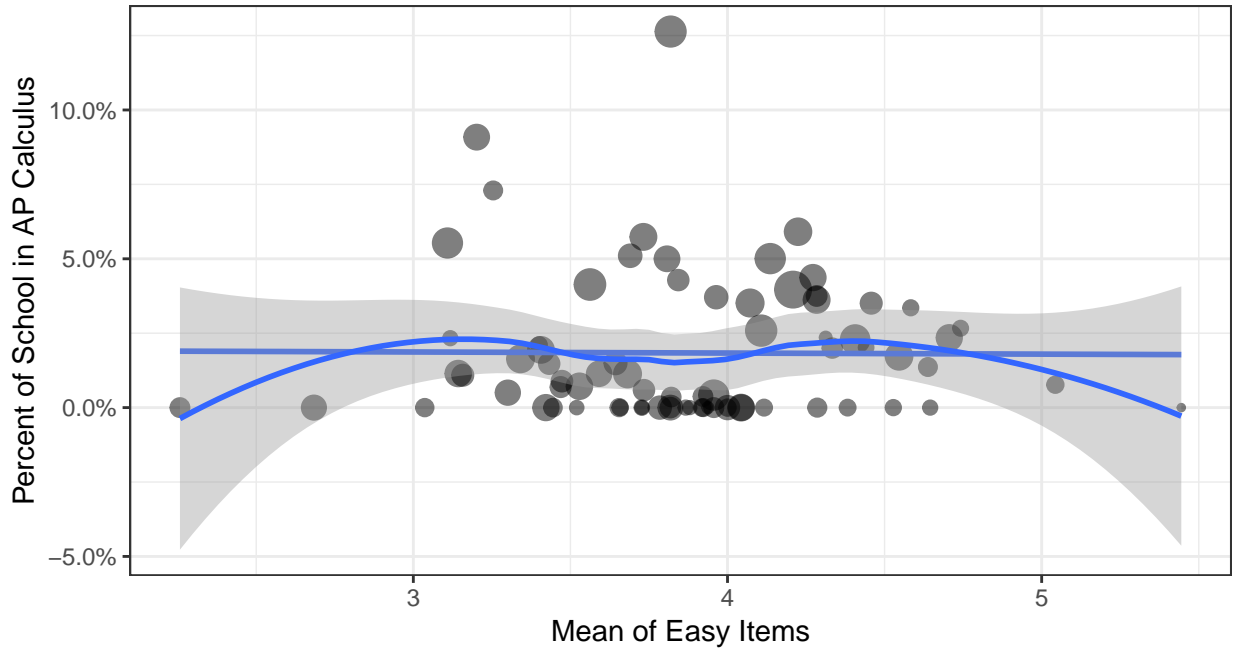
### 5.3.5.4 Estimates and Standard Errors for Linear Regression Models of School-level AP Calculus Course-taking (Number of Hard Items Challenge-seeking Measure)

	(1)	(2)
Mean Number of Hard Items (std)	0.009*** (0.003)	0.007** (0.003)
Mean Standardized Test Score (std)		0.008** (0.003)
Test Missing Indicator		0.014** (0.007)
Mean Mathematics PSAT (std)		0.002 (0.003)
PSAT Missing Indicator		-0.027** (0.013)
Proportion Black/Hispanic (std)		0.002 (0.003)
Constant	0.018*** (0.003)	0.017*** (0.003)
Observations	76	76
R <sup>2</sup>	0.146	0.321

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
std = standardized variable (mean 0, sd 1)

### 5.3.5.5 School Advanced Course-taking by Mean Number of Number of Easy Items Selected



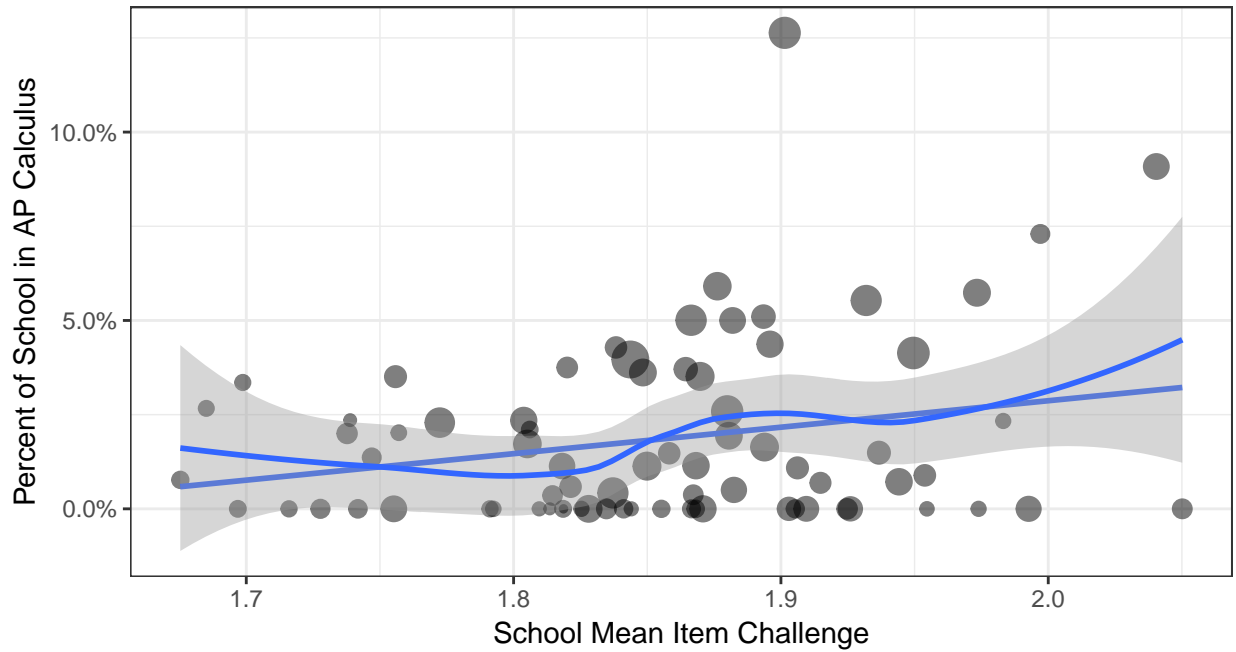
### 5.3.5.6 Estimates and Standard Errors for Linear Regression Models of School-level AP Calculus Course-taking (Number of Easy Items Challenge-seeking Measure)

	(1)	(2)
Mean Number of Easy Items (std)	-0.0002 (0.003)	-0.003 (0.003)
Mean Standardized Test Score (std)		0.011*** (0.003)
Test Missing Indicator		0.015** (0.007)
Mean Mathematics PSAT (std)		0.003 (0.003)
PSAT Missing Indicator		-0.020 (0.013)
Proportion Black/Hispanic (std)		0.003 (0.003)
Constant	0.018*** (0.003)	0.016*** (0.003)
Observations	76	76
R <sup>2</sup>	0.0001	0.269

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
std = standardized variable (mean 0, sd 1)

### 5.3.5.7 School Advanced Course-taking by Mean Mean Item Challenge



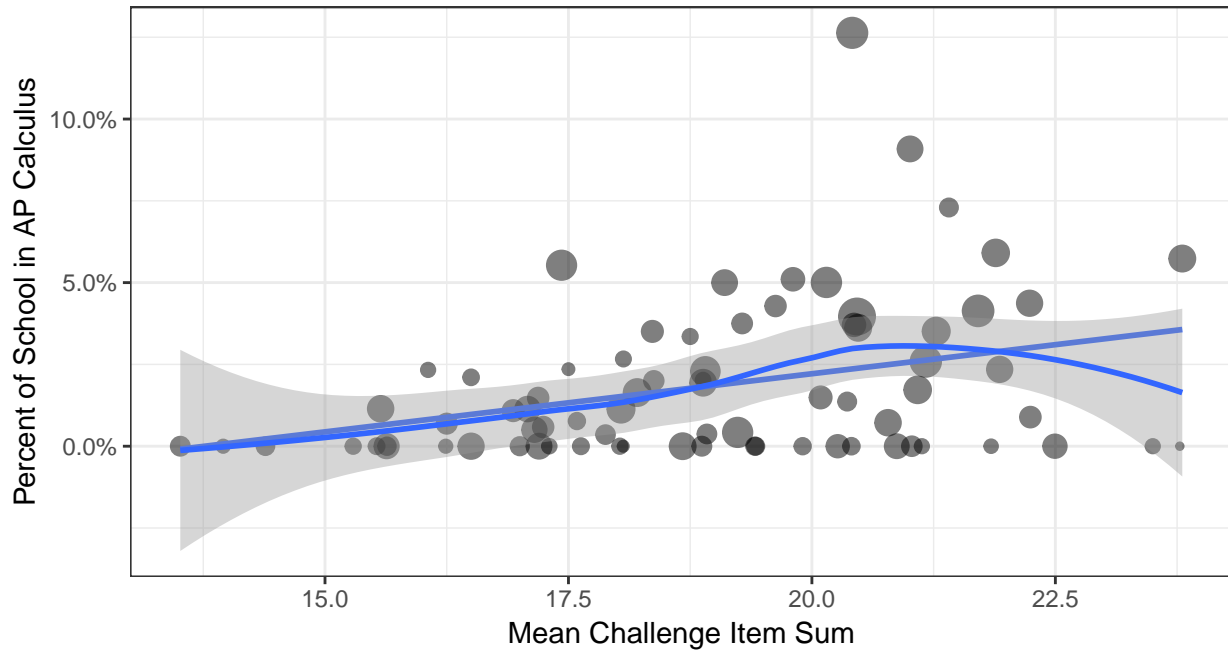
### 5.3.5.8 Estimates and Standard Errors for Linear Regression Models of School-level AP Calculus Course-taking (Mean Item Challenge Measure)

	(1)	(2)
Mean Item Challenge (std)	0.006** (0.003)	0.006** (0.003)
Mean Standardized Test Score (std)		0.010*** (0.003)
Test Missing Indicator		0.015** (0.007)
Mean Mathematics PSAT (std)		0.002 (0.003)
PSAT Missing Indicator		-0.024* (0.012)
Proportion Black/Hispanic (std)		0.001 (0.003)
Constant	0.018*** (0.003)	0.016*** (0.003)
Observations	76	76
R <sup>2</sup>	0.058	0.308

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
std = standardized variable (mean 0, sd 1)

### 5.3.5.9 School Advanced Course-taking by Mean Item Challenge Sum



### 5.3.5.10 Estimates and Standard Errors for Linear Regression Models of School-level AP Calculus Course-taking (Challenge Items Sum Challenge-seeking Measure)

	(1)	(2)
Item Challenge Sum (std)	0.008*** (0.003)	0.005 (0.003)
Mean Standardized Test Score (std)		0.008** (0.003)
Test Missing Indicator		0.015** (0.007)
Mean Mathematics PSAT (std)		0.002 (0.003)
PSAT Missing Indicator		-0.025* (0.013)
Proportion Black/Hispanic (std)		0.004 (0.003)
Constant	0.018*** (0.003)	0.016*** (0.003)
Observations	76	76
R <sup>2</sup>	0.118	0.282

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
std = standardized variable (mean 0, sd 1)

## 5.4 Correlations with Mindset

Here we report correlations between time 2 fixed mindset and alternate measures of challenge-seeking based on the worksheet behavioral task and the hypothetical question. Associations are similar across all measures.

### 5.4.1 Bivariate Correlations (Pearson) between Time 2 Fixed Mindset and Challenge-seeking Measures

Challenge-seeking Measure	Correlation	P-value	N
1. Worksheet Difference	-0.14	< .001	14084
2. Number of Hard Items	-0.15	< .001	14084
3. Number of Easy Items	0.06	< .001	14084
4. Categorical: Hard > Easy	-0.11	< .001	14084
4. Categorical: Hard < Easy	0.09	< .001	14084
5. Mean Item Challenge	-0.14	< .001	13612
6. Challenge Item Sum	-0.14	< .001	14084
Hypothetical Challenge-seeking	-0.12	< .001	14377



## 6 Model Estimates for Impacts for the US Study

### 6.1 Pre-registered Models of Intervention Impacts

The pre-registration stated that we would test progressively more covariates. This is not discussed in the paper because, as we show below, it had little impact on the results.

#### 6.1.1 Challenge-seeking (Worksheet Difference)

The intervention had a substantial impact on increasing measured challenge-seeking.

##### 6.1.1.1 Estimates and Standard Errors for Linear Regression Models of the Worksheet Difference Challenge-seeking Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.860*** (0.063)	0.862*** (0.063)	0.887*** (0.062)	0.887*** (0.063)
Prior Achievement			0.790*** (0.038)	0.831*** (0.039)
Time 1 Meaning in Life		0.180*** (0.030)	0.071** (0.030)	0.045 (0.030)
Time 1 Fixed Mindset		-0.175*** (0.025)	-0.090*** (0.025)	-0.092*** (0.025)
Gender				-0.566*** (0.064)
Mother with 4-year Degree				0.003 (0.014)
Black				-0.005 (0.107)
Hispanic				0.073 (0.104)
White				-0.438*** (0.095)
Asian				0.547*** (0.138)
Constant	-1.098*** (0.045)	-1.293*** (0.139)	-4.825*** (0.217)	-3.881*** (0.260)
Observations	14,128	14,039	14,033	13,553
R <sup>2</sup>	0.013	0.020	0.050	0.060

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### 6.1.2 Mindset

The intervention increased self-reported growth mindset by a third of scale point.

#### 6.1.2.1 Estimates and Standard Errors for Linear Regression Models of Fixed Mindset

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	-0.346*** (0.021)	-0.331*** (0.018)	-0.335*** (0.018)	-0.337*** (0.018)
Prior Achievement			-0.162*** (0.011)	-0.147*** (0.011)
Time 1 Meaning in Life		-0.060*** (0.008)	-0.038*** (0.008)	-0.044*** (0.009)
Time 1 Fixed Mindset		0.520*** (0.007)	0.503*** (0.007)	0.497*** (0.007)
Gender				-0.019 (0.018)
Mother with 4-year Degree				-0.0001 (0.004)
Black				0.119*** (0.030)
Hispanic				-0.036 (0.029)
White				-0.121*** (0.027)
Asian				-0.048 (0.039)
Constant	2.615*** (0.015)	1.425*** (0.039)	2.150*** (0.062)	2.207*** (0.074)
Observations	14,478	14,385	14,379	13,852
R <sup>2</sup>	0.018	0.300	0.311	0.315

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### 6.1.3 Reasons for Learning

The intervention also increased students' self-reported reasons for learning.

#### 6.1.3.1 Estimates and Standard Errors for Linear Regression Models of Reasons for Learning

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.118*** (0.015)	0.120*** (0.015)	0.124*** (0.014)	0.126*** (0.014)
Prior Achievement			0.213*** (0.009)	0.223*** (0.009)
Time 1 Meaning in Life		0.249*** (0.007)	0.220*** (0.007)	0.225*** (0.007)
Time 1 Fixed Mindset		-0.053*** (0.006)	-0.030*** (0.006)	-0.036*** (0.006)
Gender				0.268*** (0.014)
Mother with 4-year Degree				-0.014*** (0.003)
Black				0.104*** (0.024)
Hispanic				0.034 (0.023)
White				-0.165*** (0.022)
Asian				-0.093*** (0.031)
Constant	3.528*** (0.011)	2.758*** (0.032)	1.802*** (0.050)	1.495*** (0.059)
Observations	14,355	14,263	14,258	13,742
R <sup>2</sup>	0.004	0.097	0.134	0.168

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### 6.1.4 Hypothetical Challenge-seeking

#### 6.1.4.1 Estimates and Standard Errors for Linear Regression Models of the Hypothetical Challenge-seeking Outcome)

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.116*** (0.008)	0.117*** (0.008)	0.118*** (0.008)	0.116*** (0.008)
Prior Achievement			0.066*** (0.005)	0.076*** (0.005)
Time 1 Meaning in Life		0.037*** (0.004)	0.028*** (0.004)	0.024*** (0.004)
Time 1 Fixed Mindset		-0.011*** (0.003)	-0.004 (0.003)	-0.005 (0.003)
Gender				-0.077*** (0.008)
Mother with 4-year Degree				-0.001 (0.002)
Black				0.014 (0.014)
Hispanic				0.016 (0.013)
White				-0.080*** (0.012)
Asian				0.020 (0.018)
Constant	0.374*** (0.006)	0.267*** (0.018)	-0.027 (0.028)	0.102*** (0.034)
Observations	14,389	14,294	14,289	13,774
R <sup>2</sup>	0.014	0.021	0.033	0.048

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## 6.2 Models that Differ from Pre-Registration

### 6.2.1 Modified Growth Mindset Outcome

The pre-registered mindset outcome was modified to include a third item pertaining to the focal domain of mathematics. The results were substantively similar.

#### 6.2.1.1 Estimates and Standard Errors for Linear Regression Models of the 3-item Growth Mindset Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.399*** (0.019)	0.386*** (0.017)	0.391*** (0.016)	0.391*** (0.017)
Prior Achievement			0.189*** (0.010)	0.180*** (0.010)
Time 1 Meaning in Life		0.061*** (0.008)	0.035*** (0.008)	0.041*** (0.008)
Time 1 Fixed Mindset		-0.476*** (0.006)	-0.456*** (0.006)	-0.451*** (0.007)
Gender				-0.009 (0.017)
Mother with 4-year Degree				-0.004 (0.004)
Black				-0.125*** (0.028)
Hispanic				0.098*** (0.027)
White				0.088*** (0.025)
Asian				0.098*** (0.036)
Constant	4.084*** (0.014)	5.151*** (0.036)	4.307*** (0.057)	4.287*** (0.068)
Observations	14,510	14,415	14,409	13,878
R <sup>2</sup>	0.028	0.303	0.321	0.326

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## 6.2.2 Alternate Challenge-seeking Measures

As above, we consider whether the main results are sensitive to the alternative codings of the challenge-seeking outcome. Across all specifications, there are clear benefits of the growth mindset intervention.

### 6.2.2.1 Estimates and Standard Errors for Linear Regression Models of the Number of Hard Items Challenge-seeking Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.428*** (0.042)	0.422*** (0.042)	0.440*** (0.041)	0.443*** (0.041)
Prior Achievement			0.586*** (0.025)	0.591*** (0.025)
Time 1 Meaning in Life		0.070*** (0.020)	-0.010 (0.020)	-0.021 (0.020)
Time 1 Fixed Mindset		-0.167*** (0.016)	-0.103*** (0.016)	-0.096*** (0.016)
Gender				-0.306*** (0.042)
Mother with 4-year Degree				0.012 (0.009)
Black				-0.221*** (0.070)
Hispanic				-0.009 (0.068)
White				-0.116* (0.062)
Asian				0.359*** (0.091)
Constant	2.762*** (0.029)	2.957*** (0.092)	0.331** (0.142)	0.817*** (0.170)
Observations	14,128	14,039	14,033	13,553
R <sup>2</sup>	0.007	0.016	0.054	0.061

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### 6.2.2.2 Estimates and Standard Errors for Linear Regression Models of the Number of Easy Items Challenge-seeking Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	-0.432*** (0.042)	-0.440*** (0.043)	-0.447*** (0.043)	-0.444*** (0.043)
Prior Achievement			-0.203*** (0.026)	-0.240*** (0.026)
Time 1 Meaning in Life		-0.110*** (0.020)	-0.081*** (0.020)	-0.067*** (0.021)
Time 1 Fixed Mindset		0.008 (0.017)	-0.013 (0.017)	-0.005 (0.017)
Gender				0.260*** (0.043)
Mother with 4-year Degree				0.009 (0.010)
Black				-0.216*** (0.073)
Hispanic				-0.082 (0.070)
White				0.322*** (0.065)
Asian				-0.188** (0.094)
Constant	3.860*** (0.030)	4.249*** (0.094)	5.156*** (0.148)	4.698*** (0.177)
Observations	14,128	14,039	14,033	13,553
R <sup>2</sup>	0.007	0.010	0.014	0.024

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### 6.2.2.3 Estimates and Standard Errors for Linear Regression Models of the Mean Item Challenge Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.094*** (0.007)	0.094*** (0.007)	0.097*** (0.007)	0.097*** (0.007)
Prior Achievement			0.099*** (0.004)	0.103*** (0.005)
Time 1 Meaning in Life		0.021*** (0.003)	0.008** (0.003)	0.005 (0.004)
Time 1 Fixed Mindset		-0.020*** (0.003)	-0.010*** (0.003)	-0.010*** (0.003)
Gender				-0.063*** (0.007)
Mother with 4-year Degree				0.0002 (0.002)
Black				-0.006 (0.012)
Hispanic				0.009 (0.012)
White				-0.048*** (0.011)
Asian				0.064*** (0.016)
Constant	1.865*** (0.005)	1.841*** (0.016)	1.395*** (0.025)	1.504*** (0.030)
Observations	13,619	13,537	13,532	13,089
R <sup>2</sup>	0.012	0.019	0.054	0.064

*Note:*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01



### 6.2.2.4 Estimates and Standard Errors for Linear Regression Models of the Challenge Item Sum Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.817*** (0.178)	0.776*** (0.178)	0.841*** (0.175)	0.844*** (0.177)
Prior Achievement			2.215*** (0.106)	2.123*** (0.109)
Time 1 Meaning in Life		0.146* (0.084)	-0.157* (0.084)	-0.153* (0.085)
Time 1 Fixed Mindset		-0.814*** (0.069)	-0.573*** (0.069)	-0.528*** (0.070)
Gender				-0.617*** (0.179)
Mother with 4-year Degree				0.091** (0.040)
Black				-1.555*** (0.300)
Hispanic				0.208 (0.290)
White				0.545** (0.267)
Asian				1.114*** (0.388)
Constant	19.409*** (0.126)	21.095*** (0.392)	11.170*** (0.612)	11.787*** (0.730)
Observations	14,128	14,039	14,033	13,553
R <sup>2</sup>	0.001	0.012	0.042	0.048

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## 7 Weighted Model Estimates for Impacts for the US Study

### 7.1 Pre-registered Impacts

#### 7.1.1 Challenge-seeking (Worksheet Difference)

##### 7.1.1.1 Weighted Estimates and Standard Errors for Linear Regression Models of the Worksheet Difference Challenge-seeking Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.892*** (0.064)	0.896*** (0.064)	0.921*** (0.063)	0.932*** (0.064)
Prior Achievement			0.769*** (0.037)	0.795*** (0.039)
Time 1 Meaning in Life		0.194*** (0.030)	0.086*** (0.030)	0.057* (0.031)
Time 1 Fixed Mindset		-0.184*** (0.025)	-0.096*** (0.025)	-0.097*** (0.025)
Gender				-0.548*** (0.064)
Mother with 4-year Degree				0.017 (0.014)
Black				0.004 (0.109)
Hispanic				0.020 (0.111)
White				-0.517*** (0.100)
Asian				0.579*** (0.141)
Constant	-1.079*** (0.045)	-1.304*** (0.142)	-4.759*** (0.219)	-3.750*** (0.265)
Observations	14,128	14,039	14,033	13,553
R <sup>2</sup>	0.014	0.021	0.050	0.061

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## 7.1.2 Mindset

### 7.1.2.1 Weighted Estimates and Standard Errors for Linear Regression Models of Fixed Mindset

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	-0.349*** (0.021)	-0.328*** (0.018)	-0.332*** (0.018)	-0.332*** (0.018)
Prior Achievement			-0.142*** (0.010)	-0.131*** (0.011)
Time 1 Meaning in Life		-0.061*** (0.008)	-0.041*** (0.008)	-0.044*** (0.009)
Time 1 Fixed Mindset		0.524*** (0.007)	0.508*** (0.007)	0.502*** (0.007)
Gender				-0.016 (0.018)
Mother with 4-year Degree				0.001 (0.004)
Black				0.099*** (0.030)
Hispanic				-0.041 (0.031)
White				-0.110*** (0.028)
Asian				-0.041 (0.039)
Constant	2.620*** (0.015)	1.423*** (0.039)	2.062*** (0.061)	2.111*** (0.074)
Observations	14,478	14,385	14,379	13,852
R <sup>2</sup>	0.019	0.311	0.320	0.324

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### 7.1.3 Reasons for Learning

#### 7.1.3.1 Weighted Estimates and Standard Errors for Linear Regression Models of Reasons for Learning

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.106*** (0.015)	0.104*** (0.015)	0.108*** (0.014)	0.112*** (0.014)
Prior Achievement			0.199*** (0.009)	0.210*** (0.009)
Time 1 Meaning in Life		0.265*** (0.007)	0.239*** (0.007)	0.240*** (0.007)
Time 1 Fixed Mindset		-0.046*** (0.006)	-0.023*** (0.006)	-0.029*** (0.006)
Gender				0.266*** (0.014)
Mother with 4-year Degree				-0.007** (0.003)
Black				0.098*** (0.024)
Hispanic				0.051** (0.025)
White				-0.164*** (0.022)
Asian				-0.080** (0.031)
Constant	3.544*** (0.011)	2.687*** (0.033)	1.787*** (0.050)	1.464*** (0.060)
Observations	14,355	14,263	14,258	13,742
R <sup>2</sup>	0.003	0.103	0.136	0.167

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### 7.1.4 Hypothetical Challenge-seeking

#### 7.1.4.1 Weighted Estimates and Standard Errors for Linear Regression Models of the Hypothetical Challenge-seeking Outcome)

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.122*** (0.008)	0.122*** (0.008)	0.123*** (0.008)	0.123*** (0.008)
Prior Achievement			0.064*** (0.005)	0.072*** (0.005)
Time 1 Meaning in Life		0.036*** (0.004)	0.027*** (0.004)	0.023*** (0.004)
Time 1 Fixed Mindset		-0.016*** (0.003)	-0.008*** (0.003)	-0.010*** (0.003)
Gender				-0.070*** (0.008)
Mother with 4-year Degree				0.003* (0.002)
Black				0.013 (0.014)
Hispanic				0.014 (0.014)
White				-0.079*** (0.013)
Asian				-0.0005 (0.018)
Constant	0.374*** (0.006)	0.284*** (0.018)	-0.005 (0.028)	0.113*** (0.034)
Observations	14,389	14,294	14,289	13,774
R <sup>2</sup>	0.015	0.023	0.035	0.048

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## 7.2 Additional Results

### 7.2.1 Modified Growth Mindset Outcome

The updated mindset outcome includes a third item pertaining to the focal domain of mathematics.

#### 7.2.1.1 Weighted Estimates and Standard Errors for Linear Regression Models of the 3-item Growth Mindset Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.400*** (0.020)	0.383*** (0.016)	0.387*** (0.016)	0.387*** (0.017)
Prior Achievement			0.172*** (0.010)	0.165*** (0.010)
Time 1 Meaning in Life		0.061*** (0.008)	0.037*** (0.008)	0.039*** (0.008)
Time 1 Fixed Mindset		-0.475*** (0.006)	-0.456*** (0.006)	-0.451*** (0.006)
Gender				-0.024 (0.017)
Mother with 4-year Degree				-0.006 (0.004)
Black				-0.088*** (0.028)
Hispanic				0.102*** (0.028)
White				0.098*** (0.026)
Asian				0.122*** (0.036)
Constant	4.087*** (0.014)	5.152*** (0.037)	4.380*** (0.056)	4.386*** (0.068)
Observations	14,510	14,415	14,409	13,878
R <sup>2</sup>	0.028	0.309	0.324	0.328

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## 7.2.2 Alternate Challenge-seeking Measures

### 7.2.2.1 Weighted Estimates and Standard Errors for Linear Regression Models of the Number of Hard Items Challenge-seeking Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.415*** (0.042)	0.408*** (0.042)	0.426*** (0.041)	0.435*** (0.042)
Prior Achievement			0.556*** (0.024)	0.554*** (0.025)
Time 1 Meaning in Life		0.101*** (0.020)	0.024 (0.020)	0.006 (0.020)
Time 1 Fixed Mindset		-0.165*** (0.016)	-0.101*** (0.016)	-0.098*** (0.016)
Gender				-0.275*** (0.042)
Mother with 4-year Degree				0.023** (0.009)
Black				-0.269*** (0.071)
Hispanic				-0.010 (0.072)
White				-0.237*** (0.065)
Asian				0.364*** (0.091)
Constant	2.813*** (0.030)	2.888*** (0.093)	0.388*** (0.143)	0.932*** (0.173)
Observations	14,128	14,039	14,033	13,553
R <sup>2</sup>	0.007	0.017	0.052	0.060

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

**7.2.2.2 Weighted Estimates and Standard Errors for Linear Regression Models of the Number of Easy Items Challenge-seeking Outcome**

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	-0.478*** (0.043)	-0.488*** (0.043)	-0.496*** (0.043)	-0.497*** (0.043)
Prior Achievement			-0.214*** (0.025)	-0.241*** (0.026)
Time 1 Meaning in Life		-0.093*** (0.020)	-0.063*** (0.021)	-0.051** (0.021)
Time 1 Fixed Mindset		0.019 (0.016)	-0.005 (0.017)	-0.001 (0.017)
Gender				0.273*** (0.043)
Mother with 4-year Degree				0.006 (0.010)
Black				-0.272*** (0.074)
Hispanic				-0.030 (0.075)
White				0.280*** (0.067)
Asian				-0.215** (0.095)
Constant	3.892*** (0.030)	4.192*** (0.095)	5.148*** (0.148)	4.682*** (0.179)
Observations	14,128	14,039	14,033	13,553
R <sup>2</sup>	0.009	0.011	0.016	0.026

*Note:*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01



### 7.2.2.3 Weighted Estimates and Standard Errors for Linear Regression Models of the Mean Item Challenge Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.091*** (0.007)	0.091*** (0.007)	0.094*** (0.007)	0.095*** (0.007)
Prior Achievement			0.096*** (0.004)	0.098*** (0.004)
Time 1 Meaning in Life		0.021*** (0.004)	0.008** (0.004)	0.005 (0.004)
Time 1 Fixed Mindset		-0.021*** (0.003)	-0.010*** (0.003)	-0.010*** (0.003)
Gender				-0.059*** (0.007)
Mother with 4-year Degree				0.002 (0.002)
Black				-0.007 (0.013)
Hispanic				0.008 (0.013)
White				-0.058*** (0.012)
Asian				0.066*** (0.016)
Constant	1.871*** (0.005)	1.850*** (0.016)	1.414*** (0.026)	1.527*** (0.031)
Observations	13,619	13,537	13,532	13,089
R <sup>2</sup>	0.011	0.018	0.053	0.063

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

### 7.2.2.4 Weighted Estimates and Standard Errors for Linear Regression Models of the Challenge Item Sum Outcome

	(1)	(2)	(3)	(4)
Growth Mindset Treatment	0.643*** (0.179)	0.600*** (0.178)	0.660*** (0.176)	0.697*** (0.178)
Prior Achievement			1.985*** (0.104)	1.888*** (0.107)
Time 1 Meaning in Life		0.303*** (0.085)	0.029 (0.085)	-0.010 (0.086)
Time 1 Fixed Mindset		-0.771*** (0.068)	-0.541*** (0.069)	-0.531*** (0.069)
Gender				-0.459** (0.179)
Mother with 4-year Degree				0.146*** (0.040)
Black				-1.888*** (0.303)
Hispanic				0.446 (0.307)
White				-0.011 (0.277)
Asian				0.989** (0.390)
Constant	19.643*** (0.127)	20.631*** (0.397)	11.699*** (0.611)	12.467*** (0.736)
Observations	14,128	14,039	14,033	13,553
R <sup>2</sup>	0.001	0.011	0.036	0.043

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## 9 Experimental Balance and Attrition in the Norway Study

### 9.1 Effectiveness of Random Assignment

Random assignment was effective in creating comparable groups on observable measures. The mean standardized difference across these measured variables at baseline was -0.006 and the largest difference in absolute value was 0.047.

#### 9.1.0.1 Characteristics of Treatment (T) and Control (C) Students for Full Sample

	N (C)	Mean	SD	N (T)	Mean	SD	t	d	p-value
GPA 10th grade	3252	45.080	7.640	3289	44.910	8.103	0.906	-0.022	= 0.364
Math 10th grade	3252	3.981	1.228	3289	3.983	1.225	-0.057	0.002	= 0.954
Baseline Mindset	3252	2.583	0.987	3289	2.570	0.967	0.518	-0.013	= 0.603
Baseline Purpose	3252	4.745	0.836	3289	4.773	0.836	-1.369	0.033	= 0.170
Expectations Success	3249	4.263	1.085	3289	4.284	1.093	-0.772	0.019	= 0.439
Expectations Interesting	3249	3.884	1.352	3289	3.934	1.358	-1.483	0.037	= 0.137
Female	3252	0.559	0.496	3288	0.546	0.498	1.091	-0.027	= 0.275
Order 10th grade	3252	2.938	0.368	3289	2.925	0.422	1.323	-0.035	= 0.185
Behavior 10th grade	3252	2.954	0.341	3289	2.938	0.403	1.687	-0.047	= 0.091

### 9.2 Attrition

Among students in the full sample, 19.8% did not complete Session 2. Attrition was similar in the treatment (19.2%) and control (20.4%) groups and not differential by condition ( $\chi^2(1)=1.271$ ;  $p = 0.26$ ).

Characteristics were also balanced between treatment and control students among those in the Session 2 Sample:

#### 9.2.0.1 Characteristics of Treatment (T) and Control (C) Students for Session 2 Sample

	N (C)	Mean	SD	N (T)	Mean	SD	t	d	p-value
GPA 10th grade	2590	45.540	7.287	2657	45.410	7.898	0.648	-0.018	= 0.516
Math 10th grade	2590	4.053	1.206	2657	4.056	1.210	-0.106	0.002	= 0.915
Baseline Mindset	2590	2.568	0.966	2657	2.535	0.954	1.252	-0.034	= 0.210
Baseline Purpose	2590	4.742	0.826	2657	4.786	0.833	-1.925	0.053	= 0.054
Expectations Success	2590	4.310	1.052	2657	4.342	1.066	-1.083	0.030	= 0.278
Expectations Interesting	2588	3.944	1.318	2657	4.001	1.339	-1.546	0.043	= 0.122
Female	2590	0.560	0.496	2657	0.549	0.498	0.837	-0.023	= 0.402
Order 10th grade	2590	2.951	0.334	2657	2.935	0.396	1.548	-0.048	= 0.121
Behavior 10th grade	2590	2.962	0.314	2657	2.947	0.377	1.626	-0.048	= 0.104

## 10 Challenge-seeking Measures in the Norway Study

### 10.1 Descriptive Characteristics

#### 10.1.0.1 Summary of Challenge-seeking Measures from Worksheet Task

Variable	N	Mean	SD	Min	Max
Worksheet Difference	5247	1.031	3.170	-6	6
Number of Hard Items	5247	2.905	1.838	0	6
Number of Easy Items	5247	1.874	1.936	0	6
Categorical: Hard < Easy	5247	0.429	0.495	0	1
Categorical: Hard = Easy	5247	0.137	0.344	0	1
Categorical: Hard > Easy	5247	0.708	0.455	0	1

### 10.2 Correlations with Mindset

#### 10.2.0.1 Bivariate Correlations (Pearson) between Time 2 Fixed Mindset and Challenge-seeking Measures

Challenge-seeking Measure	Correlation	P-value	N
Worksheet Difference	-0.175	< .001	5246
Number of Hard Items	-0.116	< .001	5246
Number of Easy Items	0.177	< .001	5246
Categorical: Hard < Easy	0.141	< .001	5246
Categorical: Hard = Easy	0.014	< .001	5246
Categorical: Hard > Easy	-0.143	< .001	5246

## 11 Impact Estimates in the Norway study

### 11.1 Outcome Measures Descriptive Characteristics

	N	Mean	SD	Min	Max
Fixed Mindset T2	5246	2.3410	1.0030	1	6
Number of Hard Items	5247	2.9050	1.8380	0	6
Number of Easy Items	5247	1.8740	1.9360	0	6
Worksheet Difference	5247	1.0310	3.1700	-6	6
Categorical: Hard > Easy	5247	0.7082	0.4546	0	1
Categorical: Hard < Easy	5247	0.4288	0.4949	0	1
Categorical: Hard = Easy	5247	0.1370	0.3439	0	1
Hypothetical Challenge-seeking	5243	0.6364	0.4810	0	1
Reasons for Learning	5209	4.5070	1.0460	1	6
School Hard Work Meaningful	5239	4.9720	1.0150	1	6
Understand Meaningful Life	5237	4.6950	1.1390	1	6
Advanced Math T2	6541	0.4754	0.4994	0	1

### 11.2 Outcome Characteristics by Experimental Group

	N (C)	Mean	SD	N (T)	Mean	SD	t	d	p-value
Fixed Mindset T2	2590	2.522	1.003	2656	2.164	0.971	13.151	-0.357	= 0.000
Number of Hard Items	2590	2.734	1.779	2657	3.071	1.879	-6.675	0.189	= 0.000
Number of Easy Items	2590	2.038	1.974	2657	1.713	1.884	6.115	-0.165	= 0.000
Worksheet Difference	2590	0.695	3.210	2657	1.358	3.097	-7.617	0.206	= 0.000
Categorical: Hard > Easy	2590	0.662	0.473	2657	0.753	0.431	-7.342	0.194	= 0.000
Categorical: Hard < Easy	2590	0.470	0.499	2657	0.389	0.488	5.953	-0.162	= 0.000
Categorical: Hard = Easy	2590	0.132	0.338	2657	0.142	0.349	-1.117	0.031	= 0.264
Hypothetical Challenge-seeking	2588	0.593	0.491	2655	0.679	0.467	-6.466	0.174	= 0.000
Reasons for Learning	2568	4.433	1.019	2641	4.580	1.066	-5.110	0.144	= 0.000
School Hard Work Meaningful	2587	4.898	1.033	2652	5.044	0.992	-5.207	0.141	= 0.000
Understand Meaningful Life	2588	4.643	1.151	2649	4.745	1.125	-3.259	0.089	= 0.001

### 11.3 Impact Model Results for Each Outcome

#### 11.3.0.1 Estimates and Standard Errors for Linear Regression Models of the Worksheet Difference Challenge-seeking Outcome

	(1)	(2)	(3)
Growth Mindset Treatment	0.626*** (0.088)	0.614*** (0.085)	0.575*** (0.078)
Purpose Baseline		0.052 (0.053)	-0.058 (0.052)
Mindset Baseline		-0.352*** (0.048)	-0.126*** (0.045)
Expectations Success			0.268*** (0.044)
Expectations Interesting			0.448*** (0.038)
10th Grade Math = 2			-0.462 (0.824)
10th Grade Math = 3			-0.018 (0.796)
10th Grade Math = 4			0.784 (0.804)
10th Grade Math = 5			1.595* (0.813)
10th Grade Math = 6			2.387*** (0.833)
Female			-0.680*** (0.091)
Ratio .5	0.036 (0.140)	0.010 (0.131)	0.008 (0.105)
Ratio .8	0.107 (0.132)	0.104 (0.131)	0.089 (0.115)
Treatment estimate stats			
t-value	7.13	7.21	7.40
p-value	0.000	0.000	0.000
Observations	5,247	5,247	5,247
R2	0.012	0.024	0.207

Note: Standardized estimate for covariate-adjusted model (3) is: 0.179.

11.3.0.2 Estimates and Standard Errors for Linear Regression Models of Fixed Mindset

	(1)	(2)	(3)
Growth Mindset Treatment	-0.346*** (0.031)	-0.326*** (0.025)	-0.323*** (0.024)
Purpose Baseline		-0.080*** (0.014)	-0.056*** (0.014)
Mindset Baseline		0.578*** (0.012)	0.553*** (0.013)
Expectations Success			-0.044*** (0.017)
Expectations Interesting			-0.061*** (0.011)
10th Grade Math = 2			-0.353 (0.344)
10th Grade Math = 3			-0.335 (0.339)
10th Grade Math = 4			-0.370 (0.342)
10th Grade Math = 5			-0.373 (0.337)
10th Grade Math = 6			-0.329 (0.338)
Female			-0.135*** (0.020)
Ratio .5	-0.079 (0.061)	-0.036 (0.039)	-0.044 (0.039)
Ratio .8	-0.030 (0.044)	-0.024 (0.033)	-0.028 (0.032)
Treatment estimate stats			
t-value	-11.19	-13.30	-13.74
p-value	0.000	0.000	0.000
Observations	5,246	5,246	5,246
R2	0.033	0.354	0.370

Note: Standardized estimate for covariate-adjusted model (3) is: -0.322.

### 11.3.0.3 Estimates and Standard Errors for Linear Regression Models of Reasons for Learning

	(1)	(2)	(3)
Growth Mindset Treatment	0.140*** (0.033)	0.130*** (0.031)	0.130*** (0.030)
Purpose Baseline		0.270*** (0.021)	0.245*** (0.022)
Mindset Baseline		-0.079*** (0.019)	-0.056*** (0.018)
Expectations Success			0.022 (0.019)
Expectations Interesting			0.078*** (0.013)
10th Grade Math = 2			0.065 (0.299)
10th Grade Math = 3			0.115 (0.284)
10th Grade Math = 4			0.098 (0.288)
10th Grade Math = 5			0.076 (0.283)
10th Grade Math = 6			0.140 (0.286)
Female			0.354*** (0.035)
Ratio .5	0.041 (0.055)	0.023 (0.053)	0.036 (0.052)
Ratio .8	0.007 (0.041)	-0.003 (0.040)	0.004 (0.039)
Treatment estimate stats			
t-value	4.28	4.21	4.34
p-value	0.000	0.000	0.000
Observations	5,209	5,209	5,209
R2	0.005	0.061	0.097

Note: Standardized estimate for covariate-adjusted model (3) is: 0.128.



11.3.0.4 Estimates and Standard Errors for Linear Regression Models of the Hypothetical Challenge-seeking Outcome

	(1)	(2)	(3)
Growth Mindset Treatment	0.082*** (0.015)	0.080*** (0.016)	0.074*** (0.015)
Purpose Baseline		0.038*** (0.008)	0.018** (0.008)
Mindset Baseline		-0.049*** (0.007)	-0.019*** (0.006)
Expectations Success			0.050*** (0.009)
Expectations Interesting			0.061*** (0.006)
10th Grade Math = 2			0.072 (0.116)
10th Grade Math = 3			0.103 (0.116)
10th Grade Math = 4			0.161 (0.116)
10th Grade Math = 5			0.264** (0.115)
10th Grade Math = 6			0.332*** (0.115)
Female			-0.067*** (0.013)
Ratio .5	0.028 (0.021)	0.023 (0.020)	0.024 (0.017)
Ratio .8	0.004 (0.018)	0.003 (0.018)	0.001 (0.017)
Treatment estimate stats			
t-value	5.37	5.13	4.92
p-value	0.000	0.000	0.000
Observations	5,243	5,243	5,243
R2	0.008	0.024	0.145

Note: Standardized estimate for covariate-adjusted model (3) is: 0.151.

11.3.0.5 Estimates and Standard Errors for Linear Regression Models of the Number of Hard Items Challenge-seeking Outcome

	(1)	(2)	(3)
Growth Mindset Treatment	0.347*** (0.053)	0.342*** (0.052)	0.322*** (0.049)
Purpose Baseline		-0.017 (0.034)	-0.068** (0.033)
Mindset Baseline		-0.161*** (0.027)	-0.070** (0.028)
Expectations Success			0.102*** (0.031)
Expectations Interesting			0.198*** (0.024)
10th Grade Math = 2			-0.096 (0.393)
10th Grade Math = 3			-0.095 (0.377)
10th Grade Math = 4			0.254 (0.379)
10th Grade Math = 5			0.523 (0.384)
10th Grade Math = 6			0.995** (0.396)
Female			-0.443*** (0.056)
Ratio .5	-0.071 (0.075)	-0.080 (0.071)	-0.084 (0.061)
Ratio .8	-0.012 (0.073)	-0.012 (0.071)	-0.017 (0.065)
Treatment estimate stats			
t-value	6.49	6.57	6.62
p-value	0.000	0.000	0.000
Observations	5,247	5,247	5,247
R2	0.009	0.016	0.117

Note: Standardized estimate for covariate-adjusted model (3) is: 0.181.

11.3.0.6 Estimates and Standard Errors for Linear Regression Models of the Number of Easy Items Challenge-seeking Outcome

	(1)	(2)	(3)
Growth Mindset Treatment	-0.279*** (0.056)	-0.271*** (0.055)	-0.253*** (0.054)
Purpose Baseline		-0.069** (0.031)	-0.010 (0.033)
Mindset Baseline		0.191*** (0.031)	0.056** (0.028)
Expectations Success			-0.165*** (0.032)
Expectations Interesting			-0.250*** (0.024)
10th Grade Math = 2			0.366 (0.478)
10th Grade Math = 3			-0.078 (0.469)
10th Grade Math = 4			-0.530 (0.476)
10th Grade Math = 5			-1.072** (0.483)
10th Grade Math = 6			-1.391*** (0.492)
Female			0.237*** (0.052)
Ratio .5	-0.107 (0.082)	-0.091 (0.078)	-0.092 (0.066)
Ratio .8	-0.119 (0.083)	-0.116 (0.083)	-0.106 (0.076)
Treatment estimate stats			
t-value	-4.97	-4.89	-4.68
p-value	0.000	0.000	0.000
Observations	5,247	5,247	5,247
R2	0.008	0.019	0.181

Note: Standardized estimate for covariate-adjusted model (3) is: -0.128.

11.3.0.7 Estimates and Standard Errors for Linear Regression Models of the “When I work hard in school it makes me feel like I am doing something meaningful to my life” Outcome

	(1)	(2)	(3)
Growth Mindset Treatment	0.140*** (0.030)	0.123*** (0.027)	0.118*** (0.027)
Purpose Baseline		0.520*** (0.019)	0.487*** (0.019)
Mindset Baseline		-0.071*** (0.015)	-0.045*** (0.014)
Expectations Success			0.014 (0.019)
Expectations Interesting			0.105*** (0.013)
10th Grade Math = 2			0.446** (0.197)
10th Grade Math = 3			0.500*** (0.188)
10th Grade Math = 4			0.449** (0.189)
10th Grade Math = 5			0.393** (0.188)
10th Grade Math = 6			0.467** (0.194)
Female			0.151*** (0.028)
Ratio .5	0.050 (0.047)	0.020 (0.043)	0.027 (0.042)
Ratio .8	0.014 (0.035)	-0.001 (0.032)	0.004 (0.034)
Treatment estimate stats			
t-value	4.71	4.49	4.37
p-value	0.000	0.000	0.000
Observations	5,239	5,239	5,239
R2	0.006	0.200	0.223

Note: Standardized estimate for covariate-adjusted model (3) is: 0.114.

11.3.0.8 Estimates and Standard Errors for Linear Regression Models of the “I have a good understanding of what makes my life meaningful” Outcome

	(1)	(2)	(3)
Growth Mindset Treatment	0.095** (0.038)	0.076** (0.031)	0.075** (0.031)
Purpose Baseline		0.727*** (0.024)	0.730*** (0.024)
Mindset Baseline		0.006 (0.015)	0.000 (0.015)
Expectations Success			0.063*** (0.017)
Expectations Interesting			-0.060*** (0.012)
10th Grade Math = 2			0.167 (0.207)
10th Grade Math = 3			0.141 (0.210)
10th Grade Math = 4			0.134 (0.207)
10th Grade Math = 5			0.013 (0.212)
10th Grade Math = 6			0.026 (0.216)
Female			-0.133*** (0.024)
Ratio .5	0.052 (0.051)	0.017 (0.042)	0.014 (0.042)
Ratio .8	-0.009 (0.045)	-0.030 (0.043)	-0.034 (0.042)
Treatment estimate stats			
t-value	2.54	2.44	2.43
p-value	0.013	0.016	0.017
Observations	5,237	5,237	5,237
R2	0.002	0.282	0.291

Note: Standardized estimate for covariate-adjusted model (3) is: 0.065.

11.3.0.9 Estimates and Standard Errors for Linear Regression Models of Advanced Math taking

	(1)	(2)	(3)
Growth Mindset Treatment	0.032** (0.012)	0.031** (0.012)	0.025** (0.010)
Purpose Baseline		-0.016** (0.007)	-0.020*** (0.006)
Mindset Baseline		-0.051*** (0.007)	-0.011** (0.005)
Expectations Success			-0.015* (0.008)
Expectations Interesting			0.080*** (0.005)
10th Grade Math = 2			0.002 (0.037)
10th Grade Math = 3			0.082** (0.040)
10th Grade Math = 4			0.308*** (0.045)
10th Grade Math = 5			0.623*** (0.043)
10th Grade Math = 6			0.612*** (0.048)
Female			-0.059*** (0.012)
Ratio .5	-0.011 (0.025)	-0.013 (0.024)	-0.009 (0.017)
Ratio .8	-0.012 (0.021)	-0.012 (0.020)	-0.013 (0.016)
Treatment estimate stats			
t-value	2.60	2.56	2.58
p-value	0.011	0.012	0.011
Observations	6,541	6,541	6,541
R2	0.001	0.013	0.326

Note: Standardized estimate for covariate-adjusted model (3) is: 0.050.