The Effects of Remote Mindset Skill Training on Middle School Students: A Case Study

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The Effects of Remote Mindset Skill Training on Middle School Students: A Case Study

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A Thesis in the Field of Mathematics for Teaching for the Degree of Master of Liberal Arts in Extension Studies

Harvard University

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Abstract

While mindset and grit seem to predict success in education, it is unclear if a growth mindset and grit can be acquired in digitized remote settings. The purpose of this research is to investigate if and how a remotely administered Brainology mindset intervention workshop may lead to improvements in middle school students’ mindset on intelligence, talent development, and grit. Seven middle school students enrolled in the program participated in the training of noncognitive skills development for eight weeks. Students’ views of intelligence and talent development as fixed or malleable and their levels of grit were assessed before and after the online intervention workshop using a questionnaire that combines the Dweck Mindset Instrument (DMI) and Angela Duckworth’s Short Grit Scale (Grit-S). The results suggest the online training support the development of growth mindsets on intelligence for students with initial beliefs that the trait is malleable. Students’ mindset on talent development did not change as a result of the online intervention, and students were less gritty after the intervention.
Frontispiece
Author’s Biographical Sketch

Zhanat Zhapparov is an M.Ed in English as a Secondary Language, an ALM candidate in Math for Teaching, an Ed.D candidate in Higher Education Administration, and an instructor in K-12 STEM education. He is the president of the Central Asian Student Association at Harvard University and the founder of IVY Standard Educational Consulting, LLC. Zhanat is passionate about education, college counseling, data science, computer programming, motion graphics, and cinematography. Although he is involved in numerous businesses, Zhanat considers himself an educator above all.
Dedication

I dedicate this thesis to my dearest wife, Makpal, who led me through the valley of challenges with the light of hope and support. She is the one who motivated me to stay on track and whose encouragement helped me to finish what I started. To my children Ismail, Said, and Asiya, whose lives have been affected throughout the process in the quest for academic advancement.

I also dedicate my thesis work to my parents, friends, teachers, and all the people in my life who touch my heart. A special feeling of gratitude to my loving parents, Kulai and Bolat, who have never failed to give me moral support, and whose words of encouragement supported the tenacity that I needed the most to finish this project.

I also dedicate the thesis to Allah, the God Almighty and my creator, my source of inspiration, wisdom, knowledge, and understanding.
Acknowledgments

Thank you to my thesis director, Dr. Carolyn Gardner-Thomas, who guided me throughout the process, and the Harvard Extension School faculty and staff in numerous capacities and who kept me on track.
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Chapter I.

Introduction

Since the start of the Covid-19 pandemic in 2019, schools and communities have been compelled to think about new initiatives to address the educational demands of millions of out-of-school children in the United States and around the world. Policymakers, school administrators, and teachers are grappling with many questions relating to how best to prepare a generation of students who may be falling farther behind during Covid-19 than in a typical year. Although Covid-19 interruptions of schooling are unparalleled with any other disruption in modern times, the research literature on the impacts of missed school on student learning may portend significant learning losses due to school closures during the pandemic. Kuhfeld et al. (2020) examined how students in US schools in grades three through eight scored in fall 2019 compared to students in the same grades in fall 2020. The study found that students’ academic gains dropped about five to ten percentile points in math during the nationwide pandemic emergency. This result indicates that more students are not performing as well online as they did in 2019 prior to the pandemic.

As one could imagine, the future of education will more than likely involve some form of remote teaching and learning, whether synchronous, asynchronous, or a form of hybrid of in-person and online learning. As virtual education continues to grow in demand, transforming education at an unprecedented pace, educators will need to leverage the online platform and available technological resources to support students’
academic, emotional, social, and physical well-being. While online learning has been widely available and practiced in schools through numerous digital platforms that may offer unique benefits such as allowing students to study at their own pace and time (Blackmon & Major, 2012), online learners may struggle with having to juggle their schooling with work and home responsibilities. Virtual learning is often accompanied by a lack of a sense of community, time restrictions, and difficulties in students’ understanding of the objectives of the online course (Song, Singleton, Hill, & Koh, 2004). Smart and Cappel (2006) reported that online learning often involves time pressures to complete modules. The researchers also noted that online learning offers insufficient human contact and social interactions incentives. Song et al., (2004) also identified additional stressors in online education, including learner motivation, attrition, and technological concerns. For certain, remote online schooling may be more convenient in terms of time flexibility, individualized pacing, limited need for transportation, and lower financial cost for education (Bawa, 2016). Yet, many students underestimate the volume of work and the level of involvement required in online courses (Bawa, 2016). As such, students’ learning challenges in math, combined with technology challenges, may lead to disappointment, academic stress, and even attrition for learners accustomed to the traditional, face-to-face setting. According to Bawa (2016), the fluid nature of online learning could contribute to students’ dissatisfaction and lack of motivation.

During the Covid-19 pandemic, school administrations, teachers, parents, and students are experiencing significantly more challenges than they could have imagined. Student disengagement is likely to increase contributions to widening the academic
achievement gap. Given that remote schools are now an inevitable part of education, it is imperative that both teachers and students adapt to new teaching and learning modalities. Indeed, a significant portion of the burden associated with the transition to online and hybrid classes falls mainly on teachers as they grapple with the challenge of motivating students in a virtual environment.

As a result of the Covid-19 Pandemic, several reforms and technological incentives have been introduced to enable administrators and teachers to redefine their roles while aligning pedagogy and instructional materials to remote settings. There is ongoing study by the American Institutes of Research (AIR) using a national survey to collect educators' responses to the coronavirus from 2,500 school districts and organizations about distance learning approaches and challenges; supports for students with disabilities and English learners; district policies on grading, assessment, and graduation; and student well-being and safety (Huguet et al., 2020). According to RAND Corporation researchers (Gross & Opalka, 2020), nearly 90% of principals reported that their students lacked access to the internet, and 40% reported that access to technology and/or the internet was also a barrier for their teachers. An April 2020 EdWeek survey indicated 74% of teachers reported that their students' current level of engagement is ‘significantly lower’ or "somewhat lower" than it was prior to the pandemic, and nearly a quarter of students are truant. Additionally, the EdWeek survey reporters discovered that morale among teachers, students, and administrators nationwide plummeted during the pandemic's early months.

This research investigates the process of developing noncognitive skills in remote settings such as growth mindset in an effort to support middle school students’
motivation and engagement in an online environment. While the workshop intervention involves the training of students’ mindsets regarding intelligence, the study also looks at middle school students' beliefs about talent development to examine the influence of the development of one non-cognitive trait on other traits, and how students’ levels of grit for academic tasks may relate to their mindsets on intelligence.
Chapter II.

Literature Review

Noncognitive skills are defined as a “pattern of thought, feeling, and behavior” of individuals that may last throughout a lifetime (Borghans, Duckworth, Heckman & Weel, 2008, p. 974). Researchers including Chernyshenko, Kankaraš, and Drasgow (2018) and Kai (2016) have investigated whether academic achievement may be linked to students’ noncognitive traits such as mindset and grit. Dweck’s (2012) and Boaler’s (2015) research on the concept of mindset has garnered significant attention within the education community. While Dweck’s research looked at mindset in general, Boaler’s work addressed mathematical mindset in education, mainly elementary and middle school students. Other researchers, including Zhu et al., (2019), Duckworth, Peterson, Matthews, and Kelly (2007) agree with Dweck and Boaler’s claim that noncognitive traits can be taught and have the potential to improve students’ resilience and academic performance. In an intervention program of a nationally representative sample of in-person public high school students in the United States, the National Study of Learning Mindsets (NSLM) found a growth mindset intervention improved ninth-graders academic performance (Zhu et al., 2019). Additional research indicates that noncognitive skills can be one of the best predictors of academic achievement (Phillips-Martinez, 2017; Siharath, 2019; Stankov, Morony, & Lee, 2014). Lewis, Williams, and Dawson (2020) provide additional evidence that these characteristics can be developed, as their research show an improvement in growth mindset for a group of nursing students. They found that growth mindset scores
increased following an intervention that focused on how mindset can potentially be improved.

**Mindsets**

Dweck (2006) analyzed two types of mindsets: a growth mindset and a fixed mindset. According to Dweck, a growth mindset is based on the belief that one’s abilities are not fixed, that ability can be altered, and intelligence is malleable. The researcher also believes that individuals can develop noncognitive skills through practice, training, and structured methods. An individual with a growth mindset believes that intelligence can be developed and may lead to a desire to learn. As Dweck further noted, a growth mindset tends to embrace challenges, persists in the face of setbacks, sees the effort as the path to mastery, learns from criticism, and finds lessons and inspiration in others' success. Based on Dweck’s mindset theory, students with a growth mindset could be expected to achieve at a much higher level than their fixed-mindset peers.

On the other hand, a fixed mindset ascribes to the notion that intelligence is static and not malleable. Individuals with a fixed mindset may exhibit a desire to look smart at all times; however, they are said to lack perseverance in the face of challenges. Fixed mindset students tend to avoid difficulties. They may give up easily, see effort as fruitless and worthless, ignore constructive feedback, and feel threatened by others' success (Dweck, 2006). Consequently, students with a fixed mindset often achieve less than their full potential. According to Dweck, when students believe that their abilities are “carved in stone” (p. 6), they often feel a sense of urgency to prove themselves repeatedly. It stands to reason,
“if you have only a certain amount of intelligence, a certain personality, and a certain moral character—well, then you’d better prove that you have a healthy dose of them. It simply wouldn’t do to look or feel deficient in these most basic characteristics” (Dweck, 2006, p. 6).

The Implicit Theory of Intelligence developed by Dweck and Leggett (1988) refers to an individual's fundamental underlying beliefs about whether intelligence or abilities can change. In the Implicit Theory of Intelligence, students who received an average score between 1 and 3 points out of 6 on the Dweck Mindset Instrument (DMI), a survey used to collect data on individuals’ mindset view, are considered to hold an entity theory view, the belief that intelligence is a fixed trait, and cannot be changed. Students who received an average score between 3 and 4 points out of 6 on the DMI are classified as mixed because they do not have an explicit standpoint about intelligence, and-whether the triat can be changed. Students who received an average score between 4 and 6 points on the DMI are considered to have an incremental theory viewpoint, the belief that intelligence is a malleable quality that can increase through efforts.

It is important to note that other research studies (including Greco, 2018) found that an individual’s initial belief in the malleability of a trait such as growth mindset, may have a distinct reinforcing effect on how the trait is influenced when efforts are made to deliberately change the individuals view of that trait. In other words, activities oriented to improve students’ mindsets of a non-cognitive trait is expected to support an increase in students’ incremental views if their initial mindset regarding the trait is already incremental. Accordingly, it is anticipated that students who participated in the current study with growth mindsets regarding intelligence will continued to enhance their
mindsets given the intervention workshop’s specific target of students’ views on intelligence.

Grit

Another noncognitive trait that is often associated with a growth mindset is grit. Duckworth, Peterson, Matthews, and Kelly (2007) define grit as passion plus perseverance, two constructs identified as having significant roles in learners’ success. Grit is an advantageous psychological characteristic of learning (Duckworth, Peterson, Matthews, & Kelly, 2007; Yeager & Dweck, 2012) that may result from having a growth mindset. Despite setbacks, difficulties, and failures in the process of learning, grit enables students to persevere and operate effectively toward long-term objectives. Gritty individuals are said to view accomplishment and achievement as a process, much like running a marathon. They see resilience as a strategic edge (Duckworth, Peterson, Matthews, & Kelly, 2007).

A recent article by Park, Tsukayama, Yu and Duckworth (2020) indicates a direct relationship between mindset and grit. The researchers found that mindset and grit correlates positively due to the influence these traits have on one another. Duckworth (2013) suggests that students need to cultivate a growth mindset in order to develop grit. This coupling of mindset and grit may be particularly significant in mathematics classes as students encounter unknown undefined problems that may be challenging to solve, and could present various levels of frustration. Boaler (2015) noted, “math was the subject most in need of a mindset makeover” (p. 15). The researcher reasoned that math students tend to hold a fixed mindset and very negative beliefs about their ability to learn math, even though they may have a growth mindset in other academic subjects. Many students
believe that math is difficult and will not persevere through challenges. Park, Tsukayama, Yu, and Duckworth (2020) examined the relationship between intelligence, growth mindset, and grit over time, and concluded that the development of grit and growth mindset characteristics were "distinct but mutually reinforcing," which means that the presence of one characteristic appears to imply the presence of the other.

Online Mindset Intervention Programs

Numerous online mindset intervention programs and networks including Mindset Works, Inc. (2008); PERTS (2010); The Mindset Scholars Network (2013); and Youcubed (2013) have emerged, presenting opportunities for remote online schools to apply noncognitive skills training on a large scale. These online learning platforms offer the potential to introduce mindset intervention programs to students and evaluate students’ progress quickly, cost-effectively, and with high accuracy. In contrast to in-person approaches to training at school, online intervention programs can integrate digital platforms and train through digital mediums, such as websites and mobile apps. The training programs can easily be adapted to online teacher-led instruction and asynchronous online courses. Some key advantages of online training for noncognitive skills are (1) reduced time spent on transportation; (2) cost-effective education that alleviates financial constraints; (3) structured, standardized content packaging for easy delivery (Kenney, Hermens, & Clarke, 2004); (4) flexibility and adaptability to personalize the content to the student's abilities, interests and values (Wang, 2014); and (5) safer environment during the surge of a health crisis.

The development of non-cognitive characteristics such as growth mindset and grit may be even more critical in remote learning. Thus, it is imperative that educational
institutions design opportunities for remote learners to develop these non-cognitive traits. But what is the nature of a non-cognitive skills training workshop designed to support the development of students' academic experiences in virtual classrooms? How could the deliberate cultivation of learner characteristics such as grit and mindset within supportive online environments help on-line learners build perseverance, creativity, and resilience? Following Duckworth et al.’s (2007) findings that deliberate practices on noncognitive skills along with additional academic support may improve online learners' academic achievement, this thesis adopts the premise that providing students with learning opportunities within cognitive, social, and emotional domains in virtual settings may improve the development of grit and growth mindset. While numerous research studies in myriad contexts have explored the constructs of grit and growth mindset, further study is required to examine the training of these psychological traits in online learning environments. This study looks at how deliberately practicing noncognitive traits in remote settings may support online middle-school learners' attitudes and beliefs about intelligence, talent development, and grit.
Chapter III.
Methodology

The following sections outline the mixed methods approach employed to investigate the impact of a intervention workshop designed to support the development of remote learners’ mindset view on intelligence, and how their intelligence view relate to their views on talent development, and grit

Participants and Setting

In April 2021, 329 middle school students (sixth, seventh and eighth graders) at two Charter Schools in the northeast region of the United States were contacted via email invitation letters (See Appendix A) to participate in the study’s online Noncognitive Skills Training and Brainology Mindset Intervention program. The researcher aimed to recruit 20 to 30 students for the study. The schools were ranked 38th and 40th within the state. Combined student enrollment for both schools in 2020 was 1153 with 71% minority of which approximately 33% were Black, 24% were Hispanic, 14% were Asian, and 2% were two or more races. At both schools, students can take Advanced Placement coursework and exams. The average AP participation rate in 2020 was nearly 87%, with more than 67% passing at least one AP Exam. While the schools do not follow any specific math curriculum, all courses are aligned with state and federal frameworks and standards. According to the schools’ website, all students have equal access to rigorous mathematics. Students may choose slower pathways, based on teachers’
recommendations, while others can challenge themselves by taking multiple math courses concurrently in any given year. Regardless of the students' selections, the different versions of the same courses provide the same content.

Twenty-seven students responded to the invitation letter to indicate their interest to participate in the workshop study and their parents and guardians were emailed the description of the study and permission forms (See Appendix B) for their unique signatures and contact information. However, after discussions with the schools’ administrations regarding the scheduled times for the workshop that would not conflict with students’ core classes, one school withdrew from the study due to difficulty finding a convenient time that would work for the students and the researcher. As a result, the ten sixth graders who indicated their interest in the study could not participate.

The parents and guardians of seven students from the remaining 17 students provided consent by returning the signed permission forms, and all seven students were selected for the study and were asked to sign the assent form (See Appendix C). Students’ and parents'/guardians’ email addresses were obtained from the schools’ database. The student invitation and parent permission letter provided a description of the workshop and outlined the purpose of the research study. The student participants, the school, and the school district were assigned pseudonyms for confidentiality throughout the study. See Table 1 below with the student participants’ demographic information and the scheduled time chosen at the first session of the workshop which was held on Wednesday May 5, 2021 during the students’ lunch period.

The workshop’s sessions were scheduled around core class periods. The four workshop time options were Wednesdays Home Room Period 7:45 AM - 8:30 AM,
Table 1. Student participants demographic information

<table>
<thead>
<tr>
<th>Student</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Grade level</th>
<th>Session schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceasar</td>
<td>Male</td>
<td>Asian/Pacific Islander</td>
<td>8</td>
<td>Wed Computer Class</td>
</tr>
<tr>
<td>Hailey</td>
<td>Female</td>
<td>White</td>
<td>8</td>
<td>Wed Computer Class</td>
</tr>
<tr>
<td>Hannah</td>
<td>Female</td>
<td>Black</td>
<td>7</td>
<td>Sat Academy</td>
</tr>
<tr>
<td>Miriam</td>
<td>Female</td>
<td>Black</td>
<td>7</td>
<td>Wed Lunch</td>
</tr>
<tr>
<td>Noah</td>
<td>Male</td>
<td>Asian/Pacific Islander</td>
<td>8</td>
<td>Sat Academy</td>
</tr>
<tr>
<td>Victoria</td>
<td>Female</td>
<td>Black</td>
<td>7</td>
<td>Sat Academy</td>
</tr>
<tr>
<td>Yasmina</td>
<td>Female</td>
<td>Hispanic</td>
<td>7</td>
<td>Sat Academy</td>
</tr>
</tbody>
</table>

Wednesdays School Lunch Period 11:38 AM – 12:22 PM, Wednesdays Computer Science class (a non-core class) 10:51 AM – 11:35 AM, and Saturdays Academy 9:30 AM – 10:15 AM. None of the students signed up for the Wednesday homeroom periods.

Students met with the researcher one-on-one, in pairs, or in groups of three depending on their chosen scheduled time for the workshop and had access to the online mindset training models from their Chromebooks.

**Noncognitive Skills Training Workshop**

The primary goal of the workshop was to support’s students’ development of a growth mindset regarding intelligence, and their understanding of the connections between their beliefs and their behaviors. The researcher hypothesized that the training workshop will help students come to understand that increased effort and effective learning strategies can result in increased intelligence and that students will gain an appreciation for challenges and failures as essential aspects of growing and learning.
The workshop utilizes the Applied Brainology Student Mindset Builder developed by Dweck and Blackwell (Mindset Works, Inc., 2008) at Stanford University to foster a growth mindset in learners. The computer program based on Dweck's research on intelligence theories, teaches students about the functioning of the brain through a series of online interactive activities for goal setting, reflection, self-monitoring, and assessments. The Applied Brainology package for middle schoolers consists of five interactive video training models: 1) Growth Mindset; 2) Goal Setting; 3) Emotion, Stress, and Learning; 4) Effective Effort; and 5) Learning Strategies. Each module begins with an instructor-led introduction on the day’s agenda, followed by a remotely administered computer session that includes interactive videos that present strategies for overcoming fears and embracing uncertainties students may encounter. After the brief introductory discussion at the beginning of each session, students had access to the researcher any time during the workshop to ask questions or for clarifications. Regardless of whether students met with the researcher one-on-one or in groups, all students completed the modules individually.

After completing each module, students were assigned a quiz that they may complete as homework if they do not finish during the Zoom session. By reflecting on their approaches for learning and formulating plans for future challenges and failures, students were encouraged throughout the workshop to reflect on their beliefs about intelligence. The students completed a pre and post 30-minute Mindset-Grit Survey at the start and the end of the workshop.

The eight-week non-cognitive skills training workshop schedule is outlined in Table 2 below. The weekly sessions were held via zoom during Quarter 4 of the 2020 -
Table 2. Intervention Workshop Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Module/Topic</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>May 5</td>
<td>Pre-Mindset-Grit Survey</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>May 12 &amp; May 15</td>
<td>The Malleable Brain</td>
<td>Module 1 Quiz</td>
</tr>
<tr>
<td>3</td>
<td>May 19 &amp; May 22</td>
<td>How the Brain Works</td>
<td>Module 2 Quiz</td>
</tr>
<tr>
<td>4</td>
<td>May 26 &amp; May 29</td>
<td>Emotions and Learning</td>
<td>Module 3 Quiz</td>
</tr>
<tr>
<td>5</td>
<td>June 2 &amp; June 5</td>
<td>Brain Power</td>
<td>Module 4 Quiz</td>
</tr>
<tr>
<td>6</td>
<td>June 9 &amp; June 12</td>
<td>Memory and Learning</td>
<td>Module 5 Quiz</td>
</tr>
<tr>
<td>7</td>
<td>June 16 &amp; June 19</td>
<td>Catch up week</td>
<td>Unfinished Modules (1 – 5)</td>
</tr>
<tr>
<td>8</td>
<td>June 23 &amp; June 26</td>
<td>Post Mindset-Grit Survey</td>
<td>None</td>
</tr>
</tbody>
</table>

2021 school year, May 5 through June 26, 2021. Students were engaged in each session for approximately 40 minutes during a chosen time that was convenient for each student.

The Mindset – Grit Survey

The Mindset-Grit Survey (Appendix D) with 24 statements is compiled using the Dweck Mindset Instrument, DMI, (Appendix E) developed in 2000 by Carol Dweck, and the Grit-S scale (Appendix F) designed by Angelo Duckworth (2009). The DMI was designed to measure mindset (an individual’s belief about whether intelligence is malleable or fixed), and the Grit-S was designed to measure trait-level perseverance and passion for long-term goals.

The DMI consists of eight statements created to collect students’ thoughts about whether they believe intelligence can be changed throughout an individual’s lifetime (an incremental theorist view), or whether intelligence is determined at birth (an entity theorist view). The Mindset-Grit survey adopted Dweck’s statements as the first eight items (Statements 1 through 8).
Each statement can be classified as favorable for either a “fixed” mindset meaning that intelligence is a stable trait and cannot be changed, or “incremental” meaning that intelligence is a malleable quality that can increase through efforts. For example, statement 4 on the DMI, “To be honest, you can’t really change how intelligent you are,” is a fixed statement because it suggests that intelligence is innate and stable. By contrast, Statement 5 on the DMI, “You can always substantially change how intelligent you are,” is considered incremental because it implies that intelligence can be cultivated through efforts.

The eight talent statements were designed by altering the DMI’s original statements to examine students’ views about talent development. Statements 9 through 16 of the Mindset-Grit survey replace “intelligence” with “talent” in the DMI’s original statements to assess whether or not there is a direct correlation between how students view intelligence and talent development. Much like the first eight statements regarding intelligence, the statements about talent may be classified as favorable for a “fixed” or “incremental” mindset.

The third set of eight statements (17 through 24) were adopted from Duckworth’s Grit-S instrument to measure students’ passion and perseverance applied towards a goal over a long period. Each statement looks at students’ “consistency of interests” or “perseverance of efforts.” While grit was not the focus of the workshop, these final statements assess students’ perceptions of their levels grit as a result of the growth mindset training.

Similar to the mindset statements, the grit statements are classified as favorable for high grit or low grit. Statement number 18, for example, “Setbacks don’t discourage
“me” is consistent with a high level of grit. Statement number 19, on the other hand, “I have been obsessed with a certain idea or project for a short time but later lost interest” is consistent with a low grit score.

Data Collection and Analysis

The mixed-methods study utilizes quantitative and qualitative data collected through the Mindset-Grit surveys and documented field notes to evaluate how the online intervention supports the development of growth mindset and grit. Students rate the Mindset-Grit statements according to their levels of agreement or disagreement to express their thoughts about the fixedness and malleability of the non-cognitive traits.

The responses to the survey collected through Qualtrics before and after the Brainology intervention workshop were converted to numerical values of 1 to 6 according to a forward or reverse coding scheme (see Table 3 below) depending on the statement’s favorability for growth or fixed mindset, and 1 to 5 for favorability for high or low levels of grit. The forward coding scheme assigns lower numerical values for students’ agreements with statements worded favorably for a fixed mindset: 1 (strongly agree), 2 (agree), 3 (mostly agree), 4 (mostly disagree), 5 (disagree), and 6 (strongly disagree). Lower scores were also assigned to less gritty orientations: 1 (Very much like myself), 2 (Mostly like me), 3 (Somewhat like me), 4 (Not much like myself), and 5 (Not at all like me).

The opposite is true for the reverse coded statements with higher numerical values assigned to agreement of statements worded favorably for a growth mindset: 1 (strongly disagree), 2 (disagree), 3 (mostly disagree), 4 (mostly agree), 5 (agree), and 6 (strongly
Table 3. Mindset - Grit Survey Variable Measure and Coding Scheme

<table>
<thead>
<tr>
<th>Statement no.</th>
<th>Statement</th>
<th>Variable Measure</th>
<th>Coding Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>You have a certain amount of intelligence, and you really can’t do much to change it.</td>
<td>intelligence</td>
<td>Forward</td>
</tr>
<tr>
<td>2</td>
<td>Your intelligence is something about you that you can’t change very much.</td>
<td>intelligence</td>
<td>Forward</td>
</tr>
<tr>
<td>3</td>
<td>No matter who you are, you can significantly change your intelligence level.</td>
<td>intelligence</td>
<td>Reverse</td>
</tr>
<tr>
<td>4</td>
<td>To be honest, you can’t really change how intelligent you are.</td>
<td>intelligence</td>
<td>Forward</td>
</tr>
<tr>
<td>5</td>
<td>You can always substantially change how intelligent you are.</td>
<td>intelligence</td>
<td>Reverse</td>
</tr>
<tr>
<td>6</td>
<td>You can learn new things, but you can’t really change your basic intelligence.</td>
<td>intelligence</td>
<td>Forward</td>
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<tr>
<td>7</td>
<td>No matter how much intelligence you have, you can always change it quite a bit.</td>
<td>intelligence</td>
<td>Reverse</td>
</tr>
<tr>
<td>8</td>
<td>You can change your basic intelligence level considerably.</td>
<td>intelligence</td>
<td>Reverse</td>
</tr>
<tr>
<td>9</td>
<td>You have a certain amount of talent, and you really can’t do much to change it.</td>
<td>talent</td>
<td>Forward</td>
</tr>
<tr>
<td>10</td>
<td>Your talent is something about you that you can’t change very much.</td>
<td>talent</td>
<td>Forward</td>
</tr>
<tr>
<td>11</td>
<td>No matter who you are, you can significantly change your talent level.</td>
<td>talent</td>
<td>Reverse</td>
</tr>
<tr>
<td>12</td>
<td>To be honest, you can’t really change how much talent you have.</td>
<td>talent</td>
<td>Forward</td>
</tr>
<tr>
<td>13</td>
<td>You can always substantially change how much talent you have.</td>
<td>talent</td>
<td>Reverse</td>
</tr>
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<td>14</td>
<td>You can learn new things, but you can’t really change your basic talent level.</td>
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<td>Forward</td>
</tr>
<tr>
<td>15</td>
<td>No matter how much talent you have, you can always change it quite a bit.</td>
<td>talent</td>
<td>Reverse</td>
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<tr>
<td>16</td>
<td>You can change your basic talent level considerably.</td>
<td>talent</td>
<td>Reverse</td>
</tr>
<tr>
<td>17</td>
<td>New ideas and projects sometimes distract me from previous ones</td>
<td>Grit</td>
<td>Forward</td>
</tr>
<tr>
<td>18</td>
<td>Setbacks don’t discourage me.</td>
<td>Grit</td>
<td>Reverse</td>
</tr>
<tr>
<td>19</td>
<td>I have been obsessed with a certain idea or project for a short time but later lost interest.</td>
<td>Grit</td>
<td>Forward</td>
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<tr>
<td>20</td>
<td>I am a hard worker.</td>
<td>Grit</td>
<td>Reverse</td>
</tr>
<tr>
<td>21</td>
<td>I often set a goal but later choose to pursue a different one.</td>
<td>Grit</td>
<td>Forward</td>
</tr>
<tr>
<td>22</td>
<td>I have difficulty maintaining my focus on projects that take more than a few months to complete.</td>
<td>Grit</td>
<td>Forward</td>
</tr>
<tr>
<td>23</td>
<td>I finish whatever I begin.</td>
<td>Grit</td>
<td>Reverse</td>
</tr>
<tr>
<td>24</td>
<td>I am diligent.</td>
<td>Grit</td>
<td>Reverse</td>
</tr>
</tbody>
</table>

**Mindset**
Forward Coding: 1 (strongly agree), 2 (agree), 3 (mostly agree), 4 (most disagree), 5 (disagree), and 6 (strongly disagree)
Reverse Coding: 1 (strongly disagree), 2 (disagree), 3 (mostly disagree), 4 (mostly agree), 5 (agree), and 6 (strongly agree)

**Grit**
Forward Coding: 1 (Very much like myself), 2 (Mostly like me), 3 (Somewhat like me), 4 (Not much like myself), and 5 (Not at all like me)
Reverse Coding: 1 (Not at all like me), 2 (Not much like myself), 3 (Somewhat like me), 4 (Mostly like me), and 5 (Very much like myself).
agree). Similarly, higher values were assigned to more gritty orientations: 1 (Not at all like me), 2 (Not much like myself), 3 (Somewhat like me), 4 (Mostly like me), and 5 (Very much like myself). Students’ overall perception of mindset and grit were calculated by averaging their scores for the eight statements pertaining to each single variable (whether intelligence, talent, or grit). Scores for statements 1 through 8 were averaged for the perception of intelligence score, 9 through 16 for the perception of talent, and 17 through 24 for the perception of grit. Intelligence and talent as two different constructs may be perceived differently in relation to mindset, and the scores for the two constructs are calculated separately. The group averages for the seven students were also calculated to compare the pre and post perceptions of mindset and grit to rate the effectiveness of the intervention overall.

Qualitative data from students' levels of participation, attendance, and engagement with the online program were documented throughout the eight-week workshop and analyzed to support an understanding of the students ‘evolving mindset and grit. All Qualtrics and documented data were stored on the school-provided server using a secured google account.
Chapter IV.

Results

As planned, the study engaged students in the weekly online workshop for eight weeks during Quarter 4, starting May 5 through June 26, 2021, for approximately 40 minutes per week. The seven selected student participants began the online noncognitive skills-building workshops remotely via Zoom, however after the first two weeks, Miriam was granted permission to continue the workshop from a designated room at the school due to reported difficulties accessing the workshop from home. Students had access to the online mindset training models from their Chromebooks and met online with the researcher individually, or in groups depending on their chosen scheduled time for the workshop. Ceasar and Hailey attended on Wednesdays during Computer Science class, Miriam met with the instructor individually on Wednesdays at lunch, and Hannah, Noah, Victoria, and Yasmina met as a group during the Saturday Academy. Even though some students met in groups, they all completed the intervention modules individually. Six students completed the eight-week workshop. One student, Hailey, finished seven weeks of the study but did not attend the last session for unknown reasons.

The results of the quantitative and qualitative data analyses are reported in four sections below: Pre-intervention Week 1, Interventions Weeks 2 through 7, Post-Intervention Week 8, and Pre and Post Intervention Mindset-Grit Survey Comparison Analysis. The Pre-intervention section describes the first week’s sessions with the students and the pre-intervention Mindset-Grit survey analysis results. The Intervention
section reports analysis of qualitative data collected from the students’ interactions with the researcher, and the assessment of the students’ engagement with the interactive online program. The post-intervention section is an analysis of the post-intervention Mindset-Grit survey. The final section presents a comparison of the quantitative data from the pre and post-intervention analyses.

During Week 2 through Week 6, students were engaged with the five Applied Brainology modules: “The Malleable Mind”, “How the Brain Works”, “Emotions and Learning”, “Brain Power”, and “Molding Mindsets”. The week 7 session was designated a make-up session for students who needed additional time with the module.

Pre-Intervention: Week 1

The first week’s session of the workshop was held on Wednesday, May 5, 2021 during lunch. At this session, students chose the scheduled time that was most suitable for them to attend the Weeks 2 through 7 sessions. The session started with a short greeting and student briefly introduced themselves before a five-minutet discussion about the the purpose of the study. Students were reminded that the study was designed for them to learn about the functions of the brain and to support their understanding of the how the brain aligns with their mindset view. The workshop was also intended to offer strategies for academic success.

Students were assured they had the option to discontinue their participation at any point during the study without penalty. The technical aspects of the workshop were discussed including instructions on how to interact with the modules, how to use the Brainology website, and how to access the researcher during the sessions. The
expectations for attendance and participation were also discussed. Students were encouraged to attend all sessions, and to engage with the modules as fully as possible.

The brief overview of the intervention workshop gave students a description of the modules and the format of the activities which included discussion forums, videos and summary quizzes. The modules allowed for students to work at their own pace. If the students did not finish the modules, they had the opportunity to finish on their own or during the week 7 makeup session. Students who finished the sessions early could work on additional activities at the end of the modules.

After 15-minutes of greeting, warm up questions, and introduction, students completed the 30-minute Pre-Intervention Mindset-Grit survey (Appendix D) with Zoom camera on as they were instructed. Students were asked to complete the Pre Mindset-Grit Survey based on their thinking about intelligence and talent development in general, and their beliefs about the consistency of their own interests and effort perseverance. Students were also assured that they were no right or wrong answers. They were encouraged to self-reflect on the range of their mindsets regarding different aspects of their lives. The survey was prepared on Qualtrics and the link was shared through emails and Zoom Chat.

All students, except Miriam and Hailey signed into the zoom space at their scheduled time for the Week 1 session. Miriam was 10 minutes late due to internet connection difficulties, and Hailey did not attend the session. In response to a follow-up email, Hailey completed the survey during computer class the following day.

From field note taken during the session, it appeared that not all students were engaged. Noah, Hannah, and Victoria had their cameras off most of the time and did not
respond to spontaneous check-in questions. It was difficult to monitor student engagement with the cameras off. The students were also mainly quiet throughout the session. Except for Ceasar, the students did not talk unless prompted or asked a question, though a few of them conveyed their questions through Zoom chat. Ceasar was very talkative and was not hesitant to ask questions for clarifications about the intervention workshop and the survey. Yasmina and Hannah communicated primarily through Zoom chat that was used primarily for module clarification, pacing guide, and restroom permission.

The students’ pre-intervention Mindset-Grit survey scores are listed in Table 4 below. Students’ mindset views on intelligence range widely from 2.7 to 5.2 points out of 6.0 indicating that the students had varying perceptions about intelligence. Their talent development mindset view and the grit ranges were narrower, 3.3 to 5.5 points out of 6.0 for talent, and 2.8 to 3.5 points out of 5.0 for grit. The result shows that students’ perceptions of talent development and grit were more closely aligned than their views on intelligence. All but one student, Victoria, had higher talent development views than their intelligence views. In other words, most students viewed talent development as more malleable than intelligence. In general, the students’ grit scores were the lowest of the three variables measured.

Dweck’s (2000) classified scores ranging from 1.0 - 3.0 on the Dweck Mindset Instrument (DMI) as indicative of a fixed mindset, scores from 3.1 to 3.9 as a mixed (partially fixed and malleable) or undecided mindset, and scores ranging from 4.0 to 6.0 as a malleable mindset. Accordingly, from the baseline results in Table 4, Hailey’s score of 2.7 is the only student with a fixed mindset regarding intelligence. Both Hannah and
Table 4. Pre-Intervention Mindset-Grit Survey Results

| students' Pre-Intervention Mindset Item Scores, Intelligent View Score, Talent Development Score and Grit Score |
|----------------------------------------------------------|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Statement no.                                            | Statement                                      | Caesar | Hailey | Hannah | Miriam | Noah | Victoria | Yasmina |
| 1                                                      | You have a certain amount of intelligence, and you really can't do much to change it. | 5      | 5      | 3      | 5      | 3    | 5      | 4        |
| 2                                                      | Your intelligence is something about you that you can't change very much. | 5      | 1      | 3      | 5      | 4    | 5      | 3        |
| 3                                                      | No matter who you are, you can significantly change your intelligence level. | 4      | 1      | 3      | 5      | 6    | 5      | 3        |
| 4                                                      | To be honest, you can't really change how intelligent you are. | 5      | 6      | 3      | 5      | 6    | 5      | 6        |
| 5                                                      | You can always substantially change how intelligent you are. | 3      | 4      | 3      | 5      | 6    | 5      | 3        |
| 6                                                      | You can learn new things, but you can't really change your basic intelligence. | 2      | 3      | 3      | 4      | 5    | 6      | 3        |
| 7                                                      | No matter how much intelligence you have, you can always change it quite a bit. | 4      | 1      | 3      | 5      | 6    | 5      | 4        |
| 8                                                      | You can change your basic intelligence level considerably. | 4      | 1      | 3      | 5      | 6    | 5      | 4        |
| 9                                                      | You have a certain amount of talent, and you really can't do much to change it. | 5      | 1      | 4      | 6      | 5    | 3      | 4        |
| 10                                                     | Your talent is something about you that you can't change very much. | 5      | 3      | 4      | 6      | 5    | 6      | 5        |
| 11                                                     | No matter who you are, you can significantly change your talent level. | 5      | 4      | 6      | 6      | 6    | 4      | 4        |
| 12                                                     | To be honest, you can't really change how much talent you have. | 5      | 3      | 4      | 5      | 6    | 2      | 3        |
| 13                                                     | You can always substantially change how much talent you have. | 4      | 4      | 5      | 6      | 4    | 4      | 4        |
| 14                                                     | You can learn new things, but you can't really change your basic talent level. | 3      | 3      | 4      | 5      | 4    | 4      | 4        |
| 15                                                     | No matter how much talent you have, you can always change it quite a bit. | 4      | 4      | 5      | 5      | 6    | 4      | 5        |
| 16                                                     | You can change your basic talent level considerably. | 4      | 5      | 5      | 6      | 5    | 4      | 4        |
| 17                                                     | New ideas and projects sometimes distract me from previous ones | 1      | 5      | 3      | 1      | 3    | 3      | 5        |
| 18                                                     | Setbacks don't discourage me. | 2      | 3      | 3      | 4      | 3    | 4      | 2        |
| 19                                                     | I have been obsessed with a certain idea or project for a short time but later lost interest. | 2      | 2      | 1      | 1      | 1    | 1      | 4        |
| 20                                                     | I am a hard worker. | 4      | 5      | 4      | 4      | 5    | 4      | 4        |
| 21                                                     | I often set a goal but later choose to pursue a different one. | 2      | 1      | 4      | 3      | 2    | 3      | 4        |
| 22                                                     | I have difficulty maintaining my focus on projects that take more than a few months to complete. | 2      | 4      | 1      | 3      | 4    | 2      | 5        |
| 23                                                     | I finish whatever I begin. | 2      | 5      | 4      | 4      | 3    | 3      | 2        |
| 24                                                     | I am diligent. | 4      | 3      | 4      | 3      | 5    | 3      | 3        |

Intelligent View Score

|                           | 4 | 2.7 | 3 | 4.8 | 5.2 | 5.1 | 3.7 |

Talent Development Score

|                           | 4.3 | 3.3 | 4.6 | 5.5 | 5.3 | 4 | 4.1 |

Grit Score

|                           | 2.3 | 3.5 | 3 | 2.8 | 2.8 | 3.2 | 3.6 |

Yasmina scores of 3.0 and 3.7 respectively, indicated a mixed mindset for intelligence view, while the other four students, Ceasar, Miriam, Noah and Victoria, viewed intelligence as a malleable trait with scores of 4.0, 4.8, 5.2 and 5.1 respectively.

Similarly, for talent development views, Hailey’s 3.3 score shows a mixed mindset view, while the other six students all viewed talent development as malleable with scores of 4.0 and above.

Overall, the students’ mindset views were incremental for the most part, with only one intelligent score falling within the fixed range. The grit scores did not seem to
correlate positively with mindset views. However, despite Hailey’s low mindset scores, her grit score of 3.5 points out of 5.0 was one of the two highest amongst all participants. It is the case that the two students, Hailey and Yasmina, with the lowest intelligence mindset scores, had the highest grit scores. It is possible that the students who view intelligences as determined at birth, may be apt to believe that more grit is needed to get through their academics, and are therefore grittier students. The four students who viewed intelligence and talent development as malleable scored the lowest on grit scale. Conclusively, the results suggest that the student may view talent development as more malleable than intelligence. The students’ averages from the pre-intervention survey may imply an inverse correlation between mindset views and grit.

Intervention Weeks 2 through 7

During Week 2 through Week 6, students were engaged with the five Applied Brainology modules: “The Malleable Mind”, “How the Brain Works”, “Emotions and Learning”, “Brain Power”, and “Molding Mindsets.” During week 7, three students, Hailey, Hannah, and Noah, attended the make-up session.

Students join the Zoom session at their designated times. Each session began with a brief overview of the Brainology module, and students had the opportunity to ask any clarifying questions and to voice any concerns they had. Students worked on the modules individually with cameras on. While it was not mandatory that students keep their cameras on, it was strongly encouraged as this was the culture at the school. Teachers found that when students turn their cameras off, they tended to be distracted and were not engaged. When students finished the modules, including additional activities at the end of the module, they directly notified the researcher and waited for others to finish
Week 2: The Malleable Brain

Students interacted with the first module, “The Malleable Brain,” on May 12 and May 15. Students learned that their brains grow, change, and become more intelligent with effort. The brief overview of the module introduced pictures of a brain as it grew stronger. A few students needed clarification and guidance on the technical aspects of interacting with the module as this was the first module of the intervention. For example, Caesar, Yasmina, and Noah needed further explanation on how to interact with the modules, how to use the pacing guide, and how to navigate the online discussion board. As the students worked on the first module independently, they had access to support as needed. All students, except Miriam, finished the Malleable Brain module on time. Miriam’s internet problems continued, and as a result, she did not finish the module during the designated period. She was allowed to finish the module asynchronously as homework.

Week 2 of the intervention seemed to offer new knowledge about the brain that the students did not have prior to their interaction with the first module. Ceasar’s comment that “I knew stuff happened with neurons inside your head, but I didn't know about the connections and how they grow when we learn” (Brainology online comment, module 1, May 12) indicated an acquisition of knowledge about the brain. His comment linking learning with the connections of neurons in the brain could support the development of his mindset on intelligence and may serve to shift his view to a more incremental position. Miriam also offered her understanding of how neuron connections work. She commented that
I don't know how to describe it exactly, but what I think happens inside my brain when learning something new is like adding a new puzzle piece to a never-ending puzzle. The puzzle being your brain and that new thing you are learning be the puzzle piece. Continuing in a puzzle, there are sometimes sections, for example, the top left corner could be the tree or the middle could be the park. Your brain has these sections but sometimes it gets mixed up, ending in you getting the wrong information or mixing up others. (Brainology online comment, module 1, May 12).

Week 3: How the Brain Works

The module 2, on May 19 and May 22, was on “How the Brain Works”. Students learned about how the brain gets stronger and how we can improve memory & learning through effective study strategies. The focus of this lesson was to learn how our brains work so that we can be successful in school and in life. Students were allowed to work independently on Module 2, with the researcher monitoring them closely to provide help and guidance when necessary. The researcher assigned students to break out rooms to check in and help them individually.

During the third week, there was a major change in Miriam’s schedule. After two weeks of completing the workshop from home, Miriam was granted permission to continue the workshop at the school property in a designated room during her lunch period due to ongoing problems with her WIFI at home. As such, Miriam completed the online mindset models with the support of the researcher in person for the Weeks 3 through 8 sessions. Extra care was taken to ensure that all school regulations and Covid-
19 protocols were followed. This accommodation enabled her to engage in the study more actively.

Miriam’s brief comment on the Week 3 module provided some insight into her reflection about her interactions with the content of the workshop and how her mindset was evolving toward an incremental view of intelligence. Miriam stated that “now that I have learned a bit about what the brain needs to grow stronger, I think I should sleep more, two hours more at most, and get more omega-3 filled foods…certain types of fish and vegetables into my system”.

Yasmina’s comment similarly showed a shift toward a growth mindset on intelligence. She observed that “I think that I can improve my brain… the studying… because sometimes when I study, I listen to music, and it doesn't help a lot. I also stay on the Ipad too long and I don't think about studying or reading.” Her belief that she can indeed improve her brain is an indication that she viewed intelligence as malleable.

Week 4: Emotions and Learning

Students interacted with the third module on May 26 and May 29. The focus was on “Emotions and Learning”. Students learned about how emotions affect learning and how to manage stress. This lesson was designed for students to learn how to manage stress symptoms so that emotions don’t interfere with learning. With the researcher’s guidance and support, students work independently on the module. Students appeared more comfortable with the routine of the workshop. They asked fewer instructional questions. Everyone knew the agenda and the topic for the week.

All students finished the week’s module during their designated periods. At the end of one of the week 4 sessions, when asked, what can your friends or classmates do to
help you when you get upset or stressed out, Ceasar responded that, “your friends and classmates can help you calm down by helping you or encouraging you. They can also tell you the methods they use to calm down.” Miriam added, “my friends and classmates could just talk to me normally and make me be interactive, I find that distraction helps ease the nerves.”

Both Ceasar and Miriam were developing an understanding of the links between their emotions and learning and the importance of utilizing strategies to handle emotions and stress. It is plausible that calmer individual would have more positive outlook and will be more likely to persist in academic, social and emotional domains.

Week 5: Brain Power

On June 2nd and June 5th, students completed the fourth module on “Brain Power.” The summer camp rat experiment presented in a video in this module generated the most interests from the students and motivated a highly engaged discussion about memory and learning strategies. The experiment involved a few rats that were placed in cages, either without motion or with lots of toys and allowed to be very active. At the end of the summer, when the brains were measured, the results show the brains of the rats that lived in an environment where they got to play, exercise, and interact with toys, were up to 10% heavier than the motionless rats.

On the Brainology discussion board, Ceasar and Miriam expressed their thoughts about the rat experiment and showed their understanding of the connection between brain activity and mindset. Ceasar wrote, “I think that the rat study was pretty cool.” He pondered about the kinds of things the rats were doing in the camp that allowed them to become much smarter. Miriam’s note on the discussion board was “I thought the study
week was interesting, seeing how because the summer camp rats had things to do they were able to perform better.” The students observed that brain neurons grow as intelligence increases, an indication of their reasoning about intelligence as malleable.

Week 6: Molding Mindsets

The fifth and final module, “Molding Mindsets,” was completed on June 9th and 12th. Students learned strategies that help the brain develop new connections and may help with their academic achievements. Strategies such as “questioning” and “leaning forward” were presented. Caesar and Miriam reflected on the strategies they were already using. “I really like the slant strategy” Caesar commented. “And I think it could really work and be useful. I think I’m already good at asking questions…I could improve at sitting up and leaning forward…like focusing.” Miriam agreed that she also found the slant strategies effective, and noted that she believed she was already good at leaning forward and listening. “The problem is actually dwelling on the information,” Miriam wrote, “and it not going out the other ear.”

Week 7: Catch up week

Hailey, Hannah, and Noah attended the week 7 sessions on June 16th and June 19th that was designated for make-up work to give students the opportunity to complete any of the modules they may have missed or did not finish during the times allotted over the previous six weeks. Students were assigned to individual Zoom breakout rooms so that the researcher could checked in with them one-on-one. Hannah and Noah completed Module 4 on Emotions and Learning. Hailey worked on Module 5, Molding Mindsets.
Summary of Qualitative Data Analysis

The students’ attendance and interactions with the Brainology modules showed varying levels of interest in the intervention content. Not all students shared their thinking, but two students, Ceasar and Miriam were very transparent about their thought processes throughout the workshop. Ceasar’s and Miriam’s comments on the discussion board made their curiosity and learning about the brain and their reflections on the learning strategies visible. Both students’ commentaries indicated that they held firm beliefs that intelligence is malleable. Yasmina was also willing to share her thoughts about the week 3 module on how the brain works. Like Ceasar and Miriam, Yasmina’s connections between her own eating and sleeping habits with her brain functioning showed her thinking about the malleability of intelligence. It could be reasoned that the three students had healthy measures of a growth mindset.

The mindsets regarding intelligence views of Hailey, Hannah, Noah and Victoria were not obvious from their interactions with the modules. As the workshop did not specifically focus on the students’ talent development views, the analysis of the qualitative data from the module interactions did not provide any evidence for the students’ mindsets on talent development. Furthermore, apart from the students’ persistent efforts to complete the modules, even beyond the weekly allotted time, whether for homework or during the week 7 make-up session, evidence of their views on their own levels of grit was not conclusive from their interactions with the modules.

Post-Intervention Week 8

Week 8 was the final session of the intervention workshop. On June 23th and 26th, all students except Hailey attended the session and completed the Post Mindset-
Grid survey. During this closure session, the researcher briefly summarized the content of the modules presented during the workshop and encouraged students to practice the strategies they learned so that the strategies can become deeply-embedded habits. The researcher shared the link for a Post Mindset-Grid surveys on the Zoom chat and the students completed the survey within 30 minutes. As students finished the survey, they were allowed to leave the Zoom room. Hailey did not show up for the last session and she did not submit her post survey. There were several email exchanges asking her to complete the survey. Although she responded to the emails, she did not submit the survey for unknown reasons.

Summary of Quantitative Data Analysis

The scored results of the post-intervention Mindset-Grit survey are presented in table 5 below. Their intelligence views ranged from 3.4 to 5.2 out of 6 points, showing a tightening of the range from the pre-intervention scores (2.7 to 5.2). The post scores also show an increase from the pre scores. While the post-intervention talent development view average score range, 3.3 to 5.5 out of 6 points, did not change from the pre-intervention range, individual students’ scores for talent development view varied from pre to post. The student grit scores at post intervention range from 2.1 to 3.2 out of 5 points indicated a widening of the range and a decline in the overall grittiness of the students from the pre-interventions scores (2.8 to 3.5). A more comprehensive comparison of the pre and post survey results is discussed in the “Pre and Post Intervention - Survey Comparison” section below.
Using Dweck’s (2000) classification of the DMI scores, five of the six students who completed the post-intervention survey indicated a view that intelligence is malleable with scores above 4.0 points. Only Hannah’s intelligence view score (3.4) fell within the mixed range of 3.1 to 3.9 points. Four students (Ceasar, Miriam, Noah and Victoria) viewed talent development as malleable (above 4.0 points), with Hannah and Yasmina indicating that talent development view is mixed. No meaningful conclusion could be drawn about Hailey’s mindset views and level of grit post intervention due to the lack of data from the post survey.
Pre and Post Intervention - Survey Comparison

To assess whether the non-cognitive skills training workshop supported students’ development of a growth mindset and grit, a comparison of the pre and post intervention Mindset-Grit survey results was conducted. See Table 6 below for the students pre and post survey scores for their perceptions on intelligence, talent development, and grit.

Overall, most of the students’ intelligence view scores improved from pre-intervention to post-intervention indicating that the intervention workshop may have had a positive impact on the students mindsets on intelligence. After the intervention, the intelligence view scores improved to closer align with their talent development views. Three students, Ceasar, Victoria and Yasmina, had higher intelligence view scores than talent development views after the workshop. Where as Ceasar’s and Yasmina’s scores for talent development view were higher than their intelligence views at the start of the study, their intelligence view scores were higher than their talent development scores at the end of the study. Victoria’s intelligence view score remained consistently higher than her talent development view score from pre to post intervention. On the other hand, Hannah’s and Miriam’s pre and post intelligence view score remained lower than the talent development view scores, however, the difference between the scores for the two non-cognitive traits on the post intervention survey were negligible.

Students grit scores remained relatively low. Four students (Ceasar, Hannah, Miriam and Yasmina) registered a decline in their grit scores on the post-intervention Mindset-Grit survey when compared to the pre-intervention survey scores. Noah’s grit scores slightly increased from 2.8 to 3.0 out of 5 points, and Victoria’s grit score remained at a 3.2.
Table 6. Students’ Pre and Post Survey Score Comparison

<table>
<thead>
<tr>
<th>Student</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Grade level</th>
<th>Intelligence Score</th>
<th>Talent Development</th>
<th>Grit Score</th>
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<td></td>
<td></td>
<td></td>
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<td>Post</td>
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<td>Hannah</td>
<td>Female</td>
<td>Blk</td>
<td>7</td>
<td>3.0</td>
<td>3.4</td>
<td>4.6</td>
</tr>
<tr>
<td>Miriam</td>
<td>Female</td>
<td>Blk</td>
<td>7</td>
<td>4.8</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Noah</td>
<td>Male</td>
<td>AS</td>
<td>8</td>
<td>5.2</td>
<td>5.1</td>
<td>5.3</td>
</tr>
<tr>
<td>Victoria</td>
<td>Female</td>
<td>Blk</td>
<td>7</td>
<td>5.1</td>
<td>5.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Yasmina</td>
<td>Female</td>
<td>His</td>
<td>7</td>
<td>3.7</td>
<td>4.3</td>
<td>4.1</td>
</tr>
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<td>Average</td>
<td></td>
<td></td>
<td></td>
<td>4.1</td>
<td>4.6</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Ethnicity: H: Hispanic; Blk: Black/African American; AS: Asian/Pacifica Islander; W: White

After the intervention program, the group average increased 0.5 points (from 4.1 to 4.6) for intelligence view; stayed relatively flat for talent development view (a negligible increase from 4.3 to 4.4); and decreased by 0.4 points for grit (3.0 to 2.6). As shown in the graphs of the itemized averages for intelligence in Figure 1, the group’s perception of intelligence as malleable increased from pre to post on all eight statements (1 to 8).

Furthermore, five of the six students who completed the post-intervention survey rated intelligence as malleable, as compared with four out of seven students who perceived intelligence as malleable on the pre-intervention survey. While Hannah’s score of intelligence view was still mixed post-intervention, the score increased from 3.0 to 3.4. This result suggest that the intervention may have supported students’ growth mindset regarding intelligence.

In comparison of the students’ perception of talent development from the average scores in table 6, four students’ scores remained in the malleable range from pre-intervention to post-intervention though two of these post scores reflected a decrease
within the malleable range. Ceasar, Miriam, Noah and Victoria had talent development view scores above a 4.0, but Ceasar’s and Miriam’s were a drop from 4.3 to 4.2 and 5.5 to 5.0 respectively. Hannah and Yasmina, registered a drop in their talent development view from the malleable to the mixed range with scores of 3.5 and 3.3 respectively. It is
important to note that the four decreases in talent development views ranged from a 0.1 (as in the case of Caesar) to more than a full point (in Hannah’s case). Noah’s slight increase (5.3 to 5.5), and Victoria’s sizeable increase (4.0 to 5.0) contributed to the overall negligible increase in the group average score for talent development.

A look at the itemized scores on the survey item for the talent development statements (see items 9 to 16 on figure 1), shows only two of the eight statements (Items 12 and 15) generated increases in the group’s perception score for talent development. At pre-intervention, seven of the eight statements generated group scores in the malleable range, whereas at post-intervention, there was a slight decrease to six of the eight statement that the group scored as malleable. In summary, while students’ mindset view of talent development did not increase similarly as with their intelligence view as was expected, their perception of intelligence after the intervention was more closely align with their talent development views.

The group’s average grit scores decreased from scores 3.0 to 2.6 suggesting that mindset score improvement in intelligence view did not predict improvements in grit levels. The drops in grit view scores can be observed in Ceasar’s (2.3 to 2.1), Hannah’s (3.0 to 2.3), Miriam’s (2.8 to 2.2), and Yasmina’s (3.6 to 2.5). Only Noah’s grit slightly increased from 2.8 to 3.0. Victoria’s grit score did not change. In summary, students’ grit score did not directly correlate with their perception of intelligence. There could be other factors such as the COVID-19 pandemic that may have contributed to the drop in grit score since the study took place online and during the last quarter of the school year.
Chapter V.
Discussion

The results of the study show that the deliberate practicing of noncognitive traits in remote settings may support middle-school learners' perceptions about intelligence and talent development, but not their views regarding grit. Before and after the intervention with the Brainology module, all seven students’ perceptions of mindset were classified according to the ranges outlined by Dweck’s DMI categories, namely entity theorists (fixed mindsets), incremental theorists (growth mindsets), or mixed (neither fully fixed or growth mindset). Overall, the view scores on intelligence migrated to closely align with the talent development view scores and the students’ perceptions regarding both traits, for the most part, could be considered within the levels of a growth mindset.

The findings did not support a direct correlation of students’ views of intelligence, talent development and grit as a result of the online intervention as expected. In fact, as students’ view of intelligence improved from pre-intervention to post-intervention, their perception of grit decreased. The intervention did not appear to support students’ levels of grit.

Sense-Making of Students’ Views on Mindset

The study’s results align with Greco's (2018) finding that when considering changes in a trait, such as mindset, one's initial belief in the malleability of that trait, may have a distinct reinforcing effect on how the trait may be influenced. In other words, the
intervention’s specific targeted domain, a growth mindset, was oriented to reinforce this trait for students whose baseline beliefs pre-intervention reflected a growth mindset. As noted throughout the study, the goal of the Applied Brainology intervention workshop was to support a growth mindset that views intelligence as malleable. As noted with the students who held the view that intelligence was malleable prior to the workshop, the intervention workshop seem to reinforce this view. The views of the four students with mindsets that intelligence is malleable at pre-intervention remained consistent post-intervention.

One significant observable outcome regarding the reinforcement of intelligence as malleable was the marked increase in the view score for Ceasar with a view score (4.0) in the lower malleable range compared to students with higher scores in this range before the start of the study. Ceasar’s view score for intelligence increased to 4.7 after the intervention. Comparatively, the view scores for the other three students (Miriam, Noah and Victoria) showed smaller variations within the malleable range, 4.8 to 5.0, 5.2 to 5.1 and 5.1 to 5.2 respectively. It is important to note that the intervention also supported Yasmina’s shift in intelligence view from the mixed range (3.1 to 3.9) to the malleable range (above 4.0). Yasmina’s intelligence view increased from 3.7 to 4.3, scores consistent with the positive impact of the intervention.

It would be reasonable to surmise that students’ initial beliefs that talent development is malleable would also portend a reinforcing effect of the intervention on the development of that trait, much like the development of intelligence. However, given that the focus of the workshop was specifically on mindset regarding intelligence, the interventions’ impact on students’ talent development view was not predictable. As such,
the consistency observed in the group average for talent development view from pre to post intervention was not surprising. While the group’s overall average for intelligence view increased from 4.1 to 4.6, the group’s talent development view remained static showing a negligible 0.1 increase from 4.3 to 4.4. In this study, this observation regarding the group averages suggests that the intervention’s target on students’ views on intelligence was impactful only for that specific trait (intelligence). Furthermore, given the students’ pre-existing overall view that talent development is malleable, the intervention’s negligible impact on students’ talent development view is also reasonable. The noteworthy observation is that the group’s overall average intelligence view moved closer to the talent development view.

A closer analysis of individual student’s pre and post scores, however, may offer useful insights regarding the intervention’s impact on talent development mindsets. Four out of six students had a drop in the talent development view scores from before to after the interventions; one student (Ceasar) with a small decline from 4.3 to 4.2, and three students (Hannah, Miriam and Yasmina) with sizeable declines (4.6 to 3.5, 5.5 to 5.0, and 4.1 to 3.3 respectively. Of the four students, two (Ceasar and Miriam) had post-intervention scores for talent development that stayed within the malleable range. Both Ceasar’s and Miriam’s high level of engagement with the Brainology modules may have contributed to their sustained growth mindset regarding talent development view. The scores for the other two students (Hannah and Yasmina) dropped from the malleable to the mixed range. Noah and Victoria had increases in their talent development view scores (5.3 to 5.5 and 4.0 to 5.0 respectively). It would have been informative to gain an understanding of the impact of the intervention on students with a baseline mindset of
talent development view as fixed. The only student with a fixed mindset of talent development view before the start of the workshop was Hailey, and she did not complete the post survey to offer a sense of the intervention’s impact on her mindsets regarding the non-cognitive traits.

Sense-Making of Students’ Views on Grit

The results of the post intervention survey did not hold that the observed reinforcement of a growth mindset on intelligence would predict a reinforcement of higher levels of grit as anticipated by the researcher. This result is a conflicting conclusion to research findings by Park, Tsukayama, Yu, & Duckworth (2020) that mindset and grit correlate positively. Indeed, after the intervention program, the group’s average grit score decreased from 3.0 to 2.6 (out of 5 points), while the average intelligence score increased from 4.1 to 4.6 (out of 6 points). The decrease in grit score may be attributed to several factors including the fact that the development of grit and a growth mindset in a talent development domain was not the primary goals of the intervention.

Another factor that may have contributed to the incongruity in the study’s result between a growth mindset on intelligence and grit, is the Mindset-Grit survey instrument used to collect students’ views. The mindset items on the survey (Items 1 through 16) asked students to register their thinking about intelligence and talent development in general. Contrastingly, the survey asked students to rate their thinking about their own levels of grit in items 17 through 24 on the survey. The intelligence and talent statements did not include the “me” factor that was integral to the grit statements. Asking students to
rate their thinking about themselves as opposed to thinking about grit generally could have influence how students responded to the mindset vs grit statements.

Additionally, the mindset scores were measured using a 6-point value Likert scale while the grit scores were measured using a 5-point value Likert scale. Comparing the effects and magnitude of mindset and grit was not conducted in the study as it would require more indept statistical analyses including normalizing and standardizing the data sets. Consistency in the presentation of the mindset and grit statements on the Mindset-Grit survey using a similar Likert scale may have produced different results.

Students’ dispositions during the Covid-19 pandemic could have also impacted their thinking about their own levels of grit, particularly for online learning. The decrease in grit scores post intervention may be viewed through the lens of the students’ lived pandemic experiences during the weeks of the intervention. According to Racine, Hartwick, Collin-Vézina, & Madigan (2020), many students have had to deal with extraordinary levels of stress and trauma, and faced unprecedented emotional challenges caused by the pandemic. The researchers noted that the lack of human interactions, emotional and social aspects of learning, and restrictive pandemic regulations put students and families under tremendous stress. Students’ perception of their own grittiness during the online intervention while struggling with learning in general during the forced online arrangements as substitutes for in-person interactions with teachers and peers may not have been an ideal time for students to accurately assess their levels of grit.

The Covid-19 pandemic also affected the level of students’ interest and participation in the study. Although the invitation was sent to all middle school students
within the school district, the number of participants was limited due to the high attrition rate stemming from schedule difficulties at one school, parent communications, students’ lack of interest in remote Zoom sessions, and the school’s administrative challenges with schedules for online activities. Researchers (Dorn, Hancock, Sarakatsannis, & Viruleg, 2021) found that the Covid 19 crisis had a detrimental effect on students' academic performance as well as their overall health and well-being, with more than 35% of parents expressing concern about their children's mental health. Undoubtedly, the study was conducted under extraordinary circumstances for the student participants and online learning.

A final remarkable and noteworthy finding regarding intelligence view and grit is that students with the lowest baseline views within the fixed or low mixed mindsets ranges of intelligence reported the highest levels of grit before the intervention workshop. Hailey with the lowest intelligence view score (2.7) had the highest grit score (3.5) from the pre-interventions survey. Hannah and Yasmina with mixed range intelligence views, 3.0 and 3.7 respectively, also had two of the higher grit scores, 3.0 and 3.6 respectively. Noah, on the other hand, with the highest intelligence view score (5.2) registered the second lowest grit score (2.8). Similarly other students (including Caesar and Miriam) with malleable range intelligence view scores (4.0 and 4.8 respectively) had the lowest grit scores, 2.3 and 2.8 respectively.

This phenomenon at first glance may appear paradoxical, however, it may not be as illogical when viewed from the standpoint of students thinking about the efforts and persistence needed to overcome an entity theorist mindset of intelligence. Could it be the case that students who believe their intelligence to be fixed from birth or carved in stone
would deem it necessary to be more gritty to overcome the academic challenges resulting from their perceived limited intelligence? During the open discussion on Zoom in the first session, Hailey described intelligent students as those who always get the questions faster and come up with the correct answers. The same argument could be made for students like Caesar and Miriam who considered intelligence as malleable, but rated themselves as less gritty. Future research that looks at students’ perception of their own intelligence and their levels of grit may help to elucidate this phenomenon.

Summary

The thesis study looks at how deliberately practicing noncognitive traits in remote settings may support online middle-school learners' attitudes and beliefs about intelligence, talent development, and grit. There are four distinct findings from the analysis of quantitative and qualitative data collected using the pre and post Mindset-Grit survey and the researcher’s observations and field notes:

1. The deliberate practicing of noncognitive traits in remote settings may support middle-school learners' perceptions about intelligence and talent development, but not their views regarding grit.

2. Overall, the view scores on intelligence migrated to closely align with the talent development view scores and the students’ perceptions regarding both traits, for the most part, could be considered within the levels of a growth mindset.

3. The results did not support a direct correlation of students’ views of intelligence, talent development and grit as a result of the online intervention as expected.
4. Students with the lowest baseline views within the fixed or low mixed mindsets ranges of intelligence reported the highest levels of grit before the intervention workshop.

Limitation

The current study has several limitations. First, it was a small-scale study with only seven students, so the results are not generalizable. Additional research with a larger sample size will be important before the findings can be generalized to a larger population. Second, the instrument used may have introduced opportunities for inconsistent thinking about the constructs of mindset and grit measured in the study. The solicitation of students’ responses about their thinking regarding mindset in general, yet thinking about grit in relation to themselves, was inconsistent and may have unintentionally swayed the results. A redesign of the Mindset-Grit survey for consistency using a similar Likert scale is advisable. Third, the study conducted during the Covid-19 pandemic may have had a deleterious effect on students responses to the survey and their engagement with the online intervention. A larger number of students may have opted to participate in the study if it was conducted at a time with less stress that resulted from online learning. Regardless of interest in the study, some student were unable to participate due to a lack of internet access to online programs.

Future Direction

The mindset intervention's virtual environment may have contributed to its less effectiveness. A face-to-face class could have provided a more motivating environment with more effective teaching and feedback. Because the objectives of this study was to
determine the impact of this intervention in a virtual environment, future research may wish to learn how to replicate the benefits of an in-person environment virtually. Future studies may consider recruiting additional online participants to ensure a sufficiently large sample is analyzed. Additionally, as part of future intervention, it may be worthwhile to include more explicit education on the impact of grit and growth mindset on intelligence and talent development, as well as how they can be improved. Future research should continue to examine factors in digitized settings that promote growth mindset and grit, as well as the relationship between these noncognitive traits and academic performance.
Re: Invitation to participate in the study on noncognitive skill training

Dear Middle School Students,

I invite you to participate in a research study conducted by Zhanat Zhapparov, a graduate student at the Harvard Extension School. The purpose of the study is to investigate the process of developing essential noncognitive skills such as a growth mindset to support students’ thinking about math in an online setting. Additionally, it aims to explore how deliberately practicing noncognitive traits in digitized settings may support online middle-school learners' attitudes and beliefs about math and their abilities to learn math.

The study will take place remotely one period per week for about 8 weeks as identified by the [School District] during the Quarter-4, 2021 School Year. The study sessions will be carefully placed to free periods that will not conflict with core classes. Students will have access to the online mindset training models from their Chromebooks. After a short instruction at the beginning of each session, students will interact with series of online mindset models independently.

You are eligible to participate in this study if you are a 6th, 7th, or 8th-grade student. Parental consent is required. Your responses to the survey and study results will be anonymous and confidential.

Your participation in this study is entirely voluntary. Your academic standing and grades will not be impacted if you decide not to participate. If you choose to participate, you may discontinue participation at any time. You may also choose to disregard any of the survey questions that you do not wish to answer.

Interested students, please contact the investigator
Zhanat Zhapparov, M.Ed, ALM in Math for Teaching, Harvard University
Email: zhz945@g.harvard.edu, Tel: 781-539-9001
Appendix B.

Parental Permission Form

| Study Title: Noncognitive skill training in digitized settings |
| Faculty Advisor: Dr. Carolyn Gardner Thomas, Ph.D., is the Director of the Mathematics for Teaching Program at the Harvard Extension School |

Key Information

The research study looks at how deliberately practicing noncognitive traits in digitized settings may support online middle-school learners' attitudes and beliefs about math and their abilities to learn math.

Keywords: Noncognitive traits, mindsets, self-efficacy, grit, intervention, remote, online, research

The following is a short summary of this study to help you decide whether or not you want your child to be a part of this study. More detailed information is listed later on in this form.

Why is my child being invited to take part in a research study?

We invite your child to take part in a research study because your child showed an interest in being part of the study program.

What should I know about a research study?

The researcher will explain this research study to you and your child. Whether or not you take part is up to you and your child. Your child’s participation is completely voluntary. You and your child can choose not to take part. You and your child can agree to take part and later change your mind. You and your child’s decision will not be held against you. Your child’s grades will not be impacted if your child decides not to participate. You and your child’s refusal to participate will not result in any consequences or any loss of benefits that you and your child are otherwise entitled to receive. You and your child can ask all the questions you want before you decide.

Why is this research being done?
The factors involved in the development of learners’ characteristics through the training of noncognitive skills such as growth mindset and grit are vital pillars of remote education. But what is the nature of noncognitive skills training to support students’ academic experiences in virtual classrooms? How could the deliberate cultivation of learner characteristics such as grit and mindset within supportive online environments help distant learners build perseverance, creativity and resilience? Following the findings that deliberate practices on noncognitive skills along with additional academic support may improve online learners' academic achievement, this research adopts the premise that enabling students to take advantage of productive learning opportunities in cognitive, social, and emotional domains in virtual settings may support the development of grit and growth mindset.

How long will the research last, and what will my child need to do?

Your child will participate in a weekly online workshop for eight weeks during Quarter 4, April through June 2021 for about 40 minutes per week to study noncognitive skills development.

Is there any way being in this study could be bad for my child?

There are some risks your child might experience from being in this study, such as discomfort, emotional risk, and undue influence.

Will being in this study help my child in any way?

Deliberately practicing noncognitive traits, according to research in digitized settings, may improve your academic achievement. We cannot promise any benefits to your child or others from your taking part in this research. However, possible benefits include developing essential noncognitive skills such as a growth mindset in an effort to support students’ motivation and engagement in online learning. In addition to increased student engagement in the classroom and greater awareness of growth mindset practices, researchers, teachers, administrators, and school districts considering growth mindset strategies in the school would benefit from this study's findings.

Detailed Information

The following is more detailed information about this study in addition to the information listed above.

What is the purpose of this research?

The purpose of the research is to investigate the process of developing essential noncognitive skills such as growth mindset in an effort to support students’ motivation and engagement in online learning. This research will explore the effects of deliberately practicing noncognitive traits in digitized settings on learners' attitude and belief about math in online classes.
How long will my child take part in this research?

Middle school students from ------- District will participate in noncognitive skills-building workshops designed to help them develop grit and a growth mindset in math. Students will participate in a weekly online workshop for eight weeks during Quarter 4, April through June 2021 for about 40 minutes per week to study noncognitive skills development. Students will also complete a pre and post survey at the start and end of the workshop. Each survey is about 30 minutes. The study will take place remotely one period per week for about 8 weeks as identified by the [School District] during the Quarter-4, 2021 School Year. The study sessions will be carefully placed to free periods that will not conflict with core classes. Students will have access to the online mindset training models from their Chromebooks. After a short instruction at the begging of each session, students will interact with series of online mindset models independently. The workshop will utilize the Brainology Bridge Intervention program.

What can I expect if my child takes part in this research?

Brainology Bridge Package for middle schoolers consists of interactive video training models where students learn that challenges and failures are normal, and it is a part of growing and learning. Through interactive videos, students learn strategies for overcoming fears and embrace uncertainties. By reflecting on their approach and method for learning and plan for challenges and failures ahead, students will reflect on their beliefs about intelligence and how these beliefs impacted their behavior at the end of the program.

You may expect:

Your child to take a pre-survey that will be administered during the first week of the program. The 30-minute surveys will be asked students to answer the combination of the mindset surveys of the Dweck Mindset Instrument and the Grit Scale Survey. The models and survey questions will be modified to middle school students’ educational level age-appropriate and easy to follow.

Your child to participate to the intervention sessions consist of eight periods (40 minutes each) of content and assessments that are anticipated to be completed online during school hours from April to June 2021. Without conflicting core classes, these periods will be carefully placed to free periods such as Pirate Prep (Homerooms), Tuesday and Thursday after schools, and Saturday Academies.

Your child to have access to the online mindset training models from their Chromebooks. At the begging of each session, your child will receive a short instruction from a principal investigator. After a short instruction, your child will interact with series of online mindset models independently.
Your child to take a post-survey that will be administered during the last week of the program.

What happens if my child or I say yes, but my child or I change our minds later?

Refusal to participate in the study will not affect any future services you may be entitled to from the school. Also, your child can leave the research at any time; it will not be held against your child.

Is there any way being in this study could be bad for my child? (Detailed Risks)

There are some risks your child might experience from being in this study. According to a literature review, conducting a mindset study carries a low risk. Minor but common risks associated with mindset intervention include boredom, mental fatigue, emotional risk such as embarrassment at poor performance, and frustration. Loss of time may be a discomfort for many students. The steps to minimize these risks are frequent breaks, time accommodation, and schedule flexibility.

Undue Influence: Students might feel obligated to participate in research in an assumption that their grades may be impacted, or students might feel pressure to participate in research if everyone else in the class is doing so. To mitigate and minimize the possibility of undue influence, an investigator will provide the prospective student sufficient opportunity in the descriptions of invitation letter, assent and consent form that not participating will not impact their academic standing or grades.

We also recognize that it is impossible to predict all potential risks in an experimental procedure, and we believe that reasonable precautions will be taken to reduce both known and unknown risks.

If my child takes part in this research, how will their privacy be protected? What happens to the information you collect?

The data for this study will be collected in digital format. The student pre and post surveys and observation data will be conducted using Qualtrics and a Google account provided by the school. The school’s grade database will also be available to the researcher. The stored data will be secured so that the confidentiality of the subjects is preserved. After the study is completed, the data will be kept on a secure server on the school server for two years.

Efforts will be made to limit the use and disclosure of your child’s Personal Information, including research study and student grades, to people who have a need to review this information. We cannot promise complete secrecy. Organizations that may inspect and copy your child’s information include the IRB and other representatives of this organization.
If identifiers are removed from your child’s identifiable private information or identifiable samples that are collected during this research, that information or those samples could be used for future research studies or distributed to another investigator for future research studies without you or your child’s additional informed consent.

Can my child be removed from the research without my OK?

The person in charge of the research study or the sponsor can remove your child from the research study without your approval. Possible reasons for removal include frequent absenteeism from the research sessions, inappropriate behavior/comments, using profanity, and causing disruption to others. We will tell you about any new information that may affect your child’s stay in the research.

Who can I talk to?

If you have questions, concerns, or complaints, or think the research has hurt your child, talk to M.Ed., ALM Zhanat Zhapparov (zhz945@g.harvard.edu) or Dr. Carolyn Gardner Thomas (gardnerthomas@math.harvard.edu).

This research will be reviewed by the Harvard University Area Institutional Review Board (“IRB”). You may talk to them at (617) 496-2847 or cuhs@harvard.edu if:

Your questions, concerns, or complaints are not being answered by the research team.
You cannot reach the research team.
You want to talk to someone besides the research team.
You have questions about your child’s rights as a research subject.
You want to get information or provide input about this research.

Signature Block for Involvement of Children

Your signature documents your permission for the named child to take part in this research.

Printed Name of Child

Signature of Parent or Individual Legally Authorized to Consent Date

Printed Name of Parent or Individual Legally Authorized to Consent

Signature of Person Obtaining Consent Date

Printed Name of Person Obtaining Consent
Appendix C.
Assent to Participate in Research

Noncognitive skill training in digitized settings.

My name is Zhanat Zhapparov. I am a graduate student at the Harvard Extension School.

I am asking you to take part in my research study in collaboration with the [School District] to study the process of developing essential noncognitive skills such as a growth mindset to support students’ thinking about math in an online setting. The study also aims to explore how deliberately practicing noncognitive traits in digitized settings may support online middle-school learners' attitudes and beliefs about math and their abilities to learn math.

You will be asked to participate in a weekly online workshop for eight weeks during Quarter 4, April through June 2021, for about 40 minutes per week to study noncognitive skills development. You will also be asked to complete a pre and post survey at the start and end of the workshop. Each survey is about 30 minutes.

Your participation in this study is entirely voluntary. If you don’t want to be in this study, you don’t have to participate. Your academic standing and grades will not be impacted if you decide not to participate.

You may also choose to disregard any of the survey questions that you do not wish to answer, and you may discontinue participation at any time.

If you agree to be in this study, your responses will be anonymous and confidential.

Your parents have consented to your permission to take part in this study. But even if your parents say “yes” you can still decide not to do this at any time.

You can ask any questions that you have about the study. You can email zhz945@g.harvard.edu or call me at 781-539-9001.

Your completion of the form with your unique signature indicates your assent to participate in this study. Your signature means that you agree to be in this study. You and your parents will be given a copy of this form after you have signed it.

________________________________________ ____________________
Name of Child Date
Appendix D.

Assent to Participate in Research

Grit-S scale

Directions: Read each sentence below and then mark the corresponding box that shows how much you agree with each sentence. There are no right or wrong answers.

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<th>Strongly Agree 1</th>
<th>Agree 2</th>
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<th>Disagree 5</th>
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<tbody>
<tr>
<td>1) You have a certain amount of intelligence, and you really can't do much to change it.</td>
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<td>2) Your intelligence is something about you that you can't change very much.</td>
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<td>3) No matter who you are, you can significantly change your intelligence level.</td>
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<td>4) To be honest, you can't really change how intelligent you are.</td>
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<td>5) You can always substantially change how intelligent you are.</td>
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<td>6) You can learn new things, but you can't really change your basic intelligence.</td>
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<td>7) No matter how much intelligence you have, you can always change it quite a bit.</td>
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<td>8) You can change even your basic intelligence level.</td>
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</table>
9) You have a certain amount of talent, and you can't really do much to change it.

10) Your talent in an area is something about you that you can't change very much.

11) No matter who you are, you can significantly change your level of talent.

12) To be honest, you can't really change how much talent you have.

13) You can always substantially change how much talent you have.

14) You can learn new things, but you can't really change your basic level of talent.

15) No matter how much talent you have, you can always change it quite a bit.

16) You can change even your basic level of talent considerably.
For each of the following statements, please indicate how descriptive they are of you.

<table>
<thead>
<tr>
<th></th>
<th>Not at all like me</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Very much like me</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. New ideas and projects sometimes distract me from previous ones.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>18. Setbacks don't discourage me</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>19. I have been obsessed with a certain idea or project for a short time but later lost interest.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>20. I am a hard worker.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>21. I often set a goal but later choose to pursue a different one.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>22. I have difficulty maintaining my focus on projects that take more than a few months to complete.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>23. I finish whatever I begin.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>24. I am diligent.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Compiled using Dweck Mindset Instrument (2000) and Duckworth Grit Scale (2009)
Appendix E.

Dweck Mindset Instrument

<table>
<thead>
<tr>
<th>DWECK MINDSET INSTRUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directions: Read each sentence below and then mark the corresponding box that shows how much you agree with each sentence. There are no right or wrong answers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Mostly Agree</td>
<td>Mostly Disagree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>4</td>
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<td></td>
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</tr>
<tr>
<td>5</td>
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</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) You have a certain amount of intelligence, and you really can’t do much to change it.

2) Your intelligence is something about you that you can’t change very much.

3) No matter who you are, you can significantly change your intelligence level.

4) To be honest, you can’t really change how intelligent you are.

5) You can always substantially change how intelligent you are.

6) You can learn new things, but you can’t really change your basic intelligence.

7) No matter how much intelligence you have, you can always change it quite a bit.

8) You can change even your basic intelligence level.

Appendix F.

Grit Scale

Short Grit Scale

Directions for taking the Grit Scale: Please respond to the following 8 items. Be honest – there are no right or wrong answers!

1. New ideas and projects sometimes distract me from previous ones.*
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

2. Setbacks don’t discourage me.
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

3. I have been obsessed with a certain idea or project for a short time but later lost interest.*
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

4. I am a hard worker.
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

5. I often set a goal but later choose to pursue a different one.*
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

6. I have difficulty maintaining my focus on projects that take more than a few months to complete.*
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all
**Short Grit Scale**

*Directions for taking the Grit Scale: Please respond to the following 8 items. Be honest – there are no right or wrong answers!*

1. New ideas and projects sometimes distract me from previous ones.*
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

2. Setbacks don’t discourage me.
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

3. I have been obsessed with a certain idea or project for a short time but later lost interest.*
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

4. I am a hard worker.
   - Very much like me
   - Mostly like me
   - Somewhat like me
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5. I often set a goal but later choose to pursue a different one.*
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

6. I have difficulty maintaining my focus on projects that take more than a few months to complete.*
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

---

7. I finish whatever I begin.
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

8. I am diligent.
   - Very much like me
   - Mostly like me
   - Somewhat like me
   - Not much like me
   - Not like me at all

---

**Scoring:**

1. For questions 2, 4, 7 and 8 assign the following points:
   5 = Very much like me
   4 = Mostly like me
   3 = Somewhat like me
   2 = Not much like me
   1 = Not like me at all

2. For questions 1, 3, 5 and 6 assign the following points:
   1 = Very much like me
   2 = Mostly like me
   3 = Somewhat like me
   4 = Not much like me
   5 = Not like me at all

Add up all the points and divide by 8. The maximum score on this scale is 5 (extremely gritty), and the lowest score on this scale is 1 (not at all gritty).

---

**Grit Scale citation**


References


[Record #139 is using a reference type undefined in this output style.]


Phillips-Martinez, B. (2017). Grit and Mindset as Predictors of Student Success in a First-Time Online High School Course (Publication Number 10284998) [Ph.D., Northwest Nazarene University]. ProQuest Dissertations & Theses Global;


References


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