THE NATIONAL CENTER ON SCALING UP EFFECTIVE SCHOOLS

Using a Networked Improvement Community Approach to Design and Scale up Social Psychological Interventions in Schools

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The National Center on Scaling Up Effective Schools (NCSU) is a national research and development center that focuses on identifying the combination of essential components and the programs, practices, processes and policies that make some high schools in large urban districts particularly effective with low income students, minority students, and English language learners. The Center's goal is to develop, implement, and test new processes that other districts will be able to use to scale up effective practices within the context of their own goals and unique circumstances. Led by Vanderbilt University's Peabody College, our partners include The University of North Carolina at Chapel Hill, Florida State University, the University of Wisconsin-Madison, Georgia State University, the University of California at Riverside, and the Education Development Center.

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Abstract

In our session, we showcase work from a researcher-practitioner partnership between James Madison University, the University of Virginia, and Harrisonburg City Public Schools that is focused on developing a continuous improvement process to translate social-psychological interventions into teaching practices that enhance motivation and learning. Specifically, we highlight one of our first collaborative projects to develop and scale up an intervention to teach students about adopting a growth mindset (Dweck, 2006) to address our practitioners' concern that many of their students lacked the belief that they could learn. In addition, we discuss how our local work to scale up psychological interventions is being conducted as part of a national Networked Improvement Community sponsored by the Carnegie Foundation for the Advancement of Teaching, called the Student Agency Improvement Community.

Using a Networked Improvement Community Approach to Design and Scale up Social Psychological Interventions in Schools

One approach to reform schools is through large-scale, comprehensive school initiatives. Unfortunately, many large scale initiatives can struggle to provide effective return on investment. For example, Borman and colleagues (2003) conducted a meta-analysis of 29 school reform models (232 studies, 1,111 effect sizes) and found that comprehensive initiatives only yielded small effects on student achievement (Cohen's d = .15) while averaging $80,000 in first year costs. Alternatively, a promising approach to enhance learning involves brief psychological interventions designed to change students' perceptions of themselves and their school context. These targeted psychological interventions, such as Dweck and colleagues' (e.g., Blackwell, Trzesniewski, & Dweck, 2007) growth mindset, Hulleman and colleagues' (e.g., Hulleman & Harackiewicz, 2009) value, or Walton and Cohen's (2011) belongingness interventions, have demonstrated moderate to large effects while often requiring far less time and resources to implement (Yeager & Walton, 2011). In a recent meta-analysis, Lazowski and Hulleman (2015) found that interventions targeting individual student perceptions, attitudes, and beliefs had an average effect size of .49 standard deviations on student outcomes.

Given the evidence that such targeted psychological interventions can have powerful effects, the next step is learning how to translate these emerging psychological interventions into teaching practices. Unfortunately, the process of translating emerging research into practice can be notoriously slow. Teachers often lack the necessary expertise to adapt emerging principles from the research literature, and researchers often lack appreciation of additional factors that could limit the generalizability of their findings because they are not fully embedded within a given school context. Therefore, our approach was to bring researchers and practitioners together

to form a Networked Improvement Community (NIC) where we utilized a continuous improvement process to develop, test, and refine new practices (Bryk, Gomez, Grunow, & Le Mahieu, 2015; Lewis, 2015).

Networked improvement communities are distinguished by four key features (Bryk et al., 2015). First, they focus on achieving a common aim. Second, they engage in a careful analysis of the system producing the current outcomes and then develop a shared working theory of how to improve that system. Third, they utilize improvement research methodology to systematically design, test, and refine improvement ideas. Fourth, they accelerate the rate and spread of learning to improve their system by working collaboratively to test and effectively adapt ideas for different student populations and educational contexts.

Forming Our Network Improvement Community

Initially, our partnership united researchers from two institutions of higher education (James Madison University and the University of JMU) with educators from one public school system (Harrisonburg City Public Schools). Located in the Shenandoah Valley of Virginia, Harrisonburg City Public Schools (HCPS) is a K-12 public school district serving 5200 students in five elementary schools, two middle schools, and one high school. HCPS is racially diverse, limited in in English proficiency, economically disadvantaged, and struggling to meet annual yearly progress in a number of academic areas.

In 2013-14, we launched our local networked improvement community with 3 researchers and 6 middle school teachers with the goal of creating a new approach to professional development for the district grounded in continuous improvement to improve student motivation. Midway through our first year, we were also invited to join the Student Agency Improvement Community (SAIC) sponsored by the Carnegie Foundation for the

Advancement of Teaching to share and exchange ideas with other school districts across the country engaged in similar improvement work. SAIC is a community of six networked improvement sites across the country (Harrisonburg City Public School in Virginia, Schools That Lead in Delaware, Summit Public Schools in San Francisco, New York City Department of Education, High Tech High in San Diego, and the Community College Productive Persistence Network) focused on the common aim of equipping students with the will and skill (aka, *student agency*) to persist in the face of rigorous learning challenges. SAIC is striving to: (1) support educational organizations to solve locally-identified problems of practice, (2) develop a practical knowledge base for how to build student agency, and (3) develop and test a model that translates promising ideas into research-based, locally-effective, educational practices. The Carnegie Foundation operates as the hub of the improvement community by providing training and support in improvement science and ensuring that recent academic knowledge is accessible throughout the community.

Based on an extensive review of the psychological literature in education, four core concepts form our Student Agency Conceptual Framework: growth mindset, value, belonging, and learning strategies. Each of the members in SAIC bases their improvement efforts on the Student Agency Conceptual Framework to redesign learning contexts and implement interventions to help students: (1) believe that they can learn (growth mindset), (2) find reason and purpose for learning (value), (3) feel they belong in their learning context (belonging), and (4) use effective strategies & know-how to succeed academically (learning strategies). As a networked improvement community, we are working collaboratively to generate change ideas that are consistent with what is known in the research literature, and growing a database of improvement ideas tested across a wide array of student populations and educational settings to

determine what works where, when, and under what conditions, and more importantly if promising ideas can be successfully adapted at scale.

An example of how to scale up a psychological intervention

The goal of our session is to showcase one example of developing and scaling up a psychological intervention in our networked improvement community. One of our first locally-identified continuous improvement projects involved creating an intervention to promote middle school students' growth mindset (Dweck, 2006). This project was selected after conducting a causal systems analysis of the major motivation challenges that our teachers faced with their students. While teachers raised a number of different motivational issues, students' confidence in their ability to learn was perceived to be their greatest motivational challenge encountered with their middle school students. Our partner teachers felt that far too many of their students already had given up on school and felt helpless that they could learn and get better at certain school subjects. This led to the next step of our researcher-practitioner partnership, where we introduced teachers to relevant motivation theory and past interventions that could increase students' expectancy for learning. In particular, teachers quickly saw merit in attribution theories and changing students' attributions from a fixed mindset (i.e., that that they lacked natural ability to learn and grow) to a growth mindset (i.e., that they could improve their ability as a result of effort and willingness to challenge themselves).

Prior work on growth mindsets

For over four decades, Carol Dweck's career has focused on students' attributional styles for learning, and how students' core beliefs can set up different patterns of response especially when faced with challenges and setbacks (Dweck & Legget, 1988)**.** In her original theorizing, she suggested students hold *implicit beliefs* about a number of personal attributes that shape

students' subsequent attitudes, behaviors, and cognition. In particular, her work has focused on students' implicit beliefs about their intelligence, where she proposed that students hold one of two theories of intelligence: (1) an entity theory in which students believe their intelligence is unchangeable and fixed or (2) an incremental theory in which students believe their intelligence is malleable and can grow. These theories of intelligence were later re-labeled by Dweck (2006), and are now better known in most education circles as having a fixed mindset (entity theory) or growth mindset (incremental theory).

The implications for adopting a fixed vs. growth mindset for learning are many. Fixed mindset individuals prefer to orient themselves to performance goals, which focus on attaining positive judgments of ability and avoiding negative judgments, while growth mindset individuals prefer to orient themselves to learning goals, which focus on developing skills and knowledge (Blackwell et al., 2007; Dweck & Legget, 1988). When faced with challenge, fixed mindset individuals display a helpless learning response marked by loss of belief in ability, withdrawal of effort, negative affect, avoidance of challenge, and deterioration of performance after failure. In contrast, growth mindset individuals, when faced with challenge, exhibit a mastery learning response marked by continued belief in ability, continued effort, positive affect, seeking of challenge, and persistence through failure (Cain & Dweck, 1995; Dweck, 1999).

A number of studies suggest that students naturally prefer one mindset over the other (e.g., Dai & Cromley, 2014; Romero, Master, Paunesku, Dweck, & Gross, 2014; Shivley & Ryan, 2013) and that students' mindset can also change over time absent any particular intervention (Dai & Cromley, 2014; Shivley & Ryan, 2013). However, in an effort to increase the strength of students' growth mindsets, Blackwell et al. (2007) developed and tested one of the first experimental interventions to shift students' mindsets from fixed to growth. The

intervention was tested with low-achieving seventh grade math students. In both the intervention condition and the control, students were exposed to a series of eight 25-minute sessions once a week over an eight week period (requiring 200 overall minutes). The experience of both groups was identical across a number of the session (e.g., in sessions one and two, both groups learned about basic structure and functioning of the brain; in sessions five and six, both groups learned about stereotyping and study skills). However, in sessions 3 and 4, to introduce growth mindset thinking, the intervention group learned about how the brain changes when you learn new things much like a muscle gets stronger when you work out. In contrast, the control group learned about how the brain organizes short- and long-term memories and were taught strategies on how to encode information into long-term memory. Then in sessions seven and eight, both groups engaged in targeted discussion where they reflected on what they learned (e.g., the intervention group reflected on growth mindset principles and control group reflected on memory principles). When comparing pre- and post-test measures, students in the intervention condition group showed an increase in their growth mindset (Cohen's d =.47), but more importantly the intervention group did not experience the downward trajectory in grades that occurred over the year for the control group.

While this intervention showed promising results, each of the eight sessions was taught by a team of two experimenters in person. Implementing this intervention on a large scale would be very costly on multiple fronts (e.g., time, money, staffing). In another study, Donohoe, Topping, and Hannah (2012) studied a commercially produced growth mindset intervention by *Mindset Works*®, which is a company co-founded by Dweck, Blackwell, and others to help increase student motivation and learning. They created a web-based product called *Brainology*® that teaches students about growth mindset through animated cartoons. It consists of 4 units that

are 40-minutes each (requiring 160 minutes). The researchers found a significant increase in the students' growth mindset from pre- to post-test (Cohen's d = 1.20). However, when surveyed three months later, there was a significant decrease in growth mindset from post-test levels. In fact, there was no difference between the pre-test and follow-up growth mindset scores. While this study showed that online interventions can be effective at boosting growth mindset, it also revealed that students may need more than a one-time intervention to keep their growth mindsets strong.

In a more recent study, Paunesku, Walton, Romero, Smith, Yeager, and Dweck (2015) studied an online growth mindset intervention at an even larger scale. This intervention was delivered to 1,594 students across 13 ethnically diverse high schools. The intervention involved two online 45-minute sessions held two weeks apart (requiring 90 minutes). Researchers found that students in the growth mindset condition held a more malleable view of intelligence after the intervention. This study also looked at GPA outcomes and found that only students at-risk for dropping out of high school, who made up 33% of the sample, significantly increased their GPA following the intervention. In addition, at-risk students increased the number of satisfactory grades (A, B, and Cs) earned after the intervention.

Adapting prior growth mindset interventions for our local middle school context

Based on emerging intervention work on growth mindsets, our team set out to develop and prototype a growth mindset intervention that would be appropriate for our local middle school population of students. We began by acquiring an initial set of instructional materials used to promote a growth mindset for a much older student audience from colleagues at an applied research center at Stanford University (PERTS; Project for Education Research That Scales). These materials were used in the Paunesku et al. (2015) study reported above, and

provide an example of how to accelerate learning more quickly in a network improvement community by working collaboratively and sharing materials. We then worked on adapting the materials for our local context in two major ways: (1) to ensure our younger middle school student population with limited English proficiency could understand them and (2) to shorten a two-session PowerPoint presented on a computer (taking 90 minutes) into a one-session presentation presented to students as a computer application on a hand-held tablet (taking approximately 20 minutes). After our research team narrowed down what core information to use in the presentation, our partner teachers in our local middle school simplified the presentation even further and were instrumental in recommending changes to ensure that their student population would understand the text being presented and find the material engaging. Once the initial version of the application was created, we began a series of tests following improvement science methodology of Plan-Do-Study-Act (PDSA) cycles, where smaller scale tests were initially conducted to learn how we could make the intervention effective for our population before scaling up the intervention over time. Below we report the methodology and results for developing our growth mindset application, then in our discussion we reflect on how we are currently working with school administration and staff to scale up the intervention systematically so that all students will be introduced to growth mindset thinking at their middle school.

Method

Participants and Setting

Two hundred and sixteen students participated in our initial PDSA testing to prototype and develop the intervention. In our local school district, students in the 5th through 8th grades are grouped together for middle school. Therefore, we set out to create an intervention that would appeal to both the youngest and oldest students in the middle school, and we focused the

majority of our testing and development of the intervention with students in the classes of our partner teachers from either the 5th (N = 90) or 8th grades (N = 70). For confidentiality issues, we did not obtain additional demographics on our current student sample, but we can report overall student demographics of the school district. Our local school district is located in Harrisonburg, VA, which is also a refugee resettlement city. As a result, the student population is diverse (40% Hispanic, 15% African-American), limited in English proficiency (with students representing over 40 countries and speaking over 50 languages), and economically disadvantaged (70% free and reduced lunch).

Procedure

Our basic procedure involved having two researchers visit a classroom of one of our partner teachers and running the students through the tablet intervention. Then, a key tenet of improvement science is to engage in Plan-Do-Study-Act (PDSA) cycles to determine whether or not a proposed change idea actually leads to an improvement (Bryk et al., 2015). A PDSA cycle represents a test of a specific idea being proposed for improvement, and the goal of any given PDSA cycle is to decide whether the idea being tested should be adopted, adapted, or abandoned. If you are unfamiliar with the Plan-Do-Study-Act cycle, it is a systematic but simplified way to model a more traditional research approach. Your "Plan" proposes your change idea, what you hypothesize will happen when you implement the change, and how you intend to test your idea; your "Do" represents carrying out your change idea, collecting data to test its effectiveness, and reflecting on how the change was implemented; your "Study" represent your results of the test and reflection on how the results compared to your hypotheses of your plan; and your "Act" is your final discussion where you reflect on what your next steps should be and whether your change idea should be adopted, adapted, or abandoned.

Another key tenant of improvement science is to consider the scale of a given PDSA test. Rather than going straight to large-scale implementation of a given change idea, improvement science offers an alternative approach where tests of change ideas can be conducted on a smaller scale before scaling up the change idea, especially if knowledge about the change idea or the capacity of those you're working with to implement the change idea is low.

For example, we started our PDSA testing of the application in one classroom with older 8th grade students to see if we could first establish that the oldest students in the middle school could understand the information being presented on the tablet. Once we found that test to be successful, we moved to classrooms with our youngest 5th grade students. Our initial PDSAs also included key measures to track user-interface issues of being able to successfully launch and navigate the application and being able to type with a virtual keyboard. We also collected students' initial reactions to the material presented on the application through follow up surveys and brief focus group interviews. In particular, we measured the length of time students took to complete the app, the quality of responses that students typed in response to questions throughout the app, and their written qualitative feedback. As a result of these initial PDSA cycles, a number of refinements were made to the application before deploying the application more widely in the classrooms of our 6 participating teachers. We also shifted our focus to more traditional quantitative measures of change in pretest/post-test measures of students' growth mindset. We report examples of each of these results below.

Results

Analyses focused on student engagement with the tablet and the material

First, we evaluated student engagement with the application by looking at the length of time students took to complete the app. The application had an automatic timing device that

started as soon as students launched the application and ended as soon as they completed the last slide. The number of minutes that students took to complete the experience ranged from 4.95 to 34.88 minutes (with a mean average of 17.70, a median of 16.88, and standard deviation of 5.89 minutes). Our target goal was 15 to 20 minutes.

Second, we evaluated student engagement by the quality of responses that students typed in response to questions throughout the app, and their written qualitative feedback about their experience after completing the app.

At four different points, students were prompted to respond and apply the information they were learning on the app. We coded two things for each response possible: (1) whether they typed something and (2) the quality and theme of what they typed. We found that the response rates were 90%, 94%, 93%, and 90% respectively for each time students were prompted to type in a respond to a question. In terms of quality of responses, we were impressed with how on-task the students were and what we learned about them as a result. For example, one question asked students to respond with something they think they are not good at and then put yet at the end (e.g., "I'm not good at spelling yet"). Many of the students (25%) wrote something math related, 20% about athletics, and 14% about English. Other responses included topics such as history, science, and art. This question provided us with quick insight into a list of topics that were giving students the most difficulty in school, in the classroom, and even at home. Another question focused on how students could push themselves in school. Many of the students (36%) responded saying they could work harder in school or in their studying at home, and 30% of the students responded with a more specific learning strategy they could use such as flash cards or memorizing material. A number of students also offered responses such as thinking more positively about themselves and their ability and avoiding friends in class that distract them.

In a follow up survey after viewing the app, 84% of students shared overwhelmingly positive feedback to the question "What did you like learning today about how your brain works?", such as:

- *I liked it because I never knew how smart the brain can get.*
- *It helped me a lot. I always say I can't do this but now I will try to do it over and over again until I get it.*
- *I liked it because now I know that I can't just give up on things. I have to keep trying until I get it because I know I can learn it.*
- *I learned a lot from that presentation. Now I'm going to push myself to put that 100% effort in helping my brain grow.*
- *Now I am going to study more and pay attention to my teacher so my brain can learn new things.*
- *I like it. On a scale 1 through 10, I give it a 9.*
- *I liked it because I learned new things and new ways of feeling confident in myself.*
- *I really loved it cause now I feel like can do anything if I just keep trying.*
- *In my opinion I thought it was cool and very kind for you to teach us this.*

Then, 9% of the responses indicated a more neutral positive response (e.g., *It was OK*.), 3% 0f the responses were left blank, 2% of the responses were unrelated to the question, and only 1% of the responses expressed negative feedback about the experience (e.g., *It was not fun.*).

Analyses focused on changes in growth mindset

When evaluating pre-test/post-test measures of students' growth mindset, 60% of students reported an increased growth mindset after viewing the application and students increased by over half of a standard deviation from pre-test to post-test (d = .53). In addition, 20% of students who were initially fixed flipped to growth mindset based on the theoretical midpoint of the scale where scores of 4 or higher represent more growth mindset thinking but scores below 4 represent more fixed mindset thinking.

Additional analyses on user experience and implementation of the intervention

After each PDSA test, we also collected observational data from the researchers and teachers about students' user experience and if there were any particular problems that students

had in navigating the application and being able to use the tablet. For example, we recorded what questions students asked and needed help with during a given session. This resulted in a number of changes to instructions that appeared in the application to make the application more self-explanatory. Also, because we delivered the intervention to an entire class where each student was provided their own tablet, we kept track of additional classroom management issues that could impact the experience. For example, we quickly learned that students varied in how long it took to complete the application, and that it was beneficial to have a follow up activity for students to work quietly on while others finished the experience. Therefore, we added a drawing activity once students completed the application and post-assessment survey. First, we asked students to draw a picture of themselves doing something challenging at school (see Figure 1 for examples), then we asked them to draw a picture of what is happening inside their brain when they challenge it to grow (see Figure 2 for examples).

Discussion

Through our PDSA testing, we learned keen insights into the effectiveness of our intervention and how we could continue to refine and improve it. As a result, our team gained confidence in having created an experience that was effective in teaching middle school students about growth mindset thinking. We also learned a number of valuable lessons in our first collaborative project in our networked improvement community:

1. *Having teachers and researchers collaborating early in the development cycle is key.* Much of the initial improvement for the intervention took place as researchers and teachers worked together to share insights. Teachers and researchers were able to use their collective wisdom to diagnose problems, identify things that worked, and formulate new hypotheses and change ideas. These improvements would have taken

several cycles for researchers to discover on their own, if they discovered them at all. For example, teachers were able to identify quickly the need to greatly reduce the amount of text on each page of the intervention in order to hold the attention of their students, as well as identifying particular words that students might struggle to understand.

2. *Don't spend too much time trying to optimize your intervention before you launch it.* This is a core tenet of continuous improvement / rapid prototyping / agile development methodologies, but it can be hard to commit to. The natural tendency is to make things perfect before you deploy them. For example, as noted above, we quickly realized a need to include additional filler activities once students finished the application to provide other students more time to complete the application (especially students with limited English proficiency), which we added. Then we realized that the additional filler activities could become another important way to reinforce the growth mindset message and to serve as a manipulation check of what students learned.
3. *An intervention initially directed at changing students dramatically changed our teachers as well*. For teachers, we found that they gained a new-found appreciation for their behavior in the classroom and how they often reinforced fixed mindsets (rather than growth mindsets) with how they interacted and communicated with their students and structured various assignments. Thus, in parallel to creating and developing the growth mindset application, the group worked on how to create consistent growth mindset messaging in their day-to-day classroom interactions (by providing feedback that emphasized effort vs. ability) and to create new activities and

assignments that would allow students to demonstrate having a growth mindset orientation. A number of our teachers also recognized that they held a fixed (rather than growth) mindset about the subject matter that they taught, and that they needed to change if they could expect their students to change.

Although encouraged by our results, we continued to perform additional PDSA cycles before finalizing a plan with school administrators on how to scale up the intervention to more students in the middle school. To gain additional insight into ways that we could improve the content of the application, we began testing students individually and then interviewing them for additional change ideas on how the information presented on the application could still be improved. Up to this point, we had based the content only on the input of researchers and teachers. But rather than offering new ideas, our student interviews confirmed that the content and length of the material presented on the application was appropriate for students their age. While students did not suggest additional changes to the content, we did uncover another issue of students seeing the application multiple times (e.g., a couple of the students being interviewed had been in multiple classes of our partner teachers), which could diminish the effect of the message. As a result, we decided with school administrators that the application should only be used once with students and that we needed to develop a series of alternative activities whenever teachers wanted to reinforce growth mindset thinking in their classes.

Additionally, we were mindful that scaling up would need to require less researcher support. During our initial PDSA tests, one or two researchers were always present to introduce and run students through the application experience. So we ran an additional PDSA cycle where one of our partner teachers conducted the intervention with two of her classes (N=31) rather than the researchers. We found that students once again significantly increased their growth mindset

from pre- to post-test (Cohen's *d* =.67) and 20% of students switched from fixed to growth mindset, resulting in similar effects that we found when researchers ran students through the experience.

With this additional information, we made plans for the upcoming 2015-16 school year, to scale up and strategically administer the application to all incoming 5th grade middle students at the start of the school year to lay the foundation for students' growth mindset thinking in middle school. We also developed a more comprehensive plan to begin tracking additional student outcomes to link students' change in growth mindset thinking to their subsequent academic performance and experience in school.

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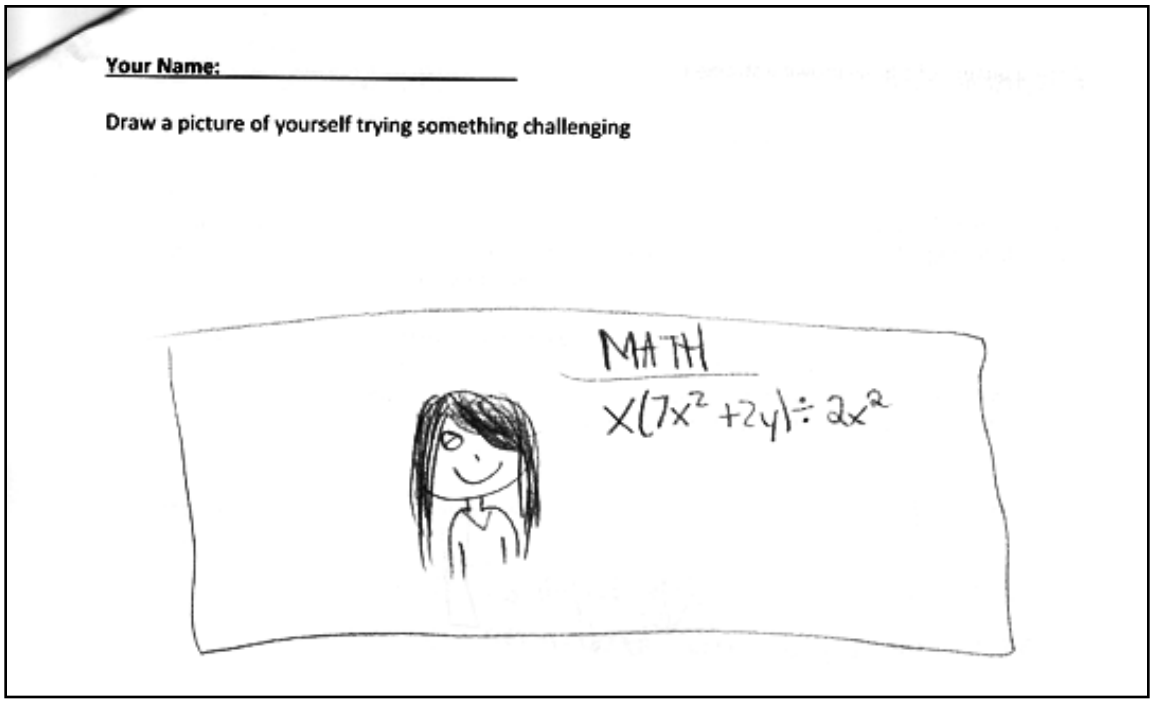
Figure 1. Examples of Middle School students drawing pictures of an activity that challenges them to make their brain grow stronger



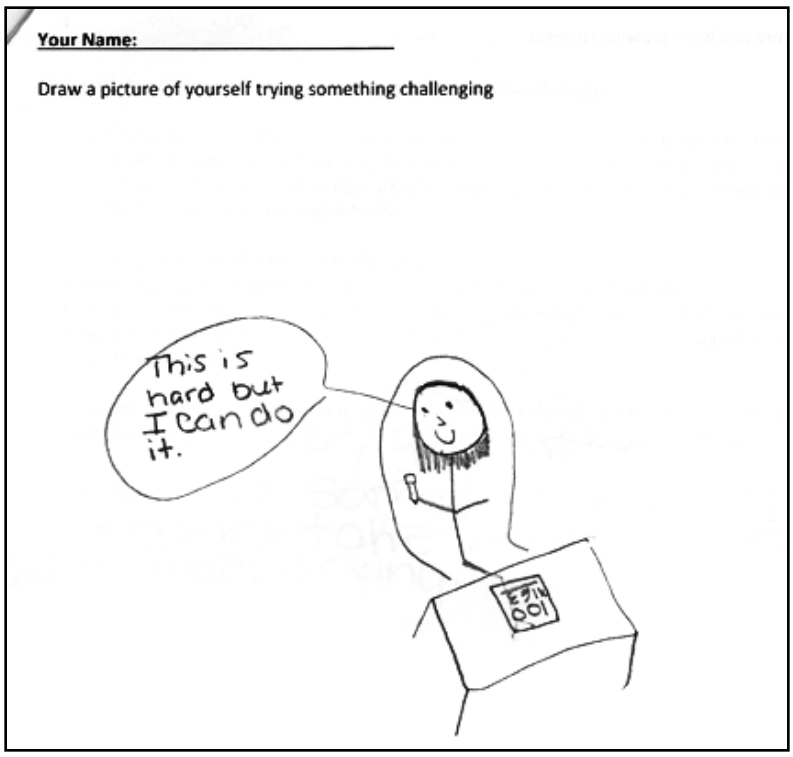
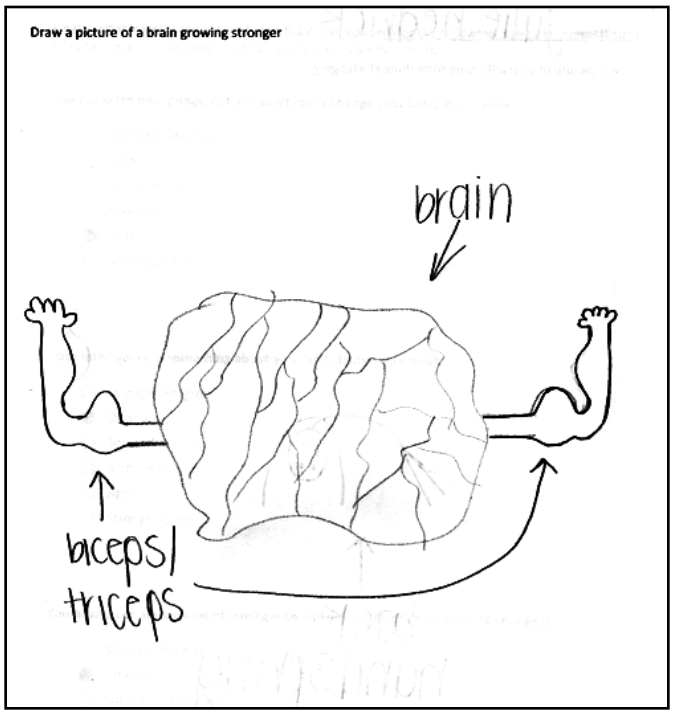
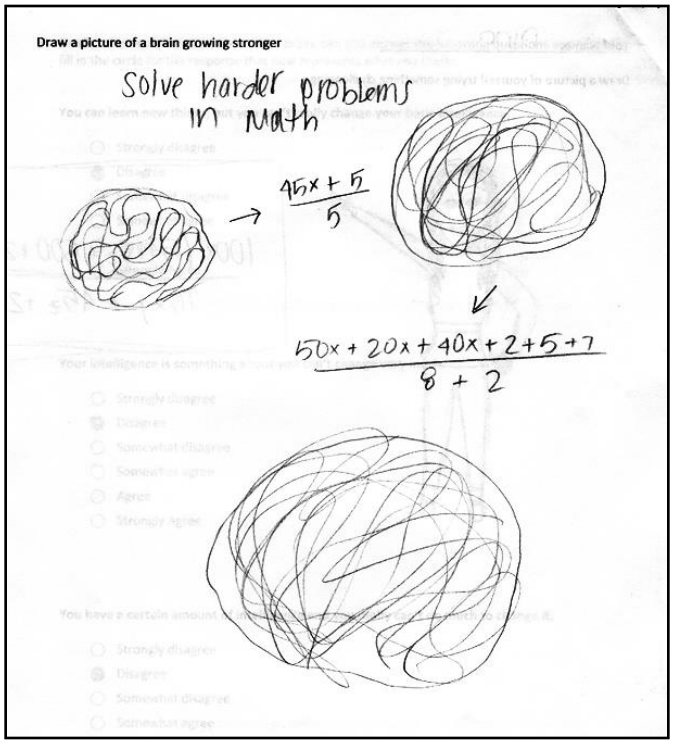

Your Name:
Draw a picture of yourself trying something challenging
This is hard but I can do it.
ERIN 001

Figure 2. Examples of Middle School students drawing pictures of what happens to their brains when doing hard harder activities





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