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Choice and Growth Mindset

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Abstract

This study sought to determine if lessons in growth mindset would improve engagement and thus positively affect elementary students in finishing work, and if enhanced engagement would enrich work quality. Prior to implementation, a tally of incomplete work cycles and an assessment of students’ overall persistence were gathered. Student interviews regarding their views on unfinished work were conducted. Five students were randomly selected to provide work samples which were assessed by the students and their teacher. Twenty-six, six to nine years-olds in a private, lower elementary Montessori classroom received four lessons to promote a growth mindset and were assessed for progression. The results showed an increase in persistence and fewer incomplete work cycles, but no improvement in work quality. Suggestions for further research include conducting the same research over a longer time period or with a larger sample size.

*Keywords:* growth mindset, grit, engagement, persistence, incomplete work
The brain is one of the most powerful organs of the human body. With small electrical impulses, it moves limbs, creates sentences, and expresses emotions. Human brains discovered complex scientific theories, created hypotheses of the creation of the universe, and redefined the world around us. But when it comes to students, many feel that their brain insufficiently executes daily academic and social tasks. Societal pressures to always have the right answer and master every skill on the first try leave students feeling inadequate, leading to low self-esteem and frustration. In a Montessori classroom, this frustration translates to students giving up on a work and returning it, incomplete, to the shelf.

In a Montessori classroom, students are encouraged to choose which assignment they would like to work on. The classroom is lined with shelves containing a myriad of activities that a student may use once they have received a lesson. Many activities involve hands-on materials that students need to lay out prior to performing the follow-up task. The teacher, also called a guide, gives lessons to students in a small group setting, presenting key ideas and providing guidance for an activity, which includes follow up tasks for the students to complete on their own. Some Montessori classrooms use a work plan to help students plan their time. The work plan lists the follow-up work for each student, which is due within two weeks of the lesson. As students complete an activity, called “a work” in my classroom, they take it to a teacher who initials on the other side of the work plan, which contains a table organized by subject and day of the week. Using this side of the work plan, students can see what they have accomplished for the week while also monitoring their upcoming due dates.
This study took place at a small, private school located in a suburb of San Francisco, California. The school enrolls approximately 75 students from the ages of 2 to 12 years-old. There is one classroom for each developmental age group, from early childhood to upper elementary.

The lower elementary classroom consists of four connected rooms, one of which is used for teacher desks and filing space. The other three are joined in an open concept style, allowing students to move freely between them. One of the three rooms was added after the house was built and thus has windows that divide it from the other two. In addition, the classroom houses a full kitchen that is used for group cooking projects throughout the school year. Students may choose which room they would like to work in and if they would like to work at a table or on the floor with either a lap-table or a rug.

The lower elementary classroom has 26 six-to-nine-year-olds with two Montessori credentialed teachers and an aide. There is an equal number of male and female students. There are six third-year students, nine second-year students, and eleven first-year students.

As I observed my students make a choice about what they would like to work on, I began noticing a trend. Students would take out a work, lay it out carefully across their rug, a process that could take up to ten minutes, and then, with a sigh, put it all back in the basket and return it to the shelf, without completing the assignment. This occurred with both tasks from their work plan and when they had free choice in the classroom. Sometimes students spent their whole three-hour work period flitting from work to work, like indecisive little birds, choosing something and then returning it to the
shelf before completion. I began to wonder why students did not persist in their work and wondered if there was a skill they were missing when it came to facing challenges.

Enter growth mindset: an educational practice where students learn how to make their brain work for them. Growth mindset teachings include lessons on the science of the brain, learning to think of the brain as a muscle, and how to change negative self-talk.

After reading several articles from studies in corporate environments and traditional classrooms, I began to wonder if a practice of growth mindset could help students overcome their frustrations and lessen the occurrence of incomplete works being returned to the shelf.

**Review of the Literature**

Researchers have studied growth mindset primarily in mainstream school settings or work environments. There is little research on the use of growth mindset strategies in Montessori schools. A Montessori classroom differs significantly from a traditional school setting. In a Montessori classroom, students decide the order in which they complete tasks, unlike a traditional classroom where all students work on the same subject at the same time. Using a work-plan sheet, Montessori students learn to prioritize assignments based on interest, time needed to complete a task, or level of difficulty.

Therefore, there are many influences on the way students make a choice within the Montessori classroom. When students decide they no longer want to work on a task, they may put it away. Many Montessorians observe that putting away an incomplete work interrupts students’ work cycle, causing them to be less effective during the work period. Students may put away work prematurely or before completing it because it is too
challenging, it has become boring, a peer has invited the child to participate in a more engaging activity, or the almost finished product does not look how the child imagined.

In order to persist in the completion of self-selected work, students need grit. Duckworth (2013) defines grit as the passion, perseverance, and stamina to achieve long-term goals. Learning about growth mindset has been identified as the best way to develop grit (Duckworth, 2013; Laursen, 2015). Prior research focusing on growth mindset has found that teaching students about how the brain adapts to challenges helps them persevere (Hochanadel & Finamore, 2015). Additionally, researchers found that student mindset can be changed from a fixed to a growth mindset: “Dweck and others have shown that with the right kind of intervention, students can be switched from a fixed mindset to a growth mindset, and their academic results tend to rise as a result” (Tough, 2012, p. 97). Dweck (2008) explains that learning about the differences between growth and fixed mindsets can cause big shifts in a person’s thought process. One of the important components of teaching a growth mindset is discussing how the brain creates connections based on prior knowledge (Hochanadel & Finamore, 2015). Dweck (2008) focuses in her workshops on how the brain grows when it is challenged and repeats an activity: “When you learn new things, these tiny connections in the brain actually multiply and get stronger. The more you challenge your mind to learn, the more your brain cells grow” (Dweck, 2008, p. 219). Once students have developed a growth mindset, researchers have found they have greater achievement and effort in school (Schmidt, Shumow, & Kackar-Cam, 2015).
This study seeks to determine if the implementation of lessons in growth mindset in a Montessori classroom improve engagement and thus positively affect elementary students’ practice of completing a work before returning it to the shelf.

**Lessons in growth mindset and the development of grit**

The central premise behind growth mindset is that when students learn how their brain works, they can develop a mindset where they can see mistakes as being a part of the process, rather than expecting perfection on the first try. Schmidt, Shumow and Kackar-Cam (2015) studied two teachers as they applied the principles of growth mindset to their seventh-grade science students through the use of a program called Brainology. Dweck developed Brainology, an online tool that teaches students about the way their brain works, through her research on growth mindset at Stanford (Dweck, 2009). The classroom study measured students’ belief in the malleability of intelligence, mastery of goals, and grades in the class. After the intervention, all students who participated in the Brainology program had developed a stronger belief in their ability to increase their intelligence (Schmidt, Shumow, & Kackar-Cam, 2015). These results are consistent with Dweck’s findings when teaching young students strategies to help them persevere in the face of challenges (Hochanadel & Finamore, 2015). Additionally, students who showed a greater application of growth mindset concepts put more effort towards their academics and had more significant achievement than their fixed mindset peers (Schmidt, Shumow, & Kackar-Cam, 2015). Some researchers question the ability to increase one’s intelligence, but Tough (2012) found one’s beliefs overrule that doubt: “Regardless of the facts on the malleability of intelligence, students do much better academically if they believe intelligence is malleable” (Tough, 2012, p. 97). Furthermore, Dweck and other
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Researchers have proved the aforementioned intervention can shift students from a fixed mindset to a growth mindset (Tough, 2012).

Students develop their mindset through interactions with the adult role models in their lives. Through her research with children, Dweck (2008) found that the development of a fixed or growth mindset begins at birth. The messages that parents, teachers, and coaches give about success substantially influence how mindset develops. Her investigation revealed that when adults praise children for their intelligence or natural ability, they become afraid to make errors and identify mistakes as a sign of failure. However, when effort is praised children embrace challenges and develop grit (Dweck, 2008). Therefore, teachers who praise for effort are more apt to inspire growth mindsets, but those who commend intelligence are likely to encourage fixed mindset (Schmidt, Shumow, & Kackar-Cam, 2015; Hochanadel & Finamore, 2015; Dweck, 2014). Laursen (2015) referenced a survey of students from kindergarten to fourth grade in his research which found 100% of kindergarteners believed they could increase their intelligence through learning. By fourth grade, only 58% believed intelligence was malleable (Laursen, 2015). Laursen (2015) draws the conclusion that traditional education stamps out curiosity for learning in almost half of students before finishing elementary school. Schmidt, Shumow, and Kackar-Cam (2015) showed that students whose teacher promoted growth mindset on two occasions per class displayed greater gains in goal mastery, higher grades, and a superior perception of the malleability of intelligence, compared to the students whose teacher discussed growth mindset only once per class. Additionally, the students in the former group showed less regression in their
use of growth mindset strategies between the post-test and follow-up period (Schmidt, Shumow, & Kackar-Cam, 2015).

Grit is developed through the use of a growth mindset. Duckworth (2013) called the passion and perseverance necessary to attain long-term goals "grit." Through her research involving cadets at West Point, Duckworth found that grit plays a greater role in success than other factors such as IQ, family income, standardized achievement test scores, and school safety (Duckworth, 2013). Duckworth (2013) identifies growth mindset as the best way to develop grit.

Yeager et al. (2016) worked to develop better materials for growth mindset intervention to be used by high school freshmen and then evaluated the students’ willingness to face a challenge, beliefs about fixed traits, and academic goals for the remainder of the school year. Within a second piece of the study, they asked students to make a math worksheet, choosing between easy or challenging problems. If students had extra time after creating it, they were invited to try to complete their own worksheet. Students who were identified to have a fixed mindset were more likely to fill their worksheet with easy problems, lacking any challenging problems (Yeager, et al., 2016). The opposite was true of students with a growth mindset, demonstrating that students with a growth mindset were more willing to face challenges (Yeager, et al., 2016).

West, et al. (2016) studied eighth-grade students within Boston's public and charter schools. They looked at four social and emotional skills – conscientiousness, self-control, grit, and growth mindset- and compared those levels with student performance in Math and English Language Arts (ELA), days absent, and days suspended. The study found students who possessed strong social and emotional skills,
such as growth mindset and grit, showed enhanced test scores in both Math and English Language Arts. Additionally, those same students are less likely to be absent or suspended from school. The study identified social-emotional skills as a practical support for academic success, with additional long-term benefits that could persist into the student's adulthood.

**Choice in Montessori and the proximal zone of development**

To understand this research, it is imperative one has an understanding of the Montessori classroom. In her study, Stairs-Vaughn (2002) visited three Montessori classrooms for intensive observations to study empowerment in a Montessori setting. She observed students within a lower elementary classroom using a to-do list to empower them to choose an activity to work on (Stairs-Vaughn, 2002). When they finished the task, the students would approach a teacher and ask to be checked off. Students worked in pairs or individually and progressed at their pace, guided by the teacher's observations. As she watched, Stairs-Vaughn (2002) noticed that students were responsible for choosing their break times. Additionally, students experienced logical consequences: if they mismanaged their time, they would spend their recess making up the work on which they were behind.

Greene (2005) wrote of her son’s lessened inspiration to learn within a traditional school environment and in turn touched on some important foundations of Montessori education. She explained that the classroom environment allows children to have freedom of choice within an intentional structure resulting in a lifelong joy of learning. Additionally, she expressed the critical nature of the guide's understanding of each child to spark the imagination and awaken a thirst for knowledge.
Kirby (2003) presented the disparity among Montessori guides as to whether they believed students should receive a presentation before attempting a work or if they should be able to pick whichever work draws their interest. The guide who insists on the presentation first does so because she wants students to be independent and thrive when they do a work, which is more likely when the guide leads the child in the process initially (Kirby, 2003). The guide who does not insist on a presentation often does so to support the child's sense of independent exploration of the classroom materials, sparking the child’s curiosity and fostering a love for learning (Kirby, 2003). Whether the guide insists on a presentation first or not, Kirby (2003) explains that the most important trait a Montessori guide can have is the skill of observation and waiting until she is sure the child needs some aid before stepping in to assist. This results in independence of choice as well as fostering a sense of grit, or persistence, within the child.

Clapper (2015) compiled research on Vygotsky’s zone of proximal development and working in a cooperative learning environment. He identified the zone of proximal development as the differentiation between what students can accomplish on their own and what a student can learn under the guidance of others (Clapper, 2015). When students are overwhelmed with a challenge, it causes learning to reach a state of disequilibrium, which leads to frustration, distractibility, and discouragement. Some students view the guide’s help as a sign of intellectual inadequacy and become defensive or disheartened. Learning from their peers allows students to take risks without the fear of disappointing the guide. Within the cooperative learning environment, students’ peers can help them move from a state of disequilibrium to a state of learning which allows the learner to
grasp new information (Clapper, 2015). These opportunities of reciprocal teaching are plentiful in the Montessori classroom.

**Influences on choice**

As choice is a critical aspect of the Montessori classroom, it is key to understand the influences of various stimuli on student choice. Montessori describes: "Free choice is the highest of all mental processes…. It is not possible to speak of free choice when all kinds of external stimuli attract a child at the same time and, having no will-power, he responds to every call, passing restlessly from one thing to another" (Montessori, 1995, p. 265). A morning in a Montessori classroom might look something like the following: A small group of students is recalling what they learned last week about anemones as the guide starts her lesson on parts of the cnidarian. One student is quietly observing, while two others walk by discussing the latest idea for their story, on their way to their table. Three students are arguing about if they should write their names in cursive or print as they sign up for snack. Students within a Montessori classroom must learn to manage various stimuli in order to choose and remain engaged with a work.

Knogler, Harackiewicz, M., Gegenfurtner, & Lewalter (2015) asked ninth and tenth-grade students to take a survey after each of six modules, indicating their interest in a topic. They identified two patterns of interest—catch, where a subject grasped student attention and elicited a positive reaction, or hold, where an issue was personally relevant and prompted the student to pursue further research (Knogler, Harackiewicz, M., Gegenfurtner, & Lewalter, 2015). They found that the same situation could stimulate interest differently in various students based on interest and previous knowledge or experiences (Knogler, Harackiewicz, M., Gegenfurtner, & Lewalter, 2015). Similarly,
when giving college undergraduates a follow-up assignment, Flowerday and Schraw (2003) found that students who had a choice whether to complete an essay or crossword were more likely to decide based on interest. Furthermore, those who had low interest in their task were more likely to switch to a new activity (Flowerday & Schraw, 2003).

Hennefield and Markson (2016) tested social influence on choice in a study involving 48 four-year-old children. Each child was presented two boxes, with a third box nearby. The experimenter looked inside the two boxes and chose a box. She described it as the better of the two. Afterward, the experimenter placed a third, neutral box with the unchosen option, and the child was asked to pick between the two. Hennefield and Markson (2016) found that the children were more likely to choose the neutral option than the option that the experimenter had rejected, therefore devaluing the unchosen option. Their work also suggested that the children trusted the experimenter as a good source of information, as they incorporated her opinion into their decisions (Hennefield & Markson, 2016). Similarly, students may include the views of their peers as they make decisions in the classroom, resulting in the avoidance of certain tasks because they are unfavorable to a student’s peers.

Katz and Assor (2006) found that students need three main attributes to a task to stay intrinsically motivated to complete it. First, students need to understand why the work is important and how it is relevant to them. Second, students need to feel comfortable in their skillset when attempting to complete the task. Third, students need to be a part of a culture that encourages choice, rather than letting others choose for them. Additionally, Katz and Assor (2006) found that undergraduate students who had action choices – how to distribute their time – felt a stronger sense of freedom of choice than
those who were given option choices – deciding which task to accomplish or not. Similarly, Dibley and Lim (1999) gave students a choice of when to perform a task and which listed obligation to do first. They found that choice, even one given within limits, lessened resistance to an activity and increased participation (Dibley & Lim, 1999).

The Montessori classroom’s foundation lies within student choice; students may choose to pursue their interest or personal connection to an activity. Peer opinion may also sway their choosing. Once they choose a work, students are observed to have a lack of perseverance in completing a challenging work. This could be due to the various stimuli they process in the classroom or it could be due to a lack of grit. Growth mindset is shown to teach students grit, strengthening their persistence in the face of challenges. Thus, this research endeavors to determine if the implementation of lessons in growth mindset will improve engagement and thus positively affect elementary students’ practice of completing a work before returning it to the shelf.
Methodology

The data tools used in this research included an assessment of student grit, student interviews, a tally of incomplete work cycles, and work samples. Each of the tools was used before and after the intervention and the results were compared.

Pre-intervention data collection

The grit scale (Appendix A) is used to measure the persistence of individuals, also called grit. I wanted to assess students’ likelihood to persist before and after receiving lessons about growth mindset in order to measure if there was a change in their grit. It was prepared by placing a number corresponding to each student at the top of the packet so that I could identify students but they would not be able to identify each other’s work. The class was divided into two groups at random and invited to complete the grit scale. I explained that there were no right or wrong answers, I just wanted to know how they think. I read each statement aloud and clarified any words the group did not understand. In instances where they did not understand the entire statement, as exhibited by a student saying “I don’t understand,” I restated the information and then reconfirmed that the group understood. Students decided if they agreed, disagreed, or were neutral towards each statement. Two students got confused with the numbering so they stayed behind after the rest of the group finished. I reread the questions in order for them to complete their assessments. One student was absent the day of the assessment. I worked with her one-on-one to complete the grit scale the day she returned to school.

Students were interviewed one-on-one (Appendix B) about their thoughts on incomplete work and reasons they may return work to the shelf. I explained that there were no right or wrong answers, I just wanted to know how they think. Additionally, they
were asked about strategies they use in order to complete a challenging work. Students were initially posed an open-ended question, followed by a more precise question if they needed more guidance. One student, whose first language is Spanish, needed translation of the questions in order to respond. The interview process took three sessions to complete with all 26 students, due to absences.

I took ten minutes each hour for the first two weeks during the daily three-hour work period to observe and tally how often individual students returned incomplete work to the shelf. Tallies were organized by subject (language, math, and cultural) and a different colored pencil was used each hour (see Appendix C). When students returned an incomplete work to the shelf, I noted their assigned number, the subject area, and which of the three hours the event occurred.

Five students were selected at random by picking sticks with student names on them. A work was selected for each of the five children from the turn-in basket, where works are placed upon completion. Students met with me one-on-one to assess their work (Appendix D). I explained that there were no right or wrong answers, I just wanted to know how they think. I read each statement aloud and the students decided if they agreed, disagreed, or were neutral. After the students assessed their work, I completed a rubric with the same assessment guidelines for their work (Appendix E).

**Growth mindset lessons**

Students were given four lessons about growth mindset after the pre-intervention data was collected. For the first lesson on growth mindset, I read the book *Your Fantastic Elastic Brain: Stretch it, Shape it* (Deak & Ackerley, 2010) to the whole class. The book describes basic anatomy of the brain as well as how the brain creates connections
between neurons when a skill is practiced. Students then worked on a worksheet (Appendix F) that displayed the increase in neuron connection strength as students practice. They used thread, twine, yarn, and rope to show a strengthening connection as students practice a skill. The worksheet also explained this process under the picture of each brain. After connecting the neurons with the various strings, I asked students to tell me what they learned from the lesson.

The next lesson in growth mindset included a game based on a favorite classroom work. Students within my class enjoy writing reports about animals that leave out the name of the animal. They call these reports a “Who Am I?” and love sharing them with their peers so that they can guess the animal. In this style, I took celebrities that the students are familiar with and described them by their failures. While half of the class was at physical education, the remaining students broke into pairs to compete with each other and try to figure out who was the celebrity. I read them the description of the failures and allowed them to consult with their partner. Then we went around in a circle to hear whom each pair had chosen. Points were awarded for the pairs that had the correct answer. After thirty minutes, the group at P.E. came back to class and received the same lesson, while the former group went to P.E.

The third lesson students had on growth mindset came in the form of their weekly journal assignment. Students were asked “What are three things you are good at? What is something you are not good at yet?” Before beginning the first work period on Monday, I lead a discussion with the class about how “yet” can be added to a statement. Students noticed that using “yet” meant that they were still practicing that skill. Students wrote their journal entries after the discussion.
The final lesson on growth mindset discussed changing the way students talk to themselves about their failures. I began by writing five statements on the chalkboard that I had heard students make when they were frustrated in the classroom. While half of the class was at P.E., the remaining students and I brainstormed some other ways that students could talk to themselves instead of what I had heard. Together, we created a list reframing the challenge in an encouraging way. Students then worked on a cut and paste worksheet (Appendix G) to choose different ways to frame negative self-talk. After completing the exercise, I asked students which method was their favorite and which method they may use next time they were feeling frustrated. After thirty minutes, the group at P.E. came back to class and received the same lesson, while the former group went to P.E.

In addition to the four formal lessons, I had continuous conversations with students when I heard them becoming frustrated with their work. These conversations included what they could say instead of criticizing themselves and how practice could help strengthen their brain in order to get better at the challenge they were facing.

**Post-intervention data collection**

After four weeks of lessons in growth mindset, the class was divided into two groups at random and I invited them to complete the grit scale. I once again explained that there were no right or wrong answers, I just wanted to know how they think. I read each statement aloud and clarified any words the group did not understand. In instances where they did not understand the entire statement, as exhibited by a student saying “I don’t understand,” I restated the information and then reconfirmed that the group
understood. Students decided if they agreed, disagreed, or were neutral towards the statement.

Students were interviewed one-on-one about their thoughts on incomplete work and reasons they may return a work to the shelf. I explained that there were no right or wrong answers, I just wanted to know how they think. Additionally, they were asked about strategies they use in order to complete a challenging work and how they feel once they have completed a challenge. Students were initially posed an open-ended question, followed by a more precise question if they needed more guidance.

During the last two weeks of the study, I took ten minutes each hour during the daily three-hour work period to observe and tally how often individual students returned incomplete work to the shelf. When a student returned an incomplete work to the shelf, I noted their assigned number, the subject area, and which of the three hours the event occurred.

For a second time, a work was selected for each of the five children from the turn in basket, where works are placed upon completion. Students met with me one-on-one to assess their work. I explained that there were no right or wrong answers, I just wanted to know how they think. I read each statement aloud and the student decided if they agreed, disagreed, or were neutral. After the student assessed their work, I completed a rubric with the same assessment guidelines for their work.
Data Analysis

The data shows that students’ grit increased after receiving growth mindset lessons and the number of incomplete works decreased. There was no indication that increased grit improved work quality.

Grit scale

Students’ answers on the grit scale were given a numerical value: 3 indicating a response that corresponds to a high amount of grit, 2 indicating a medial amount, and 1 indicating a low amount of grit. All twelve answers were added and averaged to create their grit score. The scores of all 27 students were inputted to find the mean, median, and mode. On average students scored a 2.28 before intervention.

After establishing baseline data, students received four lessons about growth mindset: how the brain works, famous failures, the power of yet, and positive self-talk. The first lesson focused on how neurons create connections as they are exposed to new information. The second examined well-known celebrities and the setbacks they experienced prior to their success. The third was a journal assignment about what students were not able to do yet but would like to practice more. The final lesson examined ways students could change their self-talk in order to promote their own growth mindset. After participating in lessons about growth mindset, on average students increased their grit score to 2.35 (see Figure 1).
Students showed an average increase in their grit score of 0.07 and a mode increase of 0.08 (see Figure 2). This indicates an increase in persistence when faced with a challenging work. Students began to stay with their work for longer periods of time and I would hear them using some of the language we had discussed during the lesson on positive self-talk. I think that learning about the brain’s need for repetition of challenging concepts helped students understand why our classroom expectations include practicing a work more than once. One parent shared with me that her first grader went home and was explaining to her baby brother, who is about six months old, that he was making new connections in his brain. She would name an animal in a book and then say “Pop! You just made a new connection!” Students took home the lessons that I gave in class and applied them to other areas of their lives, allowing them to understand the importance of the information the lessons presented.

Figure 1. Mean, median, mode grit score
When looking at the class as a whole, 62% of students increased their grit score, with 11% showing no change (see Figure 3). The students whose score decreased regularly displayed low self-esteem in their academic mindset by habitually asking for teacher approval of their work. It is possible that the students with low self-esteem were more concerned with answering the assessment items of the Grit Scale in a way that would please me, rather than answering them accurately about their own behavior. Lessons in growth mindset positively affected the way most students perceived themselves and their persistence in the face of challenge.
Interviews

During the one-on-one interviews prior to the intervention, students expressed the importance of finishing a work before returning it to the shelf. Several students expressed that they would lose their progress if they returned it to the shelf before completing it, and thus had to restart the work, making it take twice as much time. Another student conveyed worry that she would get in trouble if she put away an incomplete work. This worry was reasonable, as one of the teachers in the classroom had previously told students that they needed to complete what they started, rather than putting a work away. Through observations, I noted that it was the same few students who regularly returned an incomplete work to the shelf.

After working with growth mindset, more students identified that putting an incomplete work away was a behavior in which they did not engage by stating, “I don’t do that.” Students’ growth in persistence lead to them identifying incomplete work cycles as something that hindered their accomplishments in the classroom.
In both pre- and post-intervention interviews, students articulated how emotions influenced the completion of a challenging work. Students said they experienced feelings of happiness, pride, and even relief when they completed a challenging work that they had pushed themselves to finish. I believe that recognizing the feelings of pushing through a challenge and being proud of their accomplishments encouraged students to persist when they encountered unexpected challenges.

Figure 4. Challenges faced by students who put away an incomplete work

During interviews, students expressed the challenges they most often faced when working (see Figure 4). Prior to lessons in growth mindset, students identified a lack of interest in their own work, the large time commitment for a work, and interest in a work besides their own as the three greatest challenges they face in the classroom. After the intervention, there was a 40% decrease in the number of students who identified the time commitment or interest in a peer’s work as dissuading them from their work. Both of these situations require students to exercise persistence in completing their work, even though they would prefer to do something else. The increase in average grit score and
decrease in students identifying these two challenges during interviews indicates that as students’ persistence rises, they are more likely to stay with their work through completion.

**Tally of incomplete work**

Before receiving lessons in growth mindset, students put away works before completion from each of the three subject areas in the classroom. This occurred most often in math, which could be related to math having a right or wrong answer and the added pressure students feel to get it right. Additionally, math lessons using the Montessori materials often take longer than other works in the classroom. After lessons in growth mindset, students showed an 80% decrease in likelihood to put away a math work before completion (see Figures 5 and 6). Additionally, there was a decrease in students putting away language and cultural works, as zero students put them away during the post assessment (see Figure 6).

![Mean, Median, Mode of Incomplete Works by Subject Area Pre-Assessment](image)

*Figure 5. Mean, median, mode of incomplete works by subject area pre-assessment*
Work samples

Five students were selected at random from the class in order to compare their work before the lessons in growth mindset and after. I selected a recently completed work for each student and worked to review it with the student in a one-on-one setting. The students and I rated their work the same - pre- and post-lessons on growth mindset (see Table 1). The scores indicate there is little or no connection between lessons on growth mindset and improvement in the quality of student work. The exception to no change in the data is Student 7’s teacher assessment post-intervention. The student’s illustrations were small and rushed looking, dropping the score a point.

Figure 6. Mean, median, mode of incomplete works by subject area post-assessment
I was disappointed that there was not a correlation between lessons in growth mindset and improvement in the quality of student work. I am always looking for a way to get my students to slow down and do their best work so I was hoping these lessons would help accomplish that goal. My hypothesis was that students who rush through their work did so because producing their best work was a challenge for them. Unfortunately, the students who take extra care to do their work continued to do so and those who rush to finish raced on.
Action Plan

This study shows that Montessori students who engaged in lessons about growth mindset demonstrated a greater level of persistence. These lessons included information on how neurons strengthen their connections through repetitive action, how celebrities faced failures prior to their successes, how to use “yet” when talking about a skill set students are still acquiring, and how to change negative self-talk to encouraging, growth mindset statements. I was disappointed to find that student work quality had not changed. I am constantly looking for a way to help students understand the importance of beautiful work and was hoping that lessons in growth mindset might help that. Unfortunately, there was no change so I will have to keep looking for a different intervention.

I was pleasantly surprised by the decrease in incomplete work cycles; I did not feel as if I had seen much change in the classroom but once I began collecting the post-intervention data, I could see that there had been growth. As students increased their persistence through these lessons, their likelihood to put a work away before completion diminished. It is important students are able to push through challenges so that they are able to accomplish goals they set for themselves, in addition to those that are set for them in a work environment.

Persisting when facing a challenge is a life skill. The younger students are when they form this habit, the more it will serve them as they grow. By teaching growth mindset to first, second, and third graders, students have years of opportunity to practice persisting and increasing their grit. I hope this will translate into a lifetime of excitement when facing challenges, rather than a fear of failure, leading to risk takers who ultimately change the world we are living in.
My hope for this research is that it inspires more Montessori teachers to use growth mindset lessons in their classroom. I noticed that prior to my action research I was already discussing some of the concepts from the lessons, but using illustrations and planned class discussions strengthened the concepts for students in my class. I plan to include lessons in growth mindset with all my students each school year. I have a week at the beginning of the school year for classroom introductions and believe that growth mindset lessons would fit in well with the other content. Continuing work could be carried out through the rest of the year, such as encouraging positive self-talk or discussing the importance of repeating an activity to strengthen the brain. By giving these lessons at the beginning of the school year, I would be creating a classroom-wide set of strategies students can use when they need to repeat a work or face a challenge.

My own mindset has had to change in the process of teaching lessons on growth mindset. I realized as I was doing my research that I tend to have a fixed mindset, and am quite critical of myself when I make mistakes. I believe acknowledging my mindset allows me to work towards changing it so that I can create a classroom environment where mistakes are a part of the process, instead of an error to be criticized.

I talked with my students about my own mindset during my lessons. They were shocked to hear that an adult would have to work on the strategies I was teaching them. I think one of the best ways to teach students is to show personal vulnerability because then they see that people they admire are working towards self-improvement as well. I hope that I can continue to share my own progress with my students as we grow our mindsets together.
I would love to see this research done over a longer time table. It is hard to measure a change in mindset in only six weeks. I would like to see the results spread out over an entire school year and believe that would indicate many more important reasons growth mindset should be taught in schools. It would be interesting to look at the data throughout the time students have spent in my classroom. Since Montessori classrooms have mixed-age groupings, I teach most of my students for three years. I would like to see students’ growth from when they enter my classroom as a first grader until they leave as a third grader. I would also like to see what my students would teach other students at the school about what they have learned during their lessons on growth mindset. Since Montessori education focuses on reciprocal teaching, I would love to see what big concepts they would share with their peers.

I hope that the findings of this research help Montessori teachers mold students who happily take on challenges without the fear of mistakes. I can only imagine the brilliant thinking that will occur by future generations if they are unafraid to fail.
References


Please respond to the following 12 items.

Be honest – there are no right or wrong answers!

1. I have pushed through problems to master an important challenge.

2. New ideas and projects sometimes distract me from previous ones. *

3. My interests change from month to month. *

4. Difficulties don’t discourage me.
5. I have been unable to stop thinking about a certain idea or project for a short time but later lost interest. *

6. I am a hard worker.

7. I often set a goal but later choose to work on a different one. *

8. I have a hard time focusing on projects that take more than a few minutes to complete. *

9. I finish whatever I begin.
10. I have achieved a goal that took days of work.

11. I become very interested in new interests every few months. *

12. I am careful and thorough in my work.
Appendix B

Student Number:_________ Date___________________

- **Tell me about putting a work back on the shelf before it’s finished.**

- **Why might you put a work back on the shelf before finishing?**
  - ☐ bored
  - ☐ it took too long
  - ☐ friend’s work is more interesting
  - ☐ didn’t understand what to do
  - ☐ couldn’t focus
  - ☐ writing/drawings wouldn’t come out right
  - ☐ other (explain below)

- **Tell me about finishing a work you wanted to put back but didn’t.**

- **What strategies do you use to complete a work?**
  - ☐ chunking it into steps
  - ☐ taking a snack break
  - ☐ working on something else and coming back later
  - ☐ identify what isn’t working and change it (too much noise, sitting by a friend)
  - ☐ positive self-talk
  - ☐ other (explain below)
### Appendix C

<table>
<thead>
<tr>
<th>Incomplete Work Cycle</th>
<th>Language</th>
<th>Math</th>
<th>Cultural</th>
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<td>Student 27</td>
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<table>
<thead>
<tr>
<th>First Hour</th>
<th>Second Hour</th>
<th>Third Hour</th>
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</thead>
</table>

### Appendix D

**Student Work Self Evaluation**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Yes</th>
<th>No</th>
<th>Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>I used my best handwriting.</td>
<td>![Thumbs Up]</td>
<td>![Thumbs Down]</td>
<td>![Mixed]</td>
</tr>
<tr>
<td>My illustrations show care and effort.</td>
<td>![Thumbs Up]</td>
<td>![Thumbs Down]</td>
<td>![Mixed]</td>
</tr>
<tr>
<td>I included all the pieces of the assignment.</td>
<td>![Thumbs Up]</td>
<td>![Thumbs Down]</td>
<td>![Mixed]</td>
</tr>
<tr>
<td>My work shows a depth of understanding.</td>
<td>![Thumbs Up]</td>
<td>![Thumbs Down]</td>
<td>![Mixed]</td>
</tr>
</tbody>
</table>
### Student Work Rubric

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>2</th>
<th>1</th>
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</thead>
<tbody>
<tr>
<td><strong>Handwriting</strong></td>
<td>Handwriting shows attention to letter size, formation and spacing</td>
<td>Handwriting is legible</td>
<td>Unreadable work</td>
</tr>
<tr>
<td><strong>Illustrations</strong></td>
<td>Illustrations show great effort and care</td>
<td>Illustrations show some effort and care</td>
<td>Produces few illustrations or those that show little effort or care</td>
</tr>
<tr>
<td><strong>Completion</strong></td>
<td>Includes additions that are beyond the required elements of the assignment</td>
<td>Includes all required elements of the assignment</td>
<td>Needs reminders to include all required elements of the assignment</td>
</tr>
<tr>
<td><strong>Understanding</strong></td>
<td>Shows a deep understanding of content – has mastered the topic</td>
<td>Shows adequate understanding of the topic – more practice needed</td>
<td>Shows a lack of understanding of the topic – future lessons required</td>
</tr>
</tbody>
</table>
Appendix F

Growth Mindset: How Your Brain Works

When you learn something new, a pathway between neurons is created in your brain. Since it is a brand-new skill, the pathway is weak.

After you practice the skill a few times, the pathway between neurons starts to grow a bit stronger.

After you practice the skill many times, the pathway between neurons grows even stronger.

Once you practice the skill hundreds of times over many years, the pathway between neurons grows SUPER strong.
### Appendix G

**What can I say to myself?**

<table>
<thead>
<tr>
<th>Instead of…</th>
<th>Try thinking…</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is too hard.</td>
<td></td>
</tr>
<tr>
<td>She’s just smarter than I am.</td>
<td></td>
</tr>
<tr>
<td>I’m never going to get this.</td>
<td></td>
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<tr>
<td>I’ve never been good at this anyway.</td>
<td></td>
</tr>
<tr>
<td>I give up.</td>
<td></td>
</tr>
<tr>
<td>I can’t do hard works.</td>
<td></td>
</tr>
<tr>
<td>My brain is getting stronger as I practice.</td>
<td>This will be challenging but with effort I can do it.</td>
</tr>
<tr>
<td>I’m need to think about this more carefully.</td>
<td>I should try a different strategy.</td>
</tr>
<tr>
<td>I am working really hard at this.</td>
<td>I’m on the right track.</td>
</tr>
</tbody>
</table>