Implementing Growth Mindset Principles for Girls in STEM Elementary Classrooms Through the Creation of a Children's Book

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IMPLEMENTING GROWTH MINDSET PRINCIPLES FOR GIRLS IN STEM
ELEMENTARY CLASSROOMS THROUGH THE CREATION OF A
CHILDREN’S BOOK

by

JESSICA VAN WESTERING

A thesis submitted in partial fulfillment of the requirements for the Honors in the Major Program in Elementary Education in the College of Education and Human Performance and in The Burnett Honors College at the University of Central Florida Orlando, Florida

Summer Term, 2016

Thesis Chair: Dr. Rita Buchoff
ABSTRACT

With an emphasis on STEM education in schools, young girls begin to have an idea that math and science skills are based on one’s natural ability. A fixed mindset is the belief that one possesses an ability that comes naturally. Many girls, starting at the elementary level tend to interpret a lack of skill for being dumb, and therefore, give up on difficult subjects like math and science. On the other hand, a fluid theory of intelligence, or growth mindset is when a student values effort and understands that these “abilities” come from hard work and taking on new challenges. Students in a growth mindset see intelligence as something that can be developed overtime, while every learning opportunity, challenge, and failure is seen as an important step to becoming more knowledgeable. As a teacher, promoting a growth mindset in the classroom is key for student success; praising and encouraging students through the process of learning is more valuable then giving a grade for the final product. This thesis not only researched the differences between a growth versus fixed mindset, but also the value of fluid theories of intelligence, and the effects on elementary aged girls. This thesis includes a children’s book that promotes the idea of a growth mindset with a protagonist who learns to see the importance of persevering, working hard, and attaining success. With the picturebook intended for elementary aged students, its hope is to bring awareness to students and teachers that having a growth mindset mentality is important.
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CHAPTER ONE: INTRODUCTION

Our children’s schools are places of learning, growing, and facing challenges through the guidance of skilled teachers. With the right mindset, students are able to achieve brilliant tasks and reach unlimited goals. Theories of intelligence have been “shown to predict students’ academic achievement and engagement,” and based on whether students believe intelligence is fixed or malleable, depends on how students will face challenging subjects and assignments (Romero, 2014, p. 228). With a fixed mindset, a student will conclude that he or she has a predetermined amount of intelligence, skill, or talent (Ricci, 2013). Whereas, with a malleable mindset, or growth mindset, students believe that intelligence can be developed, and one can learn just about anything (Ricci, 2013). Especially in difficult subjects, such as math, students with a growth mindset “value learning, believe in effort, and show more resilient reactions to setbacks,” which “in turn predicts higher math grades” (Romero, 2014, p. 228). Considering, “adolescents often rate math as one of the most challenging courses,” educators should be aware of student beliefs and views, and encourage all students to work toward academic success (Romero, 2014, p.228).

It is important for teachers, school staff, and students to believe anyone can be successful, and that intelligence can grow as one uses it (Ricci, 2013). Along with that, girls seem to have a “greater sensitivity to setbacks,” and especially in subjects such as math and science, girls “don’t cope well with challenges” (Dweck, 2006, p. 3). Therefore, many girls end up viewing “intellectual ability as a gift,” and especially in math, girls often lose motivation when faced with challenges (Dweck, 2012; Dweck, 2006, p. 5). By creating a classroom that fosters a growth mindset, all students will benefit. Girls deserve, “interventions [that] need to be customized to
address the mindsets of students” (Yeager, 2012, p. 312). For these reasons, I have created a children’s book with a young girl as the protagonist, which explores the ideas of a growth and fixed mindset in a math classroom. With this story, I hope to encourage girls to succeed in math, and possibly even pursue math-related careers.

My original intent was to create a picturebook for elementary aged children. The reason I have picturebook as one work is because Wolfenbarger (2007) suggests that pictures and text should form a union that provide “visual and literary art” with both parts complementing each other (p. 273). The “connection of words and pictures” provides a unique reading experience for the reader, which is something I hoped to achieve in my picturebook (Wolfenbarger, 2007, p. 273).

This thesis will have two components: one part that is more traditional and includes a review of related research, and the second part is a more applied and creative product in the form of a children’s book. The first component of this thesis will review theoretical development of “growth” and “fixed” mindsets, as well as how to connect those ideas into the classroom, and evidence regarding how these mindsets influence student performance, particularly in math, in the elementary classroom (Dweck, 2010, p. 17). The second component of this thesis will apply this information to try to develop a quality children’s picturebook with themes surrounding growth mindsets.
CHAPTER TWO: REVIEW OF RELATED RESEARCH

This chapter provides and builds a rationale for creating a children’s book, in particular, a picturebook that addresses the importance of growth mindsets. The following subheadings guide the review of related research: Implicit theories of intelligence, Mindsets in the elementary classroom, Gender gap in STEM classrooms, An academic sense of belonging, and Essential elements of a quality picturebook.

Implicit Theories of Intelligence: Growth versus Fixed

With a fluid theory of intelligence, or a growth mindset, students are able to focus on the process, and “see intellectual ability as something that can be grown or developed over time” (Yeager, 2012, p. 306). As Yeager (2012) states, “many educational reform efforts have focused on increasing rigor in curricula and instruction, but if they do not also address resilience in the face of these more challenging standards, then making such improvements may be less effective than hoped” (p. 306). Therefore, creating a difficult curriculum without also adding “resilience,” or being able to achieve high goals even after failure, is not beneficial to a struggling student.

Mindsets in the Elementary Classroom

With a fixed mindset, students are stuck believing that they do not have an “ability” another student possesses in a certain subject; this can be detrimental to meeting that students’ learning potentials. Unlike a growth mindset, students with fixed mindsets see certain subjects as a gift, and perhaps a gift they do not possess, especially in math and science related subjects. Therefore, students should realize the importance of the learning process, and that intelligence
can evolve through hard work, while students can also contribute to the growth of their peers with active participation (Johnston, 2004). Students who possess implicit beliefs of intelligence as a fixed entity; that is, those who do not believe intelligence can be developed, may be more prone to give up in difficult subjects because failure is interpreted as a lack of a natural skill. However, students who possess fluid theories of intelligence, that is, who do believe intelligence can be developed, are able to move past these difficulties, with resilience, and succeed on a higher level. Through discussing and comparing both a growth and fixed mindset, teachers can understand that the mentality of their students affects one’s learning potential and learning goals; whereas, students are able to differentiate between passively going through school and actively being a part of the learning process, even through problematic courses.

With the lack of resilience being a fundamental part of failure, students who allow themselves to take risks, rather than focus on how smart they are or appear to be, possess a growth mindset (Dweck, 2009). Dweck (2010) suggests that a student with a growth mindset will remain involved, try new strategies, use all of one’s resources for learning, and approach academic work with excitement. Teachers should emphasize a growth mindset in their classrooms. High-achievers can continue to challenge themselves; whereas, students who start at a low academic level end up performing at the same level as those who started as high-achievers, and possibly even surpassing those students (Dweck, 2007). With a growth mindset, students begin to approach poor performances by dealing directly with their problems, these students are willing to work hard by taking on new challenges that expand one’s abilities (Dweck, 2007). Also, the most motivated students believe that an ability can be developed through effort and learning; therefore, making one’s efforts more valuable than the final outcome (Dweck, 2007).
Through a developmental process of shaping student goals, students become excited to learn; “the incremental world is about learning and growth…and everything is seen as being helpful to learn and grow” (Yeager, 2012, p. 303). Allowing students to “learn and grow” by emphasizing challenge, over success, will help one to recognize accomplishments through the process of working hard (Dweck, 2009). Although what is given to a student may pose a challenge, problem solving and persistence should be rewarded while the success of the final grade comes second to the development of the skill.

Many students seemingly get stuck in a fixed mindset when one believes that some have the ability to succeed in subjects, like math and science, and some do not have that ability. Dweck (2010) states, “students with a fixed mindset do not like effort…they tell us that when they work hard, they feel dumb;” which is common for students to start feeling during the upper elementary years (p. 17). Unfortunately, this can happen to all students, including those who are seen as high achievers; if one believes their academic abilities are “unchangeable,” students will struggle with feeling dumb, or being seen as dumb (Yeager, 2012, p. 302). Additionally, Yeager and Dweck (2012) suggest “the theory that intelligence is fixed…can lead students to interpret academic challenges as a sign that they may lack intelligence” (p. 302). Therefore, students remain in a mindset where they cannot imagine achieving certain academic objectives because of one’s ‘low intelligence’ due to a fixed view of learning. With desperate attempts to impress one’s peers or the teacher, students in a fixed mindset sometimes begin to consider cheating, lying about scores, and blaming others or outside factors to compensate for one’s lack of effort (Dweck, 2010). “Limited ability,” or poor performance on certain assignments, can cause students to feel as though they are incapable at mastering a subject; therefore, those students lose
interest in the effort that is put into their work (Dweck, 2007, p. 7). Students who feel that his or her abilities in certain subjects, especially math and science, are limited will stop fixing mistakes. With a fixed mindset, students start to feel threatened by challenging work and will no longer consider working on an intimidating assignment (Dweck, 2007). With the erroneous idea that knowledge should come naturally, a student who believes intelligence is fixed often continue facing setbacks and may never challenge one’s mind beyond their own perceived limited ability.

A growth mindset classroom should value the process of learning. Students should understand that their efforts through practicing different skills are valued more than a grade on a test, and should not focus on how smart a student is or appears to be (Dweck, 2009). In contrast to a growth mindset, students will “quickly withdraw their effort during the steps of learning if something seems to be difficult” (Dweck, 2010, p. 17). A student with an unchangeable perception of intelligence has usually given up on a certain subject and believes they do not possess the natural ability to understand that subject. Teachers who present a variety of strategies and learning styles to students in a fixed mindset will help those students to realize “intellectual ability is something that can be developed over time with effort, good strategies, and help from others” (Yeager, 2012, p. 303). Therefore, students become “more resilient when they encounter the rigorous learning opportunities presented to them” (Yeager, 2012, p. 306).

Overall, students in a growth mindset should continue to be challenged by the work that they do, considering “students’ minds grow when they stretch themselves” (Dweck, 2009, p. 61). Whereas, students with a fixed mindset need to be shown that the effort they put into assignments will intrinsically count greater than their final grade. By emphasizing effort and allowing students to persist and try his or her own way of learning, will provide a foundation for
students to feel a sense of belonging in an academic setting. Appendix C will provide further insight on growth versus fixed mindsets.

Implicit theories of intelligence influence children’s academic performance in the classroom, which is not only incompatible with the goal of educating, but also may have negative societal consequences in the long run. One of these repercussions that has recently received a great deal of attention is how implicit theories of fixed intelligence may contribute to the gender gap in STEM (science, technology engineering, and math) education. The following section provides related research in this area.

**Gender Gap in STEM Education**

STEM education trends show an increasing emphasis on the significant gender gap between men and women who shoot for and possess careers in science, technology, engineering, and math. According to the National Science Foundation, about 46% of all women were awarded doctorates in STEM-related fields (Beekman, 2015). In addition, nearly 29% of women earned a doctorate in the physical sciences, which included math (Beekman, 2015). Beekman (2015) suggests, “if one is to improve the career opportunities for females in math, engineering, and the physical sciences, the primary and secondary school pipelines for college-bound STEM students are worthy of careful study” (p. 35). With a steady increase during a nine-year period, Beekman (2015) concluded that an apparent gender gap exists during all grades in school. The largest gap of achievement occurs during third and tenth grade, which is when girls begin to have fixed views of certain subjects. Therefore, educational strategies that support and facilitate
STEM education with girls are needed across all grades, but especially elementary grades where the highest gaps are evident.

With boys reporting that they have a more positive outlook on STEM subjects, they tend to see science and math as relevant to their lives (Bamberger, 2014). Further, two to three times the amount of men graduate with a major in one of the STEM disciplines than women (Dubetz, 2013). Another issue contributes to the gender gap in women; O’Brien (2015) suggests “the most commonly studied form of social identity threat facing women in STEM-related fields is stereotype threat…when people encounter situations where they have the potential to confirm a negative stereotype about their group” (p. 669). Also, O’Brien (2015) suggests, “social identity threat can also interfere with the ability to perform difficult tasks,” leading women to “underperform” on tests or assignments that are seemingly difficult (p. 669). Therefore, to avoid being in a male-centered discipline, women opt out of STEM careers, while young girls feel like they do not belong in math and science related subjects (Good, 2012). Yeager (2012) suggests “a central task for parents and educators is to prepare students to respond resiliently when these inevitable challenges arise” (p. 312). Girls should be encouraged to pursue STEM careers even after difficulties, while young girls should be supported throughout school to endure the challenges math and science subjects present and celebrate the successes (Beekman, 2015).

With contributing factors to implicit theories of intelligence, gender gaps, and stereotype threat support the idea that girls can go through school with a negative outlook and a fixed mindset on STEM-related subjects. Therefore, this thesis took on the challenge of writing a picturebook that creates a positive image of a young girl pursuing math, despite the traditional idea that girls do not belong in those subjects. The hope is that this picturebook can show
children that “environments that support the idea of malleable ability may create opportunities…and commitment to learning in that domain” (Good, 2012, p. 702).

An Academic Sense of Belonging

Negative stereotypes not only prohibit performance in that academic discipline, but can also make particular groups feel “less valued or accepted…thus have a lower sense of belonging” (Good, 2012, p. 701). Despite high achievement, the idea that women do not belong in certain disciplines, such as math, is discouraging to a young girl who enjoys and wants to pursue a career in that field (Good, 2012). Along with gender stereotypes in academic areas, girls begin to have a “fixed view or find themselves in learning environments…they may question whether or not they have the requisite ability” (Good, 2012, p. 702). Therefore, girls tend to have an unchanged mindset when faced with one’s academic ability, especially in STEM-related subjects. Turner (2002) suggests that students use “avoidance strategies in mathematics,” especially young struggling students who are more worried about his or her “image of competence” than actually understanding the subject (p. 89). Thus, to have a sense of belonging requires students to feel comfortable enough to ask for academic support, while continuing to apply effort to one’s work. Especially when negative stereotypes are associated with girls in math and science related subjects, the emphasis is on “intellectual development” and girls are able to improve their academic success and are “less likely to feel threatened,” causing a sense of belonging and academic achievement (Turner, 2002, p. 89).

While Western societies often view math as a “talent, something that one is either born with or not,” many girls believe they are simply not born with the naturally ability, or “talent,”
that many boys seem to possess (Good, 2012, p. 701). With a “talent-driven approach” to math, especially when faced with challenges in math, student’s motivation decreases and can continue to decrease with setbacks. Therefore, girls see “the nature of intelligence as being a fixed trait,” due to low motivation levels, as a result of setbacks (Good, 2012, p. 701). Sungok, Cho, and Cassidy (2013) suggest “beliefs about the nature of intelligence…exert a significant impact on the learning process and learning outcomes,” which can influence achievement goals in students (p. 85). With teachers who believe intelligence is “inherent and predetermined” students will accept that their mindset cannot change. This can pose a challenge with students, especially girls in math and science, considering that girls can possibly go through school with an unchanged view of their academic abilities. An external factor which failure attributes to the “lack of success or failure to the difficulty of the task” or to “having bad luck,” is the basis for attribution theory in unsuccessful people (Ricci, 2013, p. 76). Incidentally girls may blame bad luck, level of difficulty, or an external locus of control to their lack of success. With a fixed perception of learning, learners likely will become stuck and believe failure is also due to an outside uncontrollable factor.

To overcome a fixed view of learning, “students who hold the mindset that ability is a malleable quality…are less focused on measuring and proving their abilities, and more focused on learning” (Good, 2012, p. 702). With the focus on the process of learning and on gaining the abilities through the development of skills, girls will find the math and science subjects easier to work through. Attribution theory also suggests that successful people attribute their success to effort, and with effort “students can demonstrate significant growth” (Ricci, 2013, p. 9; Heider, 1958). When faced with setbacks, girls need to remain strategic and effective; therefore,
academic performance can continue to increase with the right outlook on certain subjects (Good, 2012). To support a growth mindset, where girls are capable of mastering subjects such as math and science, Bamberger (2014) suggests, “positive images of women scientists and engineers can influence a female student’s commitment to a scientific career” (p. 551). According to Bamberger (2014), by displaying images of women who have succeeded in STEM-related careers, girls will therefore not be as affected by the predominant stereotype that women do not belong in science and math careers. In order to create a children’s picturebook, I have researched the necessary elements that a picturebook should contain.

**Essential Elements of a Picturebook**

The following elements are important to consider in the creation of any picturebook. Quality picturebooks should contain necessary elements to fit a student’s need and I have implemented this research into my own picturebook.

As defined by Wolfenbarger (2007), a “picturebook,” rather than picture book or picturebook “recognizes the union of text and art that results in something beyond what each form separately contributes;” therefore, the pictures and text in a picturebook should complement each other and both should provide unique insight into the story (p. 273). Wolfenbarger (2007) suggests that a picturebook should have “symmetry” between the text and illustrations; however, at the same time, the words and pictures should “tell different stories,” meaning that the illustrations and text should provide distinct qualities that further explains the plot (p. 274). Within a picturebook “the process by which the verbal text draws the reader’s attention to particular parts of the illustration,” and equally the pictures provide the text with “descriptions of
reading images” have been shown to improve a child’s literacy skills and understanding of a story (Wolfenbarger, 2007, p. 275). It is also important to note that picturebooks provide students with artistic representations of the story. Hellman (2003) suggests, “putting an emphasis on the artwork helps children learn that there are different ways of presenting information” (p.6). Picturebooks also provide children with images that are of “fine art qualities,” and should be as carefully examined as the text (Stewig, 1995, p. 1). When combined, the images and the text of a picturebook should create a “visual and literacy art form that engages young readers…in many levels of learning” (Wolfenbarger, 2007, p. 273).

Peritext

The peritext, or the “physical features and design elements” play an important role in the creation of a picturebook (Wolfenbarger, 2007, p. 274). Wolfenbarger (2007) suggests “in well-crafted picturebooks, the author, illustrator, and book designer work together to make the book’s opening pages and changing visual cues both engaging and suggestive for readers’ interpretations” (p. 274). With a reader’s focus first on the title page, the picture and the text of the title must be captivating, and in order to achieve attracting the reader to the story the text type may have “unusual shapes…and hold readers’ attention” (Stewig, 1995, p. 164). Unlike the text of the title, the font of the body of the book, Stewig (1995) suggests, should be “simpler…easy-to-read shapes that do not tire the eye” (p. 163). Front and back endpapers, or flypages can also add to the peritext of the story by containing visual cues that establish the setting or plot and set the tone of a story (Stewig, 1995). Whether simple or elaborate, the endpapers are design features that guide the story from beginning to end.
**White Space**

The use of white space in a picturebook represents the “complex relationships between space and time;” the spatial form of a picture, with a blank page surrounding an image (white space) creates a narrative through the lack of color or text (Moseley, 1988, p. 86). An example of white space can be seen in *Where The Wild Things Are*, where the images are “decreasing in the first half of the book and increasing in the second half” (Moseley, 1988, p. 87). Through Max’s imagination, the white space becomes increasingly smaller and at one point obsolete, until he has to find reality again, which is when the white space re-appears and is overwhelming on the final page (Moseley, 1988). In this story, the white space represents Max’s “mental space,” because although he is physically in his room, Max explores his imagination from inside his mind and “crosses over the line of realistic space and time into a dream world of fantasy” (Moseley, 1988, p. 89). White space can also take form within images to “enhance” and “create drama that reflects…the text” (Stewig, 1995, p. 100). The use of white space can create a hidden message within the story that helps to reveal the connection between time and space (Moseley, 1988).

**Gender Representation**

Dale (2016) suggests, “from an early age, children develop an understanding of gender…ideas about what it means to be a girl or a boy” (p. 185). The representation of gender in picturebooks shared with children should be balanced with male and female characters who breakdown stereotypical roles and who “shift toward gender equality” (Stewig, 1995, p. 27). Female and male protagonists should portray roles that realistically compare to today’s standards and encourage young readers to see that girls and boys can take part in the same activities. In the
creation of the picturebook, considerations of gender representation are important. Stewig (1995) found “picture books featured male characters far more often then was necessary to reflect their actual representation in life” (p. 27); therefore, representing females as influential characters, especially in math and science based texts that may interest those students and help them relate to that subject (Wolfenbarger, 2007).

This thesis made application of these important research findings and scholarly elements to attempt to create a children’s book that captures themes surrounding growth mindset and young girls. The following chapter, Chapter Three, includes information about the methods and process of creating a children’s book. Chapter Four provides the actual product that was created, while Chapter Five provides concluding thoughts and reflections concerning the process and the product.
CHAPTER THREE: METHODS

This chapter provides a narrative description of the process by which I created a children’s book entitled *My Third Grade Year*. Through the development of the storyline in this children’s book, I wrote the text of the book around the setting of a classroom that promotes a growth mindset and a teacher who praises and encourages all of the students. The story focuses on a third grade female protagonist in a math classroom that is unlike her previous math class. Rather, the teacher featured in this book creates lessons where students “tackle work with excitement” and involvement, and value the challenges that follow hard work (Dweck, 2010, p. 17). However, the young girl already has a fixed view of her math ability, but through the project-based, student-centered classroom with “meaningful tasks,” the girl is able to overcome the notion that math ability is more then just a gift, rather it is a skill that can be developed and perfected through working hard (Dweck, 2010, p. 18). The teacher in the story creates a classroom culture where praise is given and multiple strategies are used until the students are successful (Dweck, 2010). Along with recognizing personal goals and finding enjoyment and practicality in math, the young girl is able to see potential in her abilities, which follows with her love for math facilitated by her teacher.

**Attaining a Growth Mindset Through a Children’s Book**

Within this book, I have written about an influential character who shows a struggle in a math classroom, but who perseveres through the effort given to that academic subject. With the help of a heroic character, the teacher whom students admire and look up to for support, this book hopes to exemplify the development of growth mindsets in young children, specifically
second to third grade students. Although studies show interventions at the middle and high school level, teaching a growth mindset during the elementary years is crucial, so that interventions are not needed later in one’s school career. Therefore, students need to have adaptive mindsets during the younger years where the development of these ideas is crucial. This book will hopefully open up young students to a world of possibilities where no limit is placed on one’s intelligence or STEM career choices.

With this picturebook potentially influencing students’ natural beliefs of intelligence, by giving specific examples of achievement, overcoming obstacles with motivation, and resiliency to keep trying, students will view difficult subjects as something that can be attainable through encouragement, perseverance, and hard work. Meierdirk (2016) explains “a growth mindset can be encouraged if teachers move away from rote learning methods and allow pupils to ‘stand back’ and apply theory in creative ways” (p. 26). The story focuses on students learning math through innovative activities, which also encourages students to relate the math activities to their everyday lives. Therefore, students are able to give a purpose to his or her learning, where one can continue to improve and make reachable goals (Dweck, 2010).

In addition, this could possibly lead to having less of a gender gap, because girls become interested in pursuing STEM-related careers. By supporting girls through captivating literature to endure the challenges of math and science subjects, young females will ultimately succeed, while their mindset continues to grow. Having an influential story could potentially be useful stimuli for future researchers who may be interested in experimentally investigating lay beliefs in children. Through investigating theories of intelligence in children, researchers may want to explore interventions, such as this picturebook, further.
Creating a Plotline Containing Mathematical Content

Quality children’s books with embedded mathematical content; stories that contain mathematical language and concepts all while being entertaining, promote the importance of learning and developing math skills (Marston, 2014). Through an authentic narrative that relates to everyday situations, a story and its illustrations should easily integrate into real life problems (Marston, 2014). Along with that, Crisp (2011) suggests, “children's picture books provide images and models of who young readers can be now and what their lives can be like as adults” (p. 18). Therefore, in my children’s book, I have created a story where the protagonist discovers her abilities in math and can envision her future as someone who works in the math and science field as an adult.

Marston (2014) suggests that quality picturebooks “should be a stimulus for both the teacher and students for problem-solving” (p. 15). Stories that encourage “problem-solving” in a difficult subject are relatable to the struggles that students face, while also demonstrating the development of math skills. While picturebooks help to develop literacy, the pictures also provide “extra scaffolding” to “contextualize and introduce…relevant mathematics to our students” (Jenkins, 2010, p. 28). Not only does my children’s book encourage problem solving, but it also shows personal growth and development of a skill that took time and effort to master. The protagonist is also inspired to continue working on her math and science skills by having an activity that she can continuously work on, where she is able to gain knowledge and achieve personal success that motivates her further (Ricci, 2013).
Collaboration With Illustrator

As Wolfenbarger (2007) suggests, a “story depends on the interaction between written text and image;” therefore, during the process of creating the book, it was crucial for the illustrator (who is my dad!) and me to work together (p. 273). In truth, the process of him being able to express the story the way he interpreted the book, through illustrations, was important to me for the book to contain authentic images. However, for me, the pictures came second to the story, so rather the images complemented the text, while giving added interest through illustrations. When discussing the illustrations, I wanted certain pictures with specific paragraphs to enhance that part of the story, with drawings of interest that would excite the reader to continue reading. I also specifically asked for images of math symbols that would not make mathematical sense and that reflected a sense of confusion or a scared feeling in a young student. I wanted the un-interpretable images on the cover to try to evoke a child’s feelings of fear about math. Along with that, I would not only discuss my vision of what the pictures might look like, but I would also sketch my own pictures, and allow my dad to add or slightly change an image if he saw that it was necessary. The process of collaborating was fairly easy, and was exciting to watch the process of the images being drawn to meet the goal of being in a picturebook.
CHAPTER FOUR: RESULTING PRODUCT

*My Third Grade Year* is the original children’s book I wrote to promote a growth mindset in young girls by highlighting STEM subjects, the ability to persevere, work hard, and continue to learn through difficulty. Although the third grade protagonist has a fixed view of learning, she quickly breaks out of what she thinks she lacks, and she learns that her ability to master math is possible. The book is presented in the format of the traditional 32 page structure based on guidelines for submitting any picturebooks for possible publication.
Illustrated by: Peter Van Westering

Jessica Van Westering

MY THIRD GRADE YEAR
MY THIRD GRADE YEAR
My name is Ashley. Today is my first day of third grade and I can't wait!
orange hallway, and finally arrived at my new classroom. I walked into the school, passed the main office, through the glass doors that all of the students were running through. I Brooks Elementary. It was a huge building, with two enormous My mom pulled the car up and dropped me off right in front of
Right above the classroom door, and in pink letters that matched my brand new pink dress, read a sign that said...Mrs. Powers - Welcome to 3rd Grade.
Looking right at me.}

distracted by the addition sign with big brown eyes, which I promise, was
pictures, but they were pictures of math cartoons; I was completely
pictures, and some kids may think they are cute
pretty sight. There were pictures, and some kids may think they are cute
had its place. My eyes suddenly looked towards the board...it was not a
posters hung on the walls, desks were neatly organized, and every paper
baredly listened. My eyes wondered through the colorful classroom where
to explain the classroom rules. I was so excited to be in her class I could
After the bell rang and everyone had taken their seats, Mrs. Powers began
up very soon.

Read we would be doing math at 8:40 AM every morning, which was coming studies, specials, and reading. I kept re-reading the daunting schedule that the class schedule. It read: Bell Work, Math, Language Arts, Science, Social

After Mrs. Powers finished telling the class the rules, she started to review
CLASS SCHEDULE

1. Bell work
2. Math
3. Language arts
4. Lunch
5. Recess
6. Science/
7. Social Studies
8. Reading
be a breeze. So, I just gave up.

talent to do math like our classmate Jeremy, who found math to
match anymore. I guess Stacey and I just didn't have the natural
Therefore, I can't do math anymore. I don't even want to do
hard we worked, the teacher would look at it and say "Wrong.
all of the math worksheets we were given, but no matter how
it. My friend Stacey and I would sit in class and try our hardest on
experience with math in second grade... I just never understood
Math was my most dreaded subject. You see, I had a bad
Mrs. Powers walked up to my desk, knelt down, and asked, "Why do you need to be excused?"

"No," I stated.

"Mrs. Powers said, "Do you need to use the bathroom?"

"May I please be excused?"

When Mrs. Powers began the math lesson I raised my hand and said, "May
me, smiled and said, "This is a new year. Let's see how it goes." saying, "I just don't do math anymore." Mrs. Powers looked at Jeremy, who was always going to be better than me. I ended by so, I told her the story of when I was in second grade and how
measuring the length, width and depth of our books. We even tried to see how many books we could fit in our backpack by placing them next to the bean bag chair and even the tail of the classroom like the fish tank and the bean bag chair. We even tried to measure the weirdest things we could find in the classroom, like the named Kim. We made it into a game where we were trying to invent ahead and measured, and even partnered up. With another girl, “Why were we measuring different objects?” I thought to myself.

In our first lesson, Mrs. Powers had us measure different objects.
I went through the rest of the school day wondering what else could fit in my backpack?
I had so much fun during math that I couldn’t wait to go home and tell my mom all about it. Wait, having fun in math? It can’t be. I must be getting sick...
get through this year in math after all.
point. I felt unstoppable. I think I might
when she saw me working hard. At this
things like "keep up the good effort"
question. Mrs. Powers would also say
understood every single math
strategy should we try next?" until I
problem. Mrs. Powers would say, "What
ten. Even when I would get stuck on a
projects where I was actually having
after day she had different math
had another math assignment, and day
The next day at 8:40 sharp, Mrs. Powers
Rollercoaster! Can you imagine? I was doing math.

I looked at my mom and said, "I could have twelve friends on this row. I noticed it had four rows with three seats in each. We talked all about Mrs. Power's math class on the car ride there. As we went onto a rollercoaster, I noticed it had four rows with three seats in each. I was doing so well that my mom took Kim and me to a local theme park."
On Monday, Mrs. Powers had a special surprise for us; she brought in her friend who was a meteorologist. You know, the person who does the weather on TV? Well, it turns out she does more than just say whether it’s going to rain or not. She uses math to understand the atmosphere and calculates how to predict the weather.
we watched her use a thermometer and barometer.
figure out how the atmosphere works. She even brought us outside, and
environment, watches her weather instruments, and uses science to
scientist who wears a white lab coat. Instead, she observes the
She not only uses math, she uses science too, but she's not the kind of
meteorologist. Me? A meteorologist?

Clouds and even made a simple wind vane. I am starting to sound like a

From that point on, I started observing the weather every day. I watched the
looked at Kim and said, "Where is math?"

Science, Social Studies, Specials, and Reading. I frantically
the schedule in my head, it said: Bell Work, Language Arts,
couldn't cheer me on today. Then I looked at the board and read
posters were down. The addition sign with the big brown eyes
were all over the classroom, and weirdest of all, all the math
strange. The desks were out of place, it appeared that papers
were group today. As I walked into the classroom something seemed
play fun math games, and Kim and I would be in the same

Finally it was "math game Friday," Mrs. Powers always had us
in such a daze and couldn't even remember math anymore. Math is no longer needed in schools. After hearing this news, I was told us that math had been cancelled. Mrs. Powers overheard me and told us that math had been cancelled.
subtract how many more kids we needed for kickball during PE.

spelling words posted on the wall, and I definitely couldn’t
couldn’t tell time on the clock, I couldn’t multiply the rows of
no luck, and I couldn’t even read the numbers on the ruler. I
grabbed a ruler and tried measuring one of my books. Again,
I tried adding up all of my classmates, but I had no luck. Then I
studies.

is where I've been keeping all of my important meteorologist numbers I needed in the notebook Mirs. Powers gave me, which was really getting good at. I couldn't even write down the

Then I tried doing calculations to predict the weather, which I
school on Monday. I was too sick from not doing math.
doing spelling, reading, and writing. I couldn’t even go to
Saturday and Sunday trying to do math, but instead I was just
The day finally ended and I was miserable. I went through
was back to doing math again. Quickly, did the subtraction and found I would get $1.50 back. I
quickly did the subtraction and found I would get $1.50 back. I
my food I gave her a $5.00 bill. I know my lunch costs $3.50, so I
my food I gave her a $5.00 bill. I know my lunch costs $3.50, so I
rubbed my eyes, and as I approached the lunch lady to pay for
rubbed my eyes, and as I approached the lunch lady to pay for
surprised. I looked around and my class was lining up for lunch.
surprised. I looked around and my class was lining up for lunch.
All of a sudden, I felt someone shaking me, and I woke up so
my dream!

I realized I could never live in a world without math, not even in
I guess this math thing isn't as bad as I thought. One day I'll become a meteorologist, just so I can do math and science everyday. I'll let you know how that goes in about ten years.
grade only gets better. I can't wait!

And guess what? I was told math in fourth
THE END
CHAPTER FIVE: CONCLUDING REMARKS

Educational Implications of a Growth Mindset Classroom

By creating a growth mindset in the classroom, Dweck (2010) notes that teachers should create “meaningful learning tasks,” while encouraging students through praise (p. 18). Dweck (2010) also suggests giving students purposeful assignments, which give them a sense of effort, while emphasizing challenge and hard work. Therefore, students will have positive academic experiences and with encouraged engagement during learning. By portraying difficult tasks as fun, challenging, and exciting, and emphasizing that fast learning is not always the best learning, students will benefit by going slow, persisting, and learning at a deeper level (Dweck, 2010). Dweck (2010) also explains that Albert Einstein, one of the greatest scientists, worked on answering the same questions year to year; therefore, showing students that one does not have to master a concept on the first try. This idea will benefit a struggling learner. “Grade for growth” is a concept that teachers can introduce into their classrooms, which rather than giving a child a failing grade, that student receives a grade of “not yet” (Dweck, 2010, p. 20). Then the student can continue to learn the information until they completely understand the concept, whether it is his or her second or third try. By showing a student who is not grasping a concept to use multiple strategies, followed by the improvements he or she made, can make a child feel as though “they can become smarter” (Dweck, 2010, p. 19). Appendix A and B provide resources for teachers to create a growth mindset culture in one’s classroom.
**Seeing Failure as Growth**

Having a mindset that intelligence can be developed will help learners to believe that anything is achievable, even if it means struggle and failure at first, but to “understand with effort and perseverance, they can succeed” (Ricci, 2013, p. 2). Dweck (2006) suggests, that the higher IQ in girls, the worse they did in the subject of math. Their failure appears to be linked to the consideration that “they were unable to learn the material after confusion” (Dweck, 2006, p. 2). Therefore, educating students on neuroplasticity, which is the brain's ability to change, adapt, and “rewire” itself throughout one’s life, would be beneficial to a girl who experiences failure (Ricci, 2013, p. 5). Rather then focusing on failure as a dead end or punishment, a lack of success should be seen as information gained to move forward in learning. Students can then approach a challenge in a new way and with increased motivation (Ricci, 2013). Aditomo (2015) suggests that students should learn to “evaluate the causes” of a setback, and to “plan strategies to address those problems” (p. 200). By using different strategies, students focus on “acquiring new knowledge/skills and less concerned about proving their intelligence,” while also, “avoiding the threat of looking unintelligent” (Aditomo, 2015, p. 203). By addressing failure as a way to reflect and gain useful feedback, a growth mindset is instilled and reinforced, and learning will eventually be feasible (Ricci, 2013).

Ricci (2013) suggests that the idea promoting intelligence as being malleable starts with everyone. School staff, administrators, teachers, parents, and children must believe that anyone can be successful. Dweck (2010) notes that by telling a student they are “smart” after a successful achievement, or praising students for who they are, is similar to telling a student they have a genetic trait that one has no control over (Ricci, 2013). This can cause a student to have a
fixed mindset and see any failure as a permanent quality. By supporting a student’s action, or recognizing effort, a student can move on from any setback and continue to achieve academically. Explaining to staff, teachers, parents, and students that the brain continues to make new connections when something is learned, and with practice those connections only get stronger; therefore, “intelligence is something that grows as one uses it” (Ricci, 2013, p. 22). Aditomo (2015) reminds teachers that, “in the face of setbacks and failure, having a growth mindset would also predispose students to make effort attributions, which could protect them from negative emotions and de-motivation” (p. 203). By continually teaching about a growth mindset, students, parents, and staff will become aware of student ability and achievement, which ultimately leads to mastery (Dweck, 2010).

**Reflection**

I always considered myself someone who did not have a “math brain.” Even though I felt I lacked the natural math skills that others in my family seemed to possess, I was never turned off from math in elementary school. Actually, I enjoyed math. For me, it did not matter that I was in the regular math class over being in honors math during my fifth grade year. The important part was that I was doing well and my teacher always encouraged me. However, shortly after fifth grade, I began to view math as an impossible task. This is not surprising since I believed math was a gift that some had and some did not. I quickly sank into a fixed mindset and was scared to try anything remotely close to a math problem. My sixth grade math class was the first class I had ever failed, and from the point forward I viewed math as an impossible and unattainable equation that even a calculator could not solve.
This fixed mindset never changed through middle school and through high school. Therefore, my goal was always to pass math by giving as little effort as possible, because in my mind, math was a hopeless subject that I could never learn. As high school math became harder, my grades became lower and I failed my second math class during my junior year. At this point, I was far from disappointed because this was normal; math was officially my worst subject. Finally, I was in college and had to get through three math classes, then, I would be done for the rest of my life. I was a communication major, and made sure I would never see another addition sign, subtraction sign, or any other math related symbol again.

As I figured out my career goals, I decided to switch major to education. My first thought was: I am going to have to teach math, and how can I teach math when I cannot even do math? I was positive that I wanted to be in education, and even took a job as an afterschool teacher working with kindergarten students. A part of that afterschool job that I was not initially expecting was helping students with their homework, specifically their math homework. At this point, math seemed like a foreign language and even depicting a simple math problem in pictures would be a challenge. Nevertheless, I persisted and attempted the problems. After a year of not only working with kindergarten children, but kindergarten through fifth grade students, I learned math again. I broke out of this fixed mindset I had put myself into and realized that just by persevering and trying different problems, I could achieve more than by asking another teacher for assistance. I practiced my math skills with these students and sometimes felt as though I was learning right alongside them.

I was enjoying the experience of re-learning a subject that was once familiar to me, and yet so distasteful. As I got a better understanding for math, I began to work with students to
come up with different means of solving a problem, which allowed me to assist students who did not understand how to solve a problem in a traditional manner. Rather, I was showing students strategies and methods at a level that they could understand. I would break down a math problem into simple steps, because that is how I understand math. I had finally stepped into the growth mindset that I had been missing, in a subject that I had given up on only years earlier. I am now excited to teach math, because not only do I understand the struggles that students face when confusion arises, but I also learned to break down math to its simplest form.

Through writing this thesis and my own experience in schools and working with students, I understand why a growth mindset should be emphasized. If only I were shown the benefits of having a growth mindset in my early years, by putting effort into my work, challenging myself, and not being afraid of failure, I could have possibly avoided all the math-related troubles I had as a student. However, I also would not change my experience, because I believe it has shaped me into a successful student and will shape me to become a successful teacher. I will bring the knowledge I have gained, after researching and writing about growth mindsets and apply this information to create a learning environment in my future classroom that promotes fluid theories of intelligence.

*Thoughts After Completing My Children’s Book*

After writing and putting together my children’s book and reflecting on what a high quality picturebook contains, I have decided that my children’s book, rather, would be defined as an illustrated book. An illustrated book contains pictures to clarify the text, and adds visual elements that children enjoy looking at while reading (Stewig, 1995). Unlike an illustrated book, the text and the illustrations are fused and intertwined in such a way that the picturebook cannot
be told with only the text or only the pictures. Both are essential. A picturebook’s images and
text are both needed to tell the story. I do not believe that the illustrations in my book are
absolutely necessary. Instead, I have images that complement the text and enhance what is being
read during specific parts of the book. Therefore, I would now classify my children’s book as an
illustrated book; a book that contains pictures, but that does not have all the defining elements lof
a quality picturebook.

Future Plans

I first plan on using the research on fixed and growth mindsets to create a growth mindset
classroom through challenging students, praising students for their grit and determination during
the process of learning, and especially allowing failure until success is achieved. Along with
that, I also hope to influence young girls to explore math and science subjects in my class
through influential stories and books, such as the one I wrote, or through positive guest speakers
who are successful women in the STEM field. To further inspire students to work to their
highest potential, I will also teach my future students what a growth mindset is and how the brain
is constantly making new connections. Most importantly, I hope to develop my picturebook
further, create more distinctive images, and test whether the picturebook might influence
students, in particular young girls’ beliefs concerning intelligence. I plan to take what I have
learned during the writing process and creation of this thesis, as well as what I have achieved as
an Honors in the Major student during my undergraduate career toward fulfilling a master’s
degree in education. I will continue to expand my knowledge in the ever-growing field of
children’s literature and education, specifically in regard to elementary students’ perceptions of
formative intelligence and growth mindsets.
APPENDIX A: RESOURCES FOR TEACHERS

https://www.smore.com/n3eyx-growth-mindset-lesson-resources?ref=board

This website provides images that can be displayed throughout a classroom to promote having a growth mindset culture. The website also provides videos to boost confidence, keys to success, mindsets, and more to encourage students to possess a growth mindset and reasons why it is important to have one.


The “With Math I Can” is an initiative to stop students from saying negative comments based on their abilities in math classes, but rather to replace those negative comments with sayings that relate to a growth mindset and support the process of learning.


Khan Academy has set up a lesson plan for teachers, which explains a growth mindset and how one can achieve having a growth mindset. Other objectives from the lesson include the brain being malleable and the use of challenging work to make the brain stronger.
APPENDIX B: QUALITY PICTUREBOOKS

Children’s Books Promoting Growth Mindsets in Math and Science


APPENDIX C: GROWTH VERSUS FIXED MINDSETS

<table>
<thead>
<tr>
<th>Students in a Growth Mindset:</th>
<th>Students in a Fixed Mindset:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenge themselves and take risks</td>
<td>Do not like effort</td>
</tr>
<tr>
<td>Value effort</td>
<td>Believe everything should come naturally</td>
</tr>
<tr>
<td>Realize one must work hard to develop their abilities</td>
<td>Are threatened by tasks that require taking risks</td>
</tr>
</tbody>
</table>
References


