

# Growth Mindset Lessons and the Effects on Middle School Students' Attitudes and Effort in Mathematics

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## Abstract

National and international math assessments such as TIMSS and NAEP show students in the United States are underachieving in mathematics and lagging behind other developed nations. In the district that is the setting of this study, unsuccessful solutions such as math interventions classes were implemented to improve math achievement. An intervention that has demonstrated more promising results is Carol Dweck's model of growth mindset. Research on growth mindset has shown that growth mindset lessons can lead to increased math achievement but the literature about the effects of growth mindset lessons on other characteristics of success is lacking (Blackwell et al., 2007; Yeager and Dweck, 2012; Dweck and Mueller 1998). The present study adds to the literature in this area. This study took place at a public middle school in Northern California with a convenience sample of 41 seventh grade students in math intervention classes. Most students in the study are Hispanic (66%), from low socio-economic households (72%), and all are at least a grade level behind in math. Students in this pre-experimental, mixed method, pretest posttest study completed math performance tasks and responded to questionnaires before and after participating in a series of growth mindset lessons. From pretest to posttest, students showed statistically significant increases in math achievement ( $p=0.0001$ ), positive attitudes toward math ( $p=0.0271$ ), and confidence in their math ability ( $p=0.0323$ ). By using growth mindset lessons in their classrooms, educators have the ability to impact students on many levels.

## Research Questions

This thesis will answer the following questions: How does growth mindset instruction affect students' confidence and attitudes toward mathematics for mathematics intervention students? What are the effects of growth mindset instruction on students' effort and response to difficulty on challenging math tasks? How does growth mindset instruction affect males and females?

## Theoretical Basis

The theoretical basis of this study is seminal author Carol Dweck's model of Mindset (2006). Dweck is a psychologist, researcher and professor at Stanford University who has devoted the better part of three decades exploring why some people are successful and others are not. She has developed a model that describes people as being somewhere on the continuum from having a fixed to growth mindset. According to Dweck, individuals with fixed mindsets believe that you are born with a certain amount of intelligence which cannot be changed. Individuals with growth mindsets believe that a person's intelligence or talents can be developed through effort. Studies show that an individual's mindset or theories of intelligence helps develop patterns of response to challenges (Dweck, 2006) and that mindset can be changed through intervention (Aronson, Fried, and Good, 2002).

## Methodology

**Design:** Pre-experimental, mixed method, phenomenological study using a one group pretest/posttest.

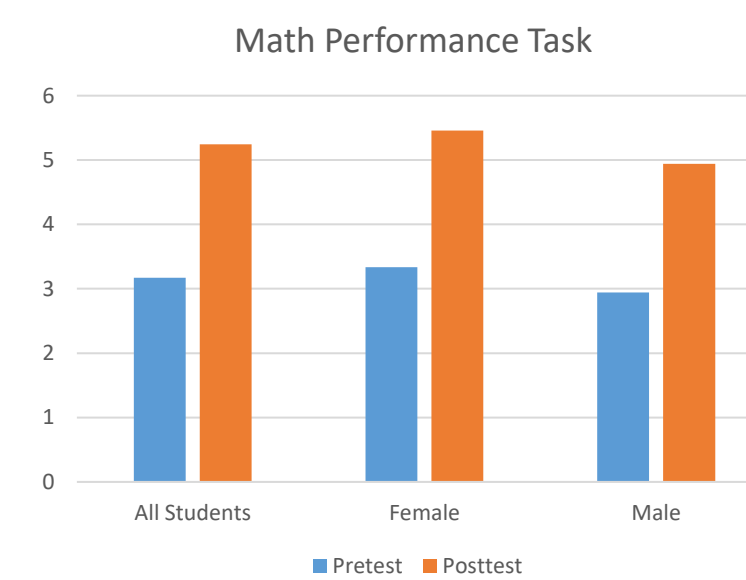
**Sample:** 41 seventh grade math intervention students from a public middle school in suburban Northern California. Mostly Hispanic (66%) and white (23%) from low socio-economic backgrounds (72% on free or reduced lunch).

**Instruments:** Pretest and posttest Likert scale and open-ended questions on confidence, attitude and mindset toward mathematics, a math performance task, and a math task student self-assessment.

**Treatment:** Online course on growth mindset and learning mathematics, *How to Learn Math: For Students*.

**Data Analysis:** Measures of central tendency and inferential statistics, including a T Test, were used to determine the quantitative significance.

## Results

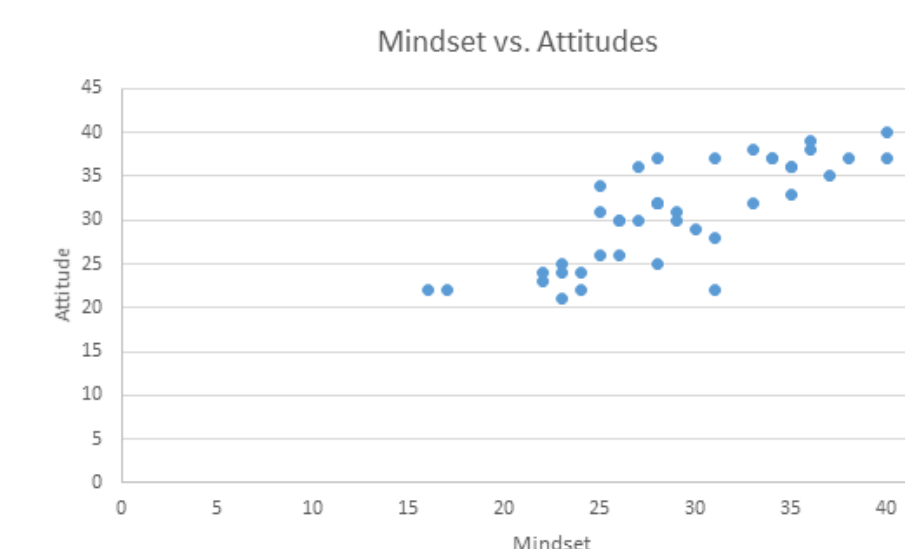
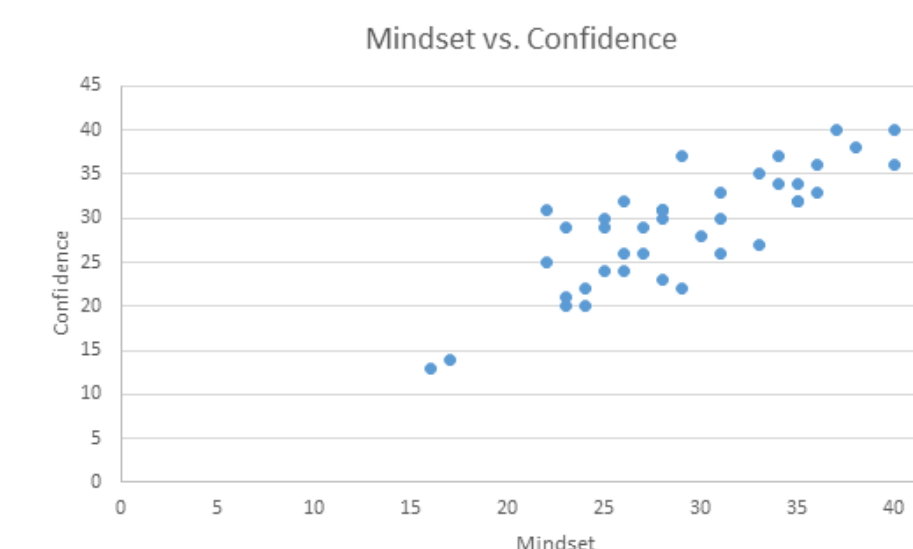


As shown on the left, student scores on the math performance task showed extremely statistically significant increases for all students ( $p=0.0001$ ), and statistically significant changes in the subgroups of female ( $p=0.0369$ ) and male ( $p=0.0301$ ) students. Female student scores started and ended higher than those of male students; however, male student scores had a larger percent increase.

The table to the right shows students' scores for the Likert scaled questionnaires. For all three questionnaires, students scores increased, meaning students exhibited more of each trait on the posttest than on the pretest. Females had lower pretest scores but showed greater growth in confidence and growth mindset. Males showed greater growth in attitude toward math.

Score Range= 10-40	Confidence	Attitude	Mindset
Pre	27.59	29.66	26.49
Post	29.23	30.73	28.98
% Change	5.97	3.62	9.39
Paired T-Test	0.0323	0.0271	0.0002

The graphs below look at the correlation between mindset scores and factors such as confidence and attitudes toward math. The correlation between students' scores on the mindset and confidence questionnaires (below on the left) shows a strong, positive correlation ( $R=0.8145$ ). The correlation between students' scores on the mindset and attitude questionnaires (below on the right) also shows a strong positive correlation ( $R=0.7989$ ).



## Conclusions

Consistent with previous research on growth mindset interventions, students' achievement had significant increases from pretest to posttest. However, the findings of this study go beyond showing increases in achievement. Students' scores on the posttest Likert scaled questionnaires and their responses to the self-assessment at the end of the math task also demonstrated increases for confidence, attitude, mindset, effort, and perseverance. In addition, correlations between mindset and other factors such as confidence and attitudes suggest these positive changes are attributable to changed beliefs about the nature of math intelligence.

While the data did not reveal any major trends by gender, one interesting thing did become apparent. When looking at male and female subgroups, whichever groups had the lower pretest scores in an area demonstrated the largest growth in that same area. This was true in all areas where data was broken down by gender (math achievement, confidence, attitude and mindset). In a sense, the growth mindset lessons levelled the playing field. This may have been because students who had lower scores had greater potential for gain or increased motivation to improve.

Findings on growth mindset imply that strictly teaching content without regard for students as individual human beings is constrictive. Through growth mindset lessons, teachers can help students believe they have the ability to be successful and improve their identities as math students. By using growth mindset lessons in their classrooms, educators impact students on many levels, and better prepare them for an increasingly demanding world. While the findings of this study were significant, more research is needed to confirm these theories.

## Primary Literature Cited

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