Effects of Growth Mindset Training on Undergraduate Statistics Students

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Abstract
Undergraduate introductory statistics courses have experienced numerous changes in the past century, for instance, increased enrollment and diversification of students required to take the courses. Promising research has been conducted on mathematical mindsets, however, no research is available for introductory statistics courses. This presentation addresses the effect of growth mindset training on students in mathematics.

Keywords
college students, attitude, research, intellect, performance

Disciplines
Higher Education | Statistics and Probability

Comments
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EFFECTS OF GROWTH MINDSET TRAINING ON UNDERGRADUATE STATISTICS STUDENTS

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Introductory Statistics & Mindsets

- Intro stats courses have experienced numerous changes in the past century ([Onwuegbuzie & Wilson, 2003](http://example.com/onwuegbuzie2003)).
  - Increased enrollment
  - Diversification of students required to take the course
- Promising research has been conducted on mathematical mindsets
- No research is available for introductory statistics courses
Mindset Theory

- Builds on attribution theory (Weiner, 1985)
- Mindsets are metacognitive processes that an individual holds concerning beliefs about their cognitive abilities (Boekaerts et al., 2003; Burns & Isbell, 2007; Mangels et al., 2006)
- Influence affective reactions and behaviors.
What is a Mindset?

- **Growth Mindset**
  - Intelligence is not fixed, but malleable

- **Fixed or Mindset**
  - Intelligence is fixed and unchangeable
  - Little one can do to improve intelligence

- **Mindsets are domain specific**

- **Students with fixed mindsets towards math have “a significant disadvantage”** ([Dweck, 2008, p. 1](#))
Gender and Mathematics

- Mathematics has historically utilized a talent-driven approach (Good, Rattan, & Dweck, 2012)
- A stereotype that males are more capable than females (Dweck, 2008; Good et al., 2012)
- This combination can have detrimental effects on females
- Fortunately, student’s mindsets can be altered.
Population and Sample

- Undergrad students enrolled in intro stats between August 2014 and May 2015 at a small, liberal arts college in the US
- 121 students enrolled, 52.9% response rate
- 64 students in the sample, 32 females and 32 males
Instruments

Implemented pre and post semester.

- **Student Attitudes Towards Statistics – 36© (SATS)** (Schau, 2003)
  - Assessed student attitude

- **The Comprehensive Assessment of Outcomes in a first Statistics course (CAOS)** (Assessment Resource Tools for Improving Statistical Thinking, 2005)
  - Measured mastery of statistical concepts
Growth Mindset Treatments

- Designed from successful research
- Four, 15-minute growth mindset training sessions during class time
- Goal: help students understand how the brain functions biologically with a focus on the malleability of intelligence.
### Posttest SATS© Scores by Gender Controlling for Pretest SATS©

Statistically significant results for **effort** and **value**.

<table>
<thead>
<tr>
<th></th>
<th>Male (n = 32)</th>
<th>Female (n = 32)</th>
<th>MSE</th>
<th>F value</th>
<th>p-value</th>
<th>η_p²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Affect</strong></td>
<td>4.599</td>
<td>4.177</td>
<td>0.037</td>
<td>0.035</td>
<td>.851</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Cognitive Competence</strong></td>
<td>4.890</td>
<td>4.776</td>
<td>0.058</td>
<td>0.207</td>
<td>.651</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Difficulty</strong></td>
<td>3.900</td>
<td>3.567</td>
<td>0.140</td>
<td>0.408</td>
<td>.525</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>Effort</strong></td>
<td>4.940</td>
<td>5.570</td>
<td>4.065</td>
<td>4.407</td>
<td>.040*</td>
<td>0.067~</td>
</tr>
<tr>
<td><strong>Interest</strong></td>
<td>4.289</td>
<td>4.141</td>
<td>1.298</td>
<td>1.678</td>
<td>.200</td>
<td>0.027~</td>
</tr>
<tr>
<td><strong>Value</strong></td>
<td>4.812</td>
<td>5.059</td>
<td>3.788</td>
<td>9.402</td>
<td>.003*</td>
<td>0.134~</td>
</tr>
</tbody>
</table>

* denotes significant difference at .05; ~ denotes small or medium effect size
Posttest Mastery by Gender Controlling for Pretest Scores

- Females increased mastery of statistical concepts at a statistically significant greater rate than males.
- An examination of previous semesters showed no difference.

<table>
<thead>
<tr>
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<th>Male (n = 32)</th>
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<th>p-value</th>
<th>η_p²</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAOS</td>
<td>.562</td>
<td>.583</td>
<td>0.063</td>
<td>5.296</td>
<td>.025*</td>
<td>0.080~</td>
</tr>
</tbody>
</table>

* denotes significant difference at .05;  ~ denotes small or medium effect size
Conclusion

- Growth mindset training is a promising method to address the underrepresentation of females in mathematics and other STEM fields (science, technology, engineering, and mathematics).
- Replication is necessary to learn more
References


