Fixed Mindset, Math Anxiety and Working Memory
(# 317)

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Agenda

- Intros
- Working Memory
- Math Anxiety
- Growth Mindset
- Take Away
- Summary
Intros
Stop and Jot

- Setting aside systemic issues within the school system, what are some individual reasons that some of your students may be unsuccessful?
Working Memory
Working Memory

A system of temporary storage AND manipulation of information

(Baddeley and Hitch, 1974)
Working Memory

1. Stimuli/input
   - Short-term memory
     - 15 - 30 secs

2. Rehearsal
   - Long-term memory
     - 1 sec - Lifetime
   - Sensory memory
     - 1 - 3 secs

3. Forgetting
   - Caused by biological factors, or antecedent processes
Working Memory

- Passive Storage (STM) – storage capacity - 7 items
- When Rehearsal is prevented – 4 items;
- Limit differs from person to person
- The core of math is reasoning – thinking through why methods make sense and talking about the reasons for the use of different methods. (Boaler, 2013)
**Reflection**

- **Stop and Jot** – How is working memory used by students learning math?

- **Turn and Talk** - Turn and tell your neighbors two things that stand out with you.
Math Anxiety
Math Anxiety Defined

Math anxiety is “a feeling of tension, apprehension or fear that interferes with math performance.” (Ashcraft, 2002)
Causes of Math Anxiety

• **Personal/Individual**
  - Realistic concern with personal level of math skills
  - Actual deficits with math skills

• **Classroom**
  - Classroom strategies that exert pressure (Ashcraft, 2002)
  - Timed Tests (Ashcraft, 2002)
  - Begins as early as first grade (Maloney & Beilock, 2012)

• **Social Cues**
Causes of Math Anxiety – Social Cues

Social cues that subtly convey the message that math should be feared (Beilock & Willingham, 2014)

“Teachers who are anxious about their own math abilities impart these negative attitudes to some of their students.” (Maloney & Beilock, 2015)

Girls in elementary school are likely to develop math anxiety if their female elementary school teachers are math-anxious. (Beilock, Gunderson, Ramirez & Levine, 2009)
Impact of Math Anxiety

- Creates “Working Memory Disruption” and co-opts working memory needed for successful math problem solving (Ashcraft & Kirk, 2001; Ashcraft & Moore, 2009; Engle, 2002; Young, Wu, & Menon, 2012).

- Math Anxiety robs people of working memory (Ashcraft, 2002)

- Higher math anxiety is associated with lower achievement (Ramirez, Gunderson, Levine & Beilock, 2012)

- Is specific to math (math anxiety did not predict results on reading comprehension test)
Math Fact Memorization

When we ask students to memorize math facts, then test them on those facts – two things occurs:

Where are these facts stored?

1. Students are stressed by the time pressured test
2. Stress shuts down working memory

(Boaler, 2015; Beilock, 2011; Ramirez, et al, 2013)
Let’s reflect on our list of qualities, for you, and the students that come to mind, which of the qualities that we listed may be a manifestation of math anxiety?

How could you find out? What could you do about it?
Solutions – Alleviating Math Anxiety

• Talking about the elephant in the room
• Discussing the physiological responses associated with anxiety (palm sweating, heart racing, etc.)
• Regulate Negative emotions by writing expressively possibly in a math journal or learning log
Strategies

- Chunk learning into smaller chunks to aid learning and review (5-10 minute chunks)
  - **Turn and Talk**
  - **Stop and Jot**
- Prime the pump – activate prior knowledge or emotion to create a connection to content
Mindsets
The Effect of Praise on Mindsets

Carol Dweck: The Effect of Praise on Mindsets (2006)

https://www.youtube.com/watch?v=TTXrV0_3UjY
Read each statement and decide whether you mostly agree or mostly disagree with it.

1. Your intelligence is something very basic about you that you can’t change very much.
2. No matter how much intelligence you have, you can always change it quite a bit.
3. You can learn new things, but you can’t really change how intelligent you are.
4. You can always substantially change how intelligent you are.

(Dweck, 2006)
Fixed Mindset
1. Your ________ is something very basic about you that you can’t change very much.
3. You can learn new things, but you can’t really change how ________ you are.

Growth Mindset
2. No matter how much ________ you have, you can always change it quite a bit.
4. You can always substantially change how ________ you are.

Dweck, 2006)
## Summary of Dweck's Mindset

<table>
<thead>
<tr>
<th>Fixed</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>ability is static</td>
<td>ability is developed</td>
</tr>
<tr>
<td>avoids challenges</td>
<td>embraces challenges</td>
</tr>
<tr>
<td>gives up easily</td>
<td>persists in obstacles</td>
</tr>
<tr>
<td>sees effort as fruitless</td>
<td>sees effort as necessary</td>
</tr>
<tr>
<td>ignores useful criticism</td>
<td>learns from criticism</td>
</tr>
<tr>
<td>threatened by others</td>
<td>inspired by others’ success</td>
</tr>
</tbody>
</table>
Stop and Jot

- Let’s reflect on our list of qualities, for you, and the students that come to mind, which of the qualities that we listed may be a manifestation of math anxiety?

- How could you find out? What could you do about it?
The base of the shed will be a square measuring 18 feet by 18 feet. The height of the rectangular sides will be 9 feet. The measure of the angle made by the roof with the side of the shed can vary and is labeled as $x^\circ$. Different roof angles create different surface areas of the roof. The surface area of the roof will determine the number of roofing shingles needed in constructing the shed. To meet drainage requirements, the roof angle must be at least 117°.
(For Teachers) What to do? Praising Wisely

Instead of "person praise" (e.g., "You are creative"), offer "process praise":

A. Praise the strategy (e.g., "You found a really good way to do it.")
B. Praise with specificity (e.g., "You seem to really understand fractions.")
C. Praise effort (e.g., "I can tell you've been practicing.")
Don’t Praise at All! Instead of Praise, Observe!

Research shows that praise, altogether, can be demotivating.

Instead – Observe and Comment
Strategies

- Teach Students about “Mindsets”
  - **PERTS Mindset Kit** (by Stanford University)
  - Khan Academy’s Growth Mindset Lesson

- Teacher Education
  - [YouCubed.org](https://youcubed.org)
  - Mindsets by Carol Dweck
  - Carol Dweck – TED Talks
Take Away

Stop and Jot

- What is your take away from this session?
- Write down one thing you want to share with a colleague
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D4X8R-NPZ84

Share your experience with your colleagues in the Discussion Group
References


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