m&m’s of Math
The Model:
WCTC Lifelong Learning Workshops

- Don’t Eat the Marshmallow
  - Grit
  - Growth Mindset
  - Self-Control

- Crush Bad Study Habits
  - Think
  - Space
  - Test

- Take Note
  ... on readings
  ... in class
  ... to learn

- Getting Things Done
  - Capture
  - Clarify
  - Plan
m&m’s of Math Workshop

Mindset

Methods

Mastery
I am naturally bad at Math.
The Power of YET

“I don’t get it... yet.”
“I can’t do this... yet.”
“I’m no good at math... yet.”

Give yourself messages that are POSITIVE and TRUE.
Mistakes are the stepping stones to wisdom.

We learn from trial and error; we become wise by understanding problems.

Mistakes provide the next lesson.
Continuum of Learning

Mindset
Typical Forgetting Curve for Newly Learned Information
Mary Cha – A Personal Story

“... get started early and leave time for it to digest...”
Spaced Practice

<table>
<thead>
<tr>
<th>Leslie</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>1/2 hour</th>
<th>A grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee Ann</td>
<td>1 hour</td>
<td>1 hour</td>
<td>1 hour</td>
<td>1 hour</td>
<td>1 hour</td>
<td>1 hour</td>
<td>1 hour</td>
<td>1 hour</td>
<td>B grade</td>
</tr>
<tr>
<td>Nora</td>
<td>4 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C grade</td>
</tr>
</tbody>
</table>

Legend:
- A grade: 1/2 hour per session
- B grade: 1 hour per session
- C grade: 4 hours total

Total hours:
- Leslie: 6 hours
- Lee Ann: 7 hours
- Nora: 4 hours
Practical Suggestions

Before Class

1. Review

2. Prime Pump
Practical Suggestions During Class

1. Take Note!

2. I have a Question!

(Lifelong Learning Workshop)
Practical Suggestions

After Class

1. Concept Sheet
2. Homework
3. Get Help
Continuum of Learning

Mindset

Methods
Mastery
<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 - 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 - 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Afternoon</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 - 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 - 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evening</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 - 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Weekly Study Timetable

<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 - 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 - 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Afternoon</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 - 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 - 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evening</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 - 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Math Class
- Math Class
## Weekly Study Timetable

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-12</td>
<td></td>
<td>Preview</td>
<td>Math Class</td>
<td>Review</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-7</td>
<td></td>
<td></td>
<td>Math Center</td>
<td>Review</td>
<td>Math Center</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Homework</td>
</tr>
<tr>
<td>8-9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Homework</td>
</tr>
<tr>
<td>9-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Homework</td>
</tr>
<tr>
<td>10-11</td>
<td>Homework</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Homework &amp; Study</td>
</tr>
</tbody>
</table>
6) Brian sells a power saw for $184.95. The saw cost him $98.65. What is the percent of markup based on the selling price?

\[
\frac{\text{Markup}}{\text{Cost}} = \frac{184.95 - 98.65}{98.65} \times 100 = 86.30\%\]

\[
\text{M}\% = \frac{46.7}{100} = 46.7\%\]

An air compressor has a markup rate of 138\% based on cost. It sells for $595. Find the amount of the markup.

\[
\begin{align*}
C &= 100\% \\
+ M &= \frac{138}{100} \\
\frac{C + M}{S} &= \frac{238}{100} \\
S &= \frac{595}{238}\]
\]
\[
\text{M} = 595 - 250 = 345\]

8) A desk is marked up 42\% based on cost. What is the rate of markup based on selling price?

\[
\frac{42\%}{142\%} = 29.6\%\]

9) A kitchen set is marked up 18\% on selling price. What is the rate of markup based on cost?

\[
\frac{18\%}{82\%} = 22.0\%\]

10) Car tires were originally sold for $340 for a set of four. They were subsequently sold for $238. What is the percent of the markdown?

\[
\frac{\text{Markdown}}{\text{Original Price}} = \frac{340 - 238}{340} \times 100 = 30\%\]

Highlight problems that were difficult to solve

Rework those problems
Blocking vs Interleaving

Skill A

Skill B

Skill C

OR

A B C B A C A C B B C A
Continuum of Learning

Mindset  Methods  Mastery
Evolution of m&m’s of Math Workshop

• Workshop Delivery
  • separate offerings
  • during math classes

• Math Center Activities
  Developing a MATH Mindset  →  Growth Mindset
  Making Time for Math  →  Scheduling Work Time
  Building BRAIN Power  →  Neurogenesis
Developing a Math Mindset

Is your mindset helping you learn or keeping you from learning?

Learning Math Requires
- The belief that you CAN learn math
- Willingness to put forth effort
- Grit to overcome setbacks

Research shows that a GROWTH mindset together with DETERMINATION leads to success.

THINK ABOUT how your math mindset is affecting you:

Positive, Growth Mindset → Learning → Reaching Your GOALS

Negative, Fixed Mindset → Roadblocks → Difficulty Reaching Your Goals

ACTIVITY: Tell us how your math mindset is helping you succeed. Earn a bag of M&M’s!
Making Time for Math

Do you schedule your math work time?

Learning Math Requires
• Practicing new concepts
• Reworking difficult problems
• Mixing different kinds of problems

If you schedule math practice, you are more likely to actually do the work.

ACTIVITY: Schedule your math work time.
Show us your schedule to earn a bag of M&M’s!
Practice, Practice, and More Practice

Learning Math Requires
• Time
• Effort
• Good Study Strategies

As you practice math problems, new neural pathways form in the brain.
The more you practice, the stronger the pathway!

Do you rework difficult problems?
If you sing a song once, will you be able to recall all of the lyrics? Probably not. It is similar in math: working a problem once is not enough to form a strong connection so that you will be able to rework similar problems in the future.

When you come to a problem that you need help on, highlight it. Keep a list of those problems and rework them frequently until you can do them without help.

ACTIVITY: Keep a list of problems that you needed help on today. Show us your list to earn a bag of M&M’s!
# m&m’s of Math

*Take notes in the boxes to best retain what you learn today.*

<table>
<thead>
<tr>
<th>Mindset</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Mindset M&amp;M" /></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Methods M&amp;M" /></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mastery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Mastery M&amp;M" /></td>
<td></td>
</tr>
</tbody>
</table>
Action Plan—Choose one technique and describe how you plan to apply it.

_____ Work to build a growth mindset: Develop a positive affirmation to eliminate negative self-talk.

_____ Develop a study schedule and stick to it. Schedule frequent, shorter study sessions (spaced practice).

_____ Get help when you don’t understand a concept or cannot find the correct answer to a problem.

_____ Create concept sheets (summary sheets) as you study each unit.

_____ Carry a highlighter and mark problems that you missed or needed help on. Rework these problems until they no longer cause you to struggle.

_____ Take practice tests to see if you know the material.

_____ Other:

---

Math help is available at

WCTC’s Math Center, B-110A

Monday – Thursday  8:30 am – 7: 30 pm

Friday  8:30 am – 1:00 pm

---

Helpful Resources

Oakley, B. (2014) *A Mind for Numbers* outlines research-based tools and strategies to effectively learn math and science.

Rosenkrantz, P. How to study math, science and engineering, www.cpp.edu/~Rosenkrantz/skills2.htm

For resources regarding effective study, visit The Learning Scientists online at http://www.learingscientists.org

Learning How to Learn Facebook page, available at https://www.facebook.com/StudyHike/

Instructional videos on math topics

Khan Academy at https://www.khanacademy.org/

Additional math practice problems

Kuta Software at https://www.kutasoftware.com/
Goals of the Workshop
- Educate students about effective, research-based, math study techniques
- Follow lifelong learning workshop format (½ hour, 3 parts, note-taking handout w/ resources)

Overview

Mindset
- Growth mindset (Carol Dweck)
  o Working through a blocked working memory
  o Consciously create positive self-talk (power of “yet”)
  o Learning = new connections in the brain (neuroplasticity research—Michael Merzenich)
    = effort and good strategies
    ≠ fixed abilities
- Grit—Mistakes are a stepping stone to learning (Angela Duckworth)

Methods
- The Forgetting Curve (Ebbinghaus 1885, exponential decay $R = e^{-kt}$)
- Spaced Practice (Benjamin & Tullis) → Subconscious processing
- Practical suggestions for before, during, after class
  o Before → review & preview
  o During → note taking, asking questions
  o After → concept sheet, homework (& check answers), get help

Mastery
- Scheduling time
- Creating neural chunks (long term memory) using “problem problems” (Barbara Oakley)
  o Identify/Highlight difficult problems
  o Rework / rework / rework
- Interleaving (D. Rohrer, 2012)
- Self-testing (Dunlocky & Willingham, 2013)

Contact Information: Sally Yakel syakel@wctc.edu  Laura Seeman lseeman@wctc.edu