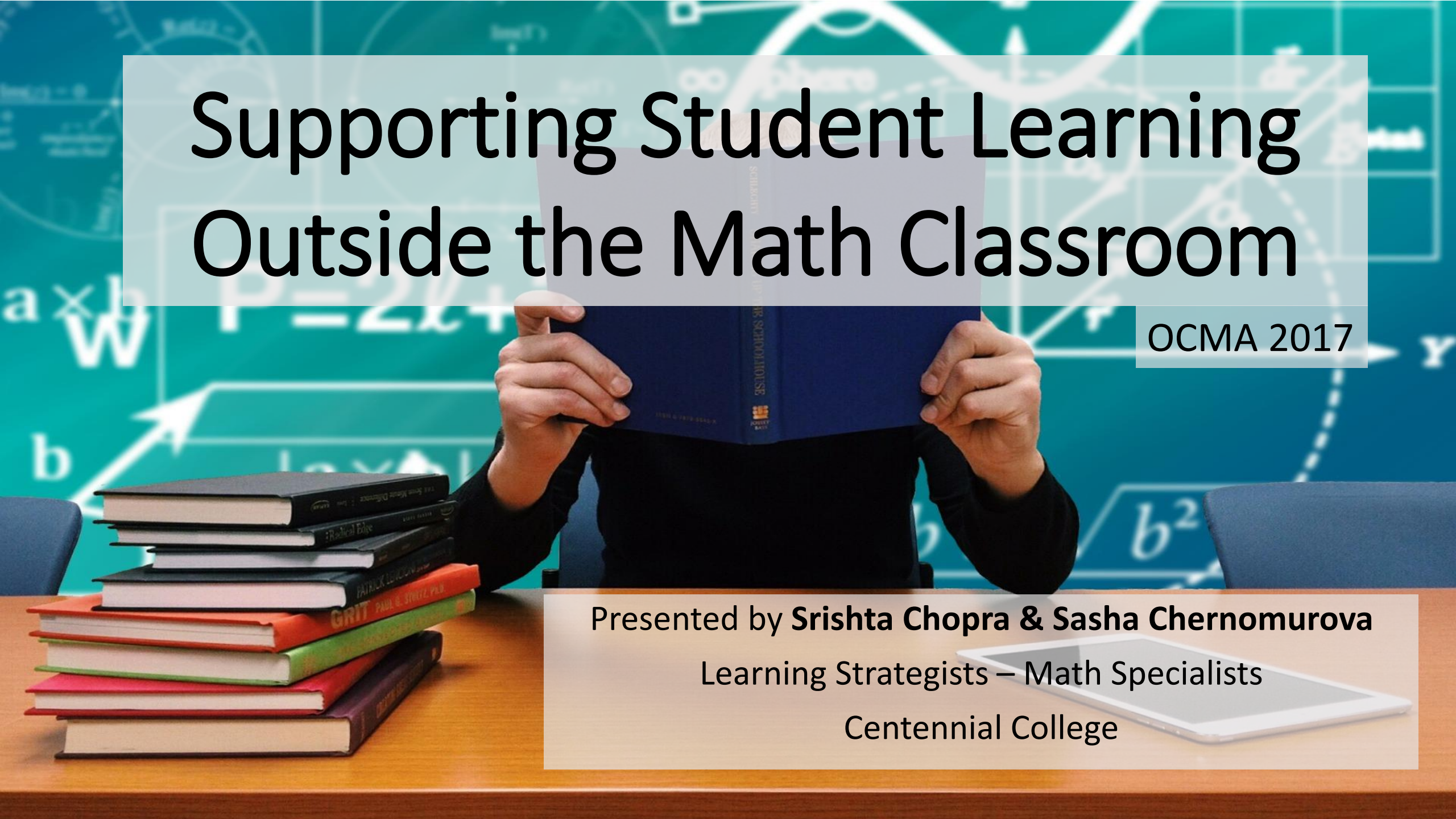


Supporting Student Learning Outside the Math Classroom

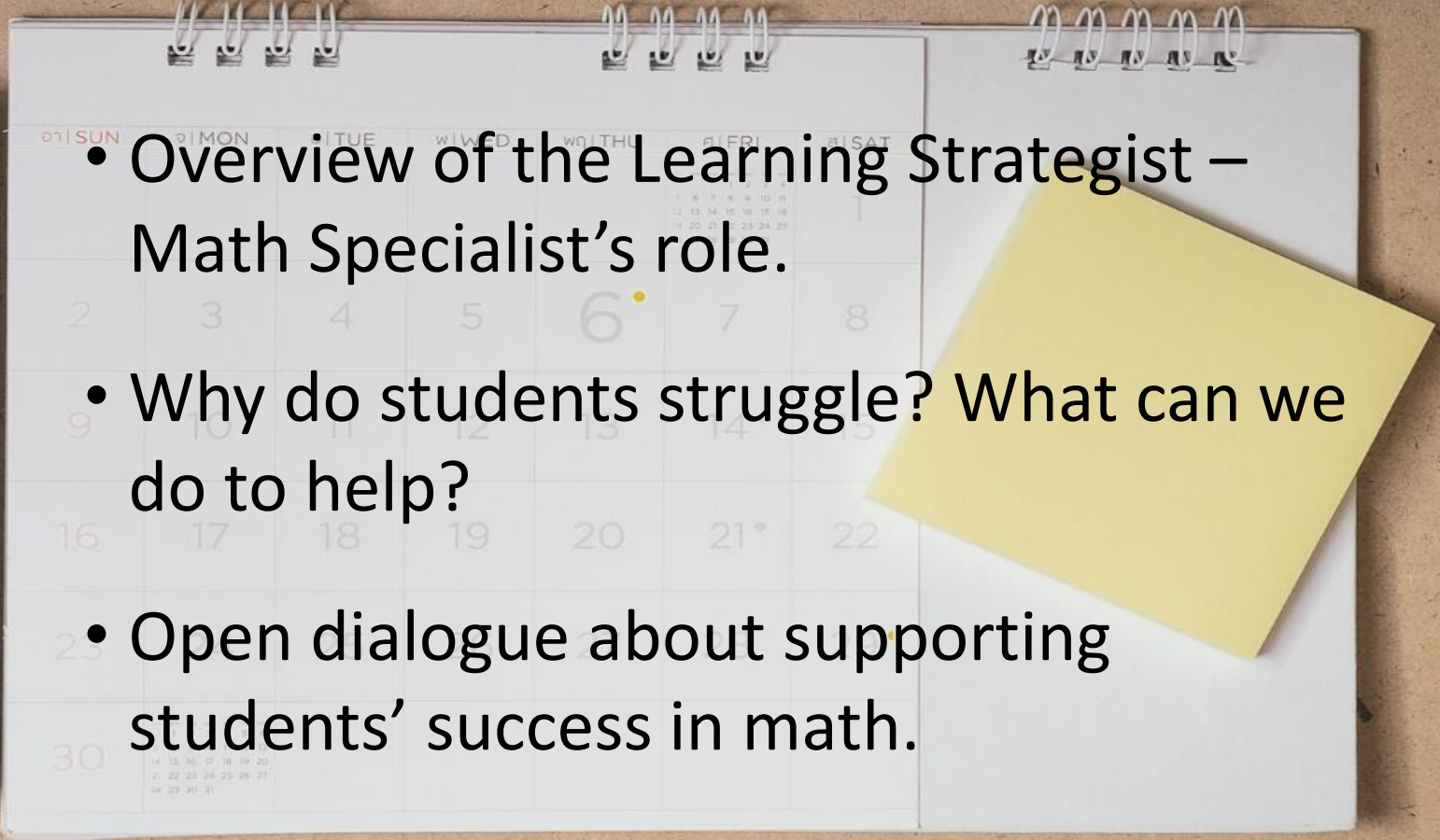
OCMA 2017

The background image shows a person's hands holding an open blue book. In the foreground, on a wooden desk, is a stack of several books with various colored spines (black, white, orange, green, red, purple). To the right of the stack is a white tablet. The background is a teal color with faint mathematical symbols and graphs, including $a \times b$, w , b , $P = 2x +$, b^2 , and y .

Presented by **Srishta Chopra & Sasha Chernomurova**
Learning Strategists – Math Specialists
Centennial College



Agenda:

- 
- Overview of the Learning Strategist – Math Specialist's role.
 - Why do students struggle? What can we do to help?
 - Open dialogue about supporting students' success in math.

What does a Learning Strategist – Math Specialist do?



Workshops

One-on-one appointments

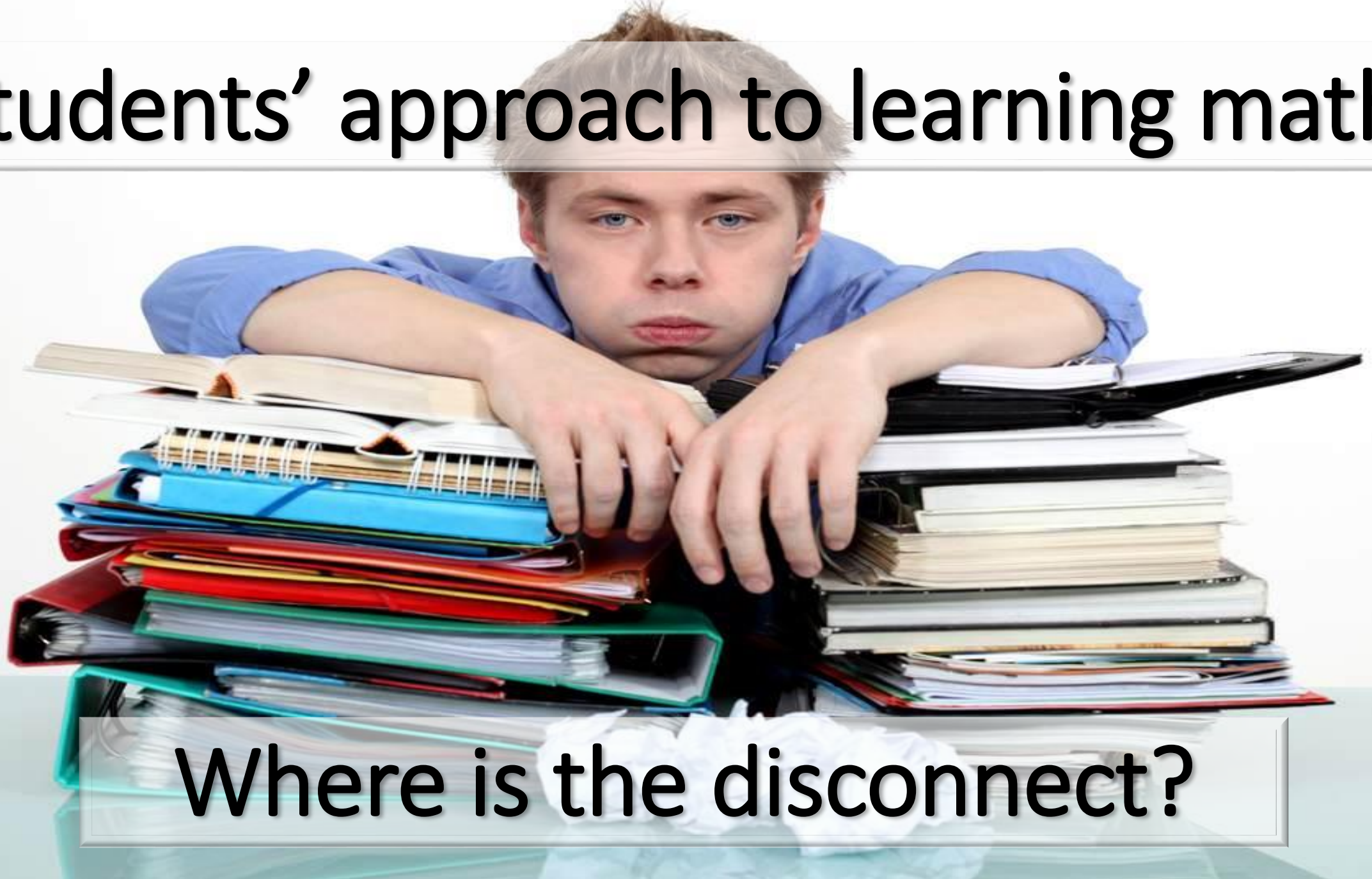
Learning Centre math services

Tutor training & development

Math community of practice

Math advising

Students' approach to learning math.



Where is the disconnect?



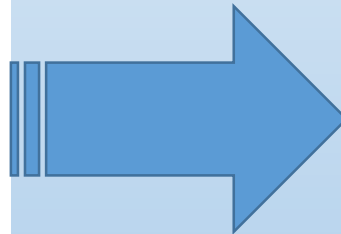
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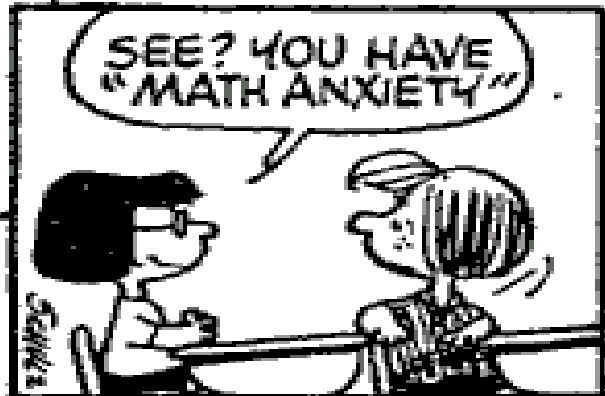
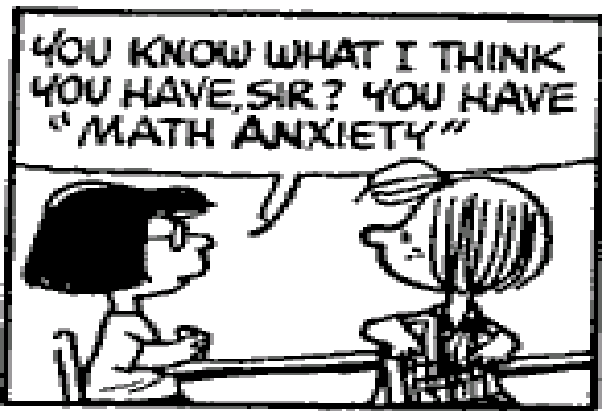
1. Preconceived notions about math.



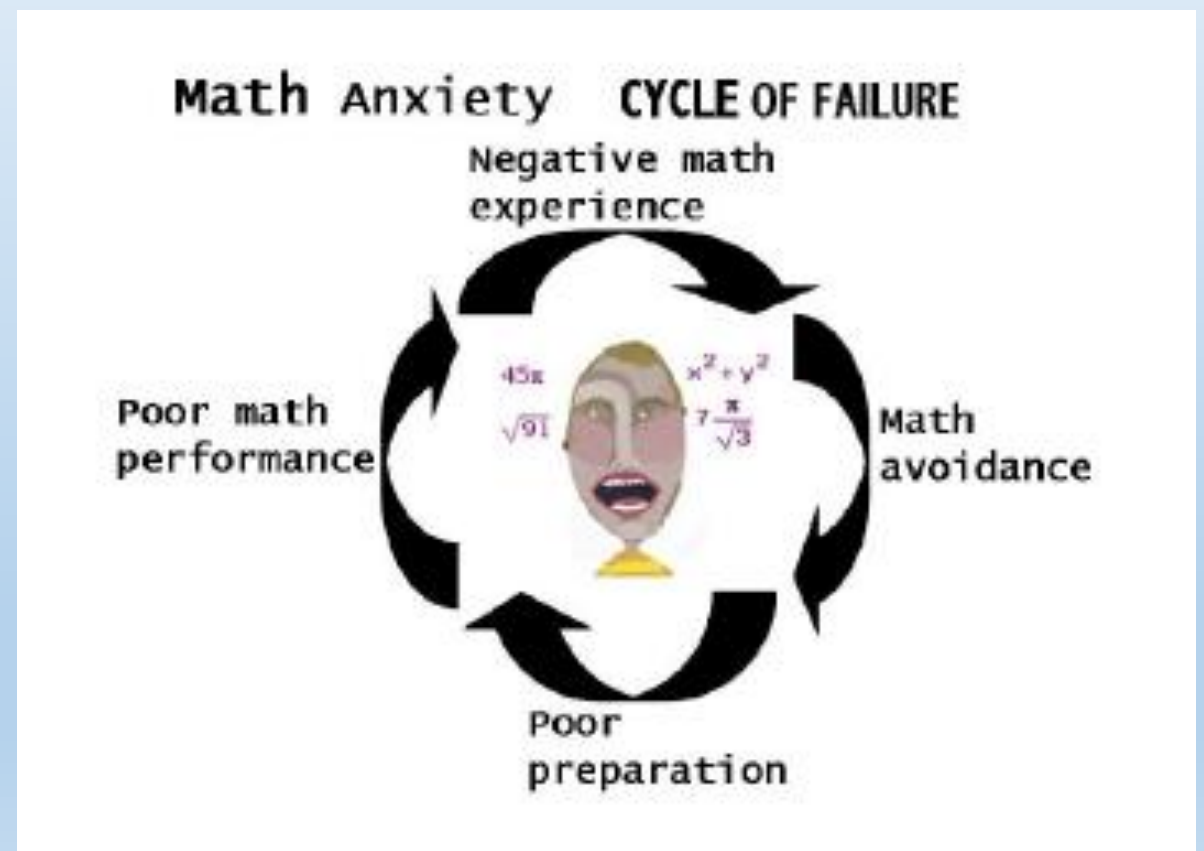


BIG IDEA — A NATIONWIDE PLAN FOR NUMERACY

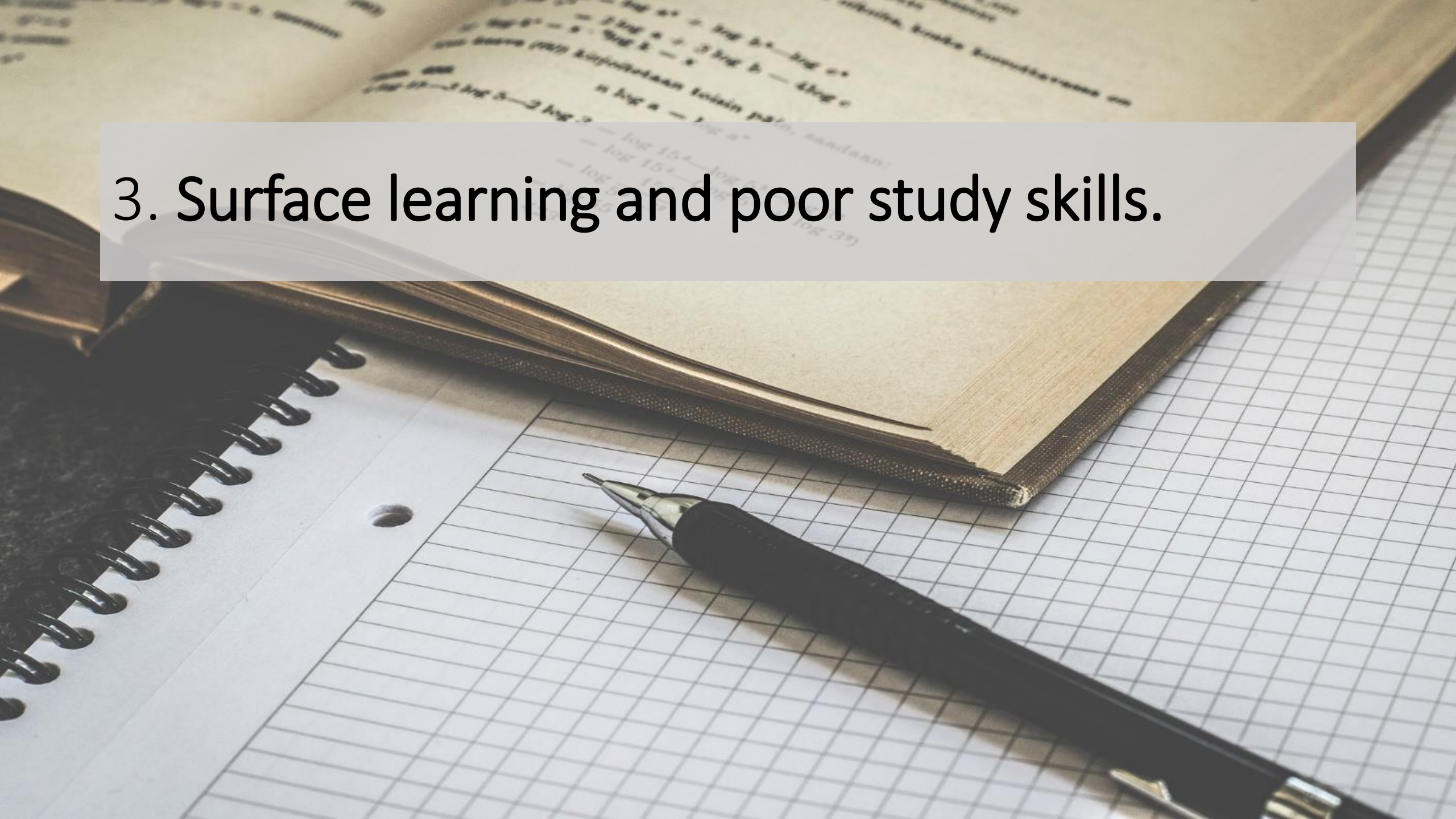




2. Lack of confidence and math anxiety.



3. Surface learning and poor study skills.



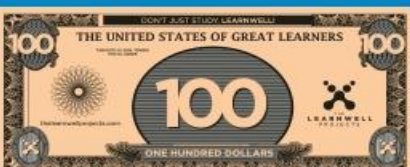
THINKWELL-LEARNWELL™ DIAGRAM

Lower Order Thinking Skills

Higher Order Thinking Skills

Surface Approach to Learning

Deep Approach to Learning

Metacognitive Learning Goals	Bloom's Higher Order Thinking Skills	Corresponding Learning Outcomes	Outcome Valuation
To Identify or Define Information Students seek to answer some form of this what-based question: Can I list and/or define the key terms?	Remembering Students work to recall/recognize information, ideas, and principles in the approximate form in which they were learned.	Able to Recall or Duplicate Information Students will be able to reproduce information in similar form as the original source. Corresponds to tasks in which cues are embedded.	
To Explain Information Students seek to answer some form of this why-based question: Can I explain the reasoning behind the ideas/concepts?	Understanding Students work to explain and provide rationales to support concepts and/or principles.	Able to Provide Rationales for Information Students will be able to explain why concepts are essential to understanding the topic, subject, story, etc. Corresponds to tasks that require explanations or elaborations.	
To Apply Information to New Situations Students seek to answer some form of this how-based question: Can I apply this information to a new or different situation, problem or context?	Applying Students work to transfer principles and/or concepts to a different problem or task with minimal cues or direction.	Able to Apply Information to Different Situations Students will be able to use information to complete a problem or task with minimal direction or cues. Corresponds to tasks that require application of knowledge to a situation.	
To Compare and Contrast Information Students seek to answer some form of this analytical question: Can I distinguish processes, procedures or principles from seemingly identical processes, procedures or principles?	Analyzing Demands that students be able to distinguish and differentiate between comparable processes, functions, methods, etc.	Able to Discern Nuances of Information Students will be able to discern patterns, differences and similarities within information. Corresponds to tasks that require students to distinguish between similar sets of information, processes or outcomes.	
To Make Judgments About Information Students seek to answer some form of this evaluative question: Can I determine the best rationale, plan, solution, course of action, etc., given the information?	Evaluating Demands that students be able to make judgments with information.	Able to Reach Conclusions with Information Students will be able to make judgments about information they've analyzed. Corresponds to tasks that require students to decide which course of action, solution or option is best.	
To Introduce, Develop a Viewpoint Students seek to answer some form of this generative question: Can I synthesize the information in an original way?	Creating Demands that students be able to construct new information from existing information.	Able to Produce New Information Students will be able to present new meaning or generate new knowledge. Corresponds to tasks that require students to produce authentic work.	

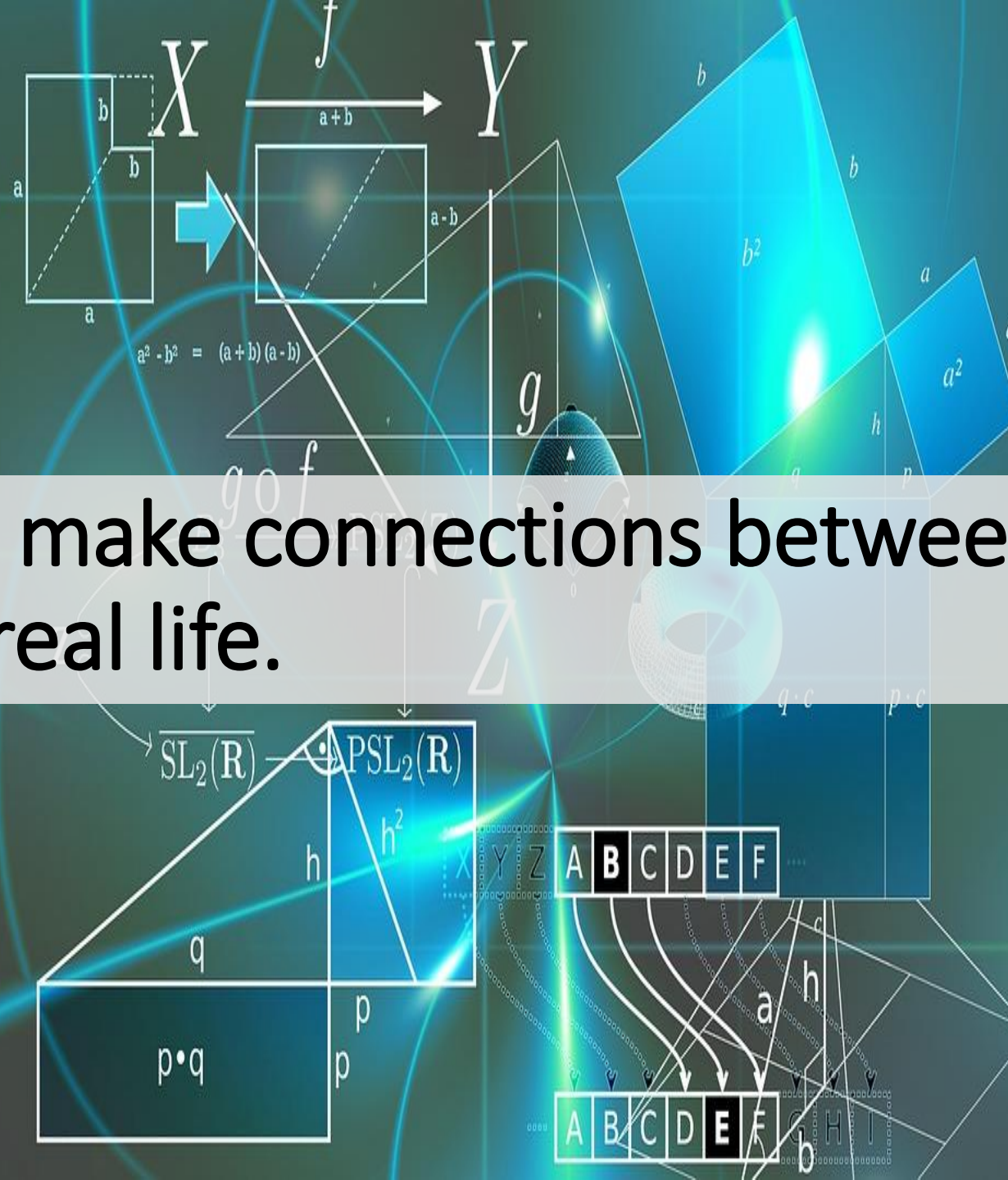
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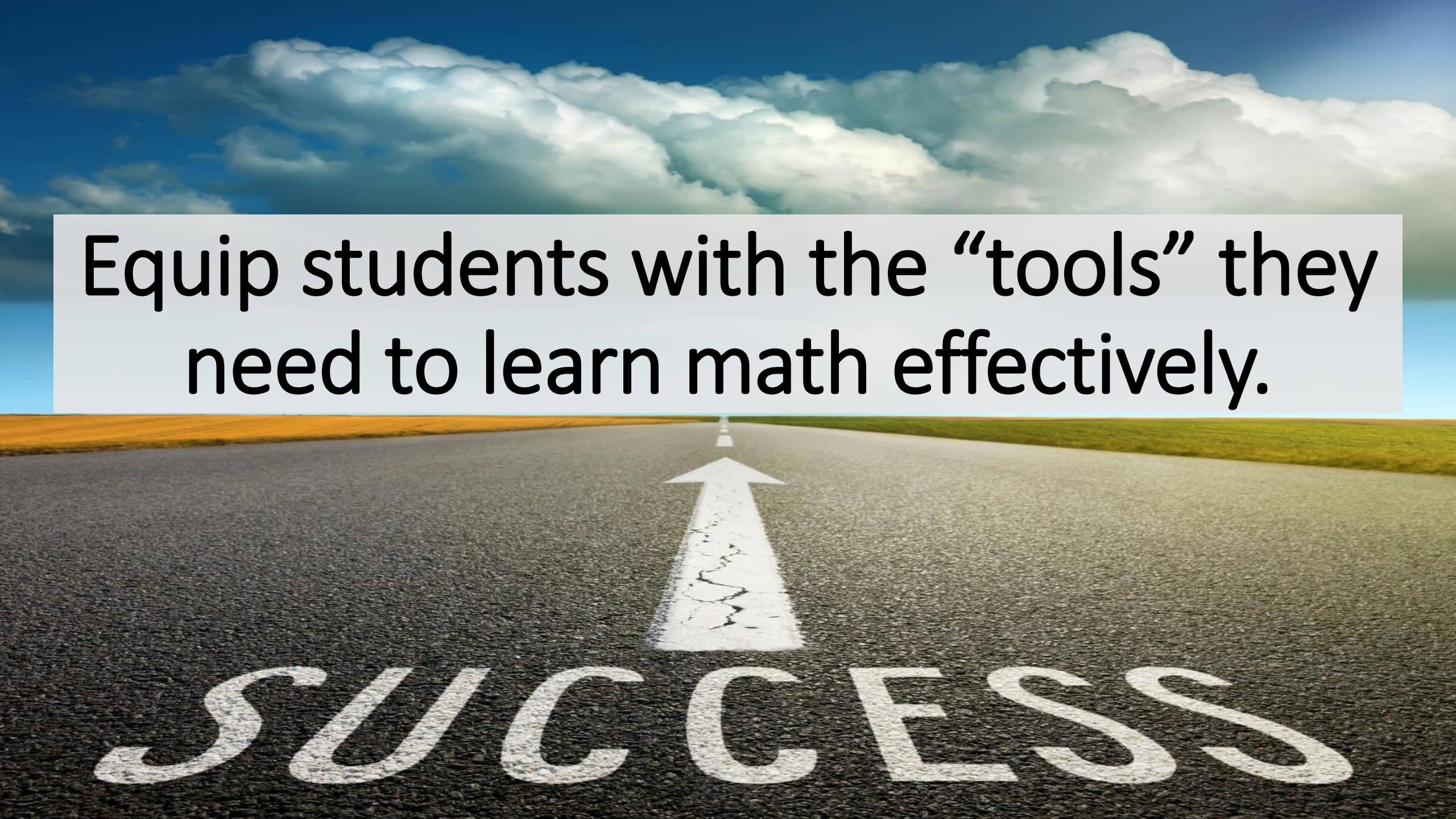


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4. Unable to make connections between math topics or to real life.

Equip students with the “tools” they need to learn math effectively.

A wide, straight asphalt road stretches towards a horizon under a blue sky with white clouds. A large white arrow is painted on the road, pointing directly towards the horizon. The word "SUCCESS" is painted in large, white, stylized capital letters across the width of the road, positioned just behind the arrow's tail.

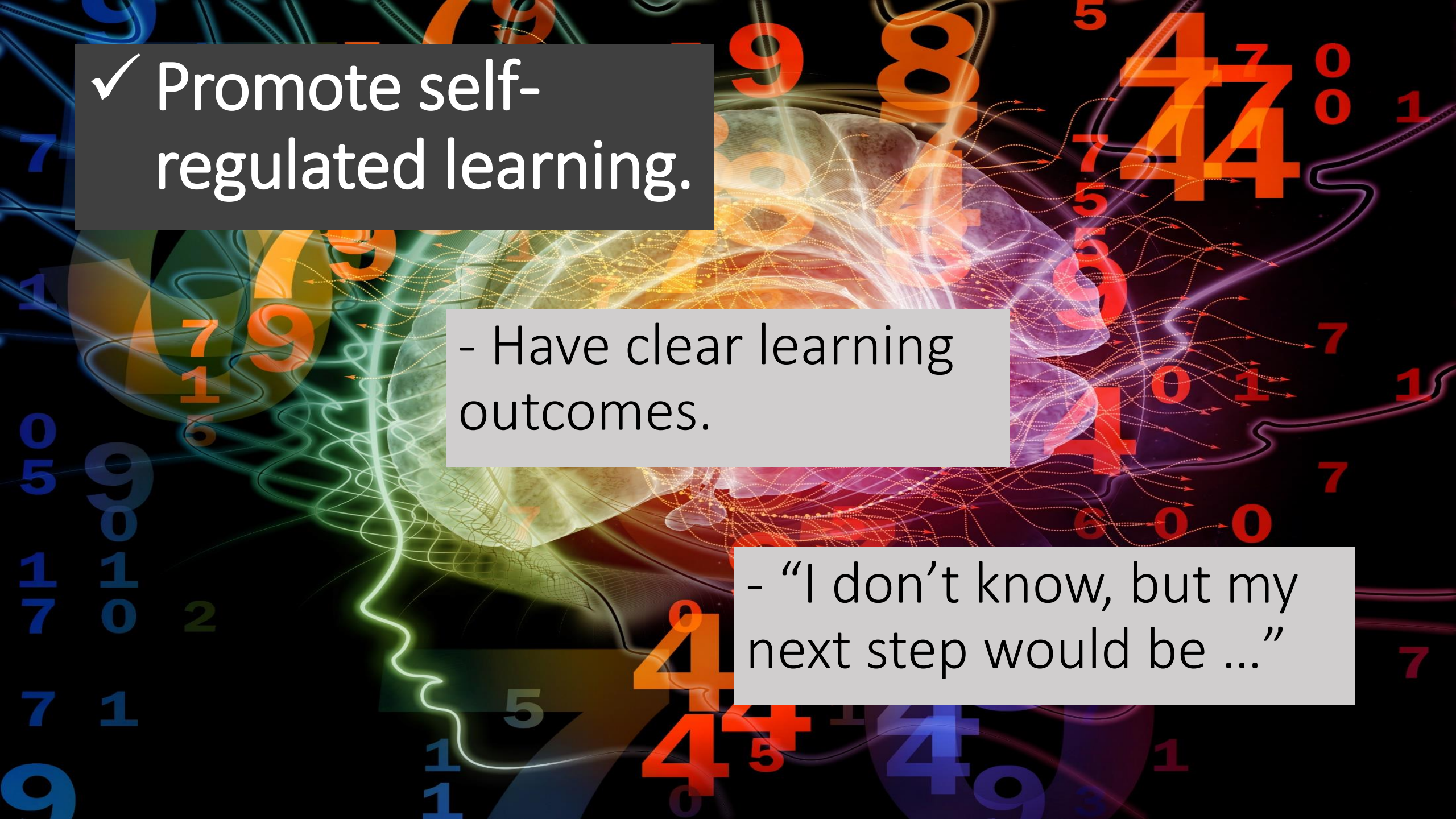
SUCCESS

✓ Strong foundational knowledge of math content.

- Review previous content related to new content.



- Refer students to learning centre/tutoring services.

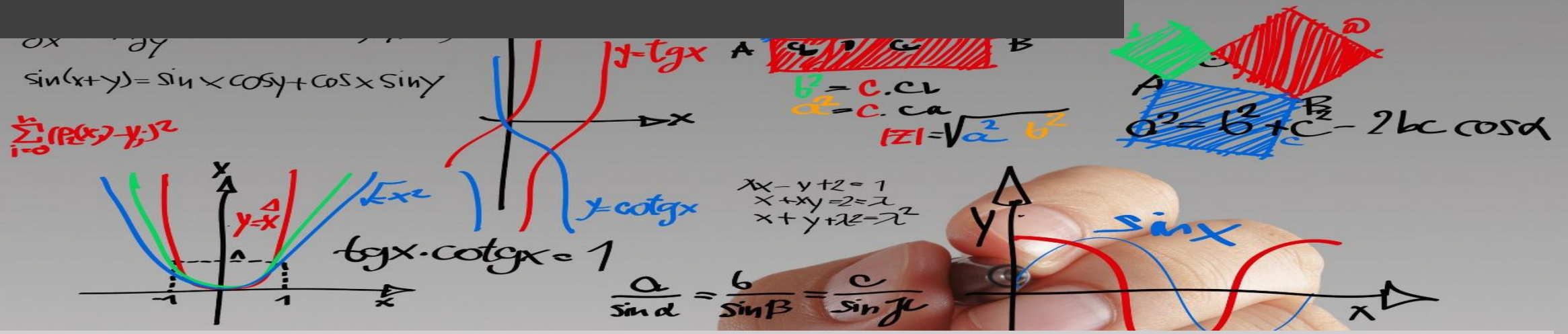
The background is a complex, abstract composition. It features a dark, almost black, base color. Overlaid on this are various elements: large, semi-transparent numbers in blue, orange, and red, some of which are slightly blurred or double-exposed. A prominent, glowing green and yellow neural network or brain-like structure is visible in the center-left, with numerous small nodes and connecting lines. To the right, there are more intricate, glowing purple and pink patterns that resemble a complex web or a stylized brain. The overall effect is one of high-tech, digital, and cognitive complexity.

✓ Promote self-regulated learning.

- Have clear learning outcomes.

- “I don’t know, but my next step would be ...”

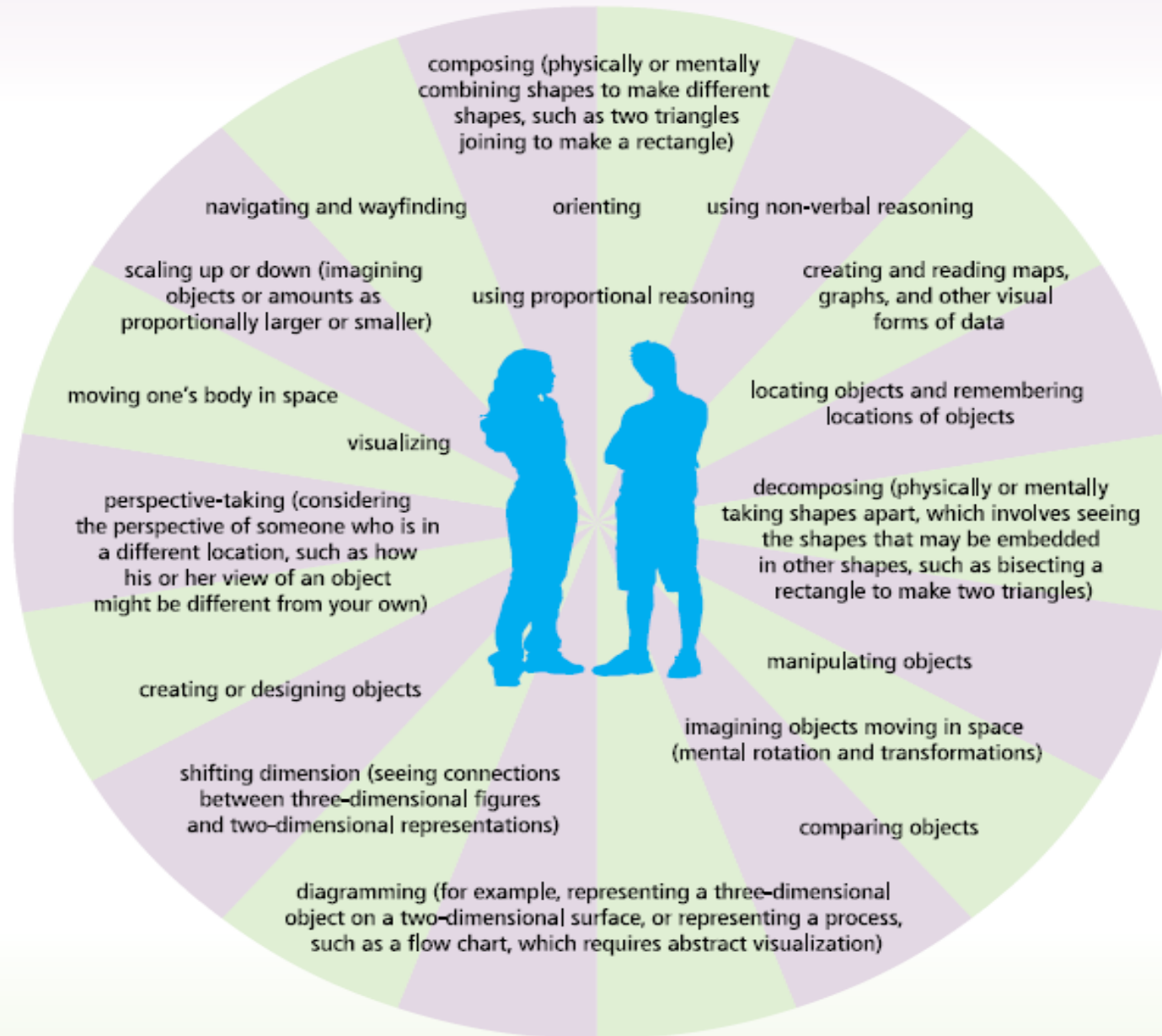
✓ Build visual-spatial reasoning.



“...by losing the finer dexterity of my hands, I was forced to travel the universe in my mind, and try to visualize the ways in which it worked.”

~Stephen Hawking

Spatial reasoning can involve



How can we promote visual-spatial reasoning?

1. Spatial language:

Using words like rotation, translation, transformation or left, right, above, below. Words that visually describe space change or positioning.

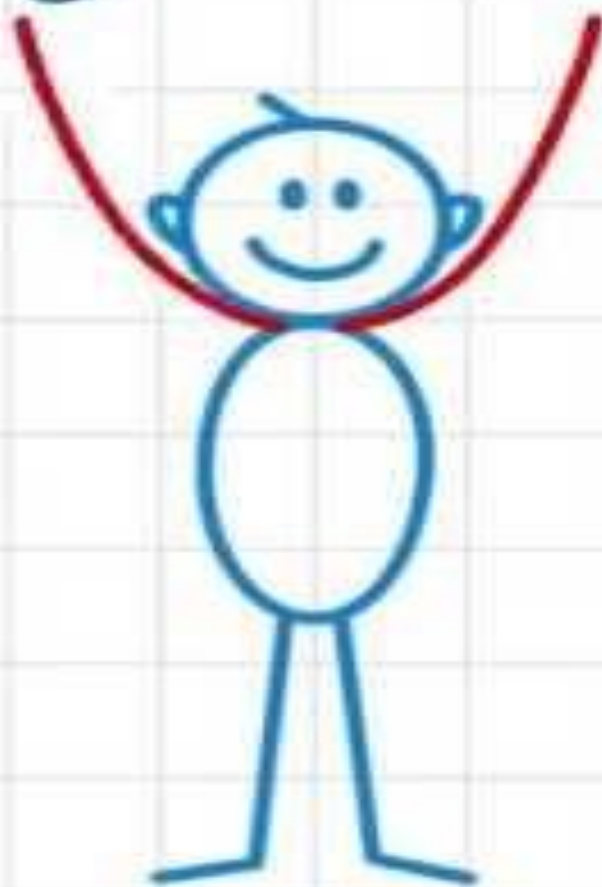
2. Visual displays of data:

Diagrams, pictures, graphs to visually represent mathematical concepts or quantity.

3. Gestures:

Hand gestures or bodily gestures to depict mathematical concepts like rotation, transformation. Helps with patterning.

$$y = x^2$$



How can we promote visual-spatial reasoning?

4. **Manipulatives and technology.**
5. **Visual – spatial reasoning prompts:**
“What can you see in your mind...”
6. **Playful opportunities** to enhance this reasoning:
Puzzles and games
7. **Visualizing in mind with pictures :**
Jo Boaler – youcubed.org
Example: 16×27 using mental math

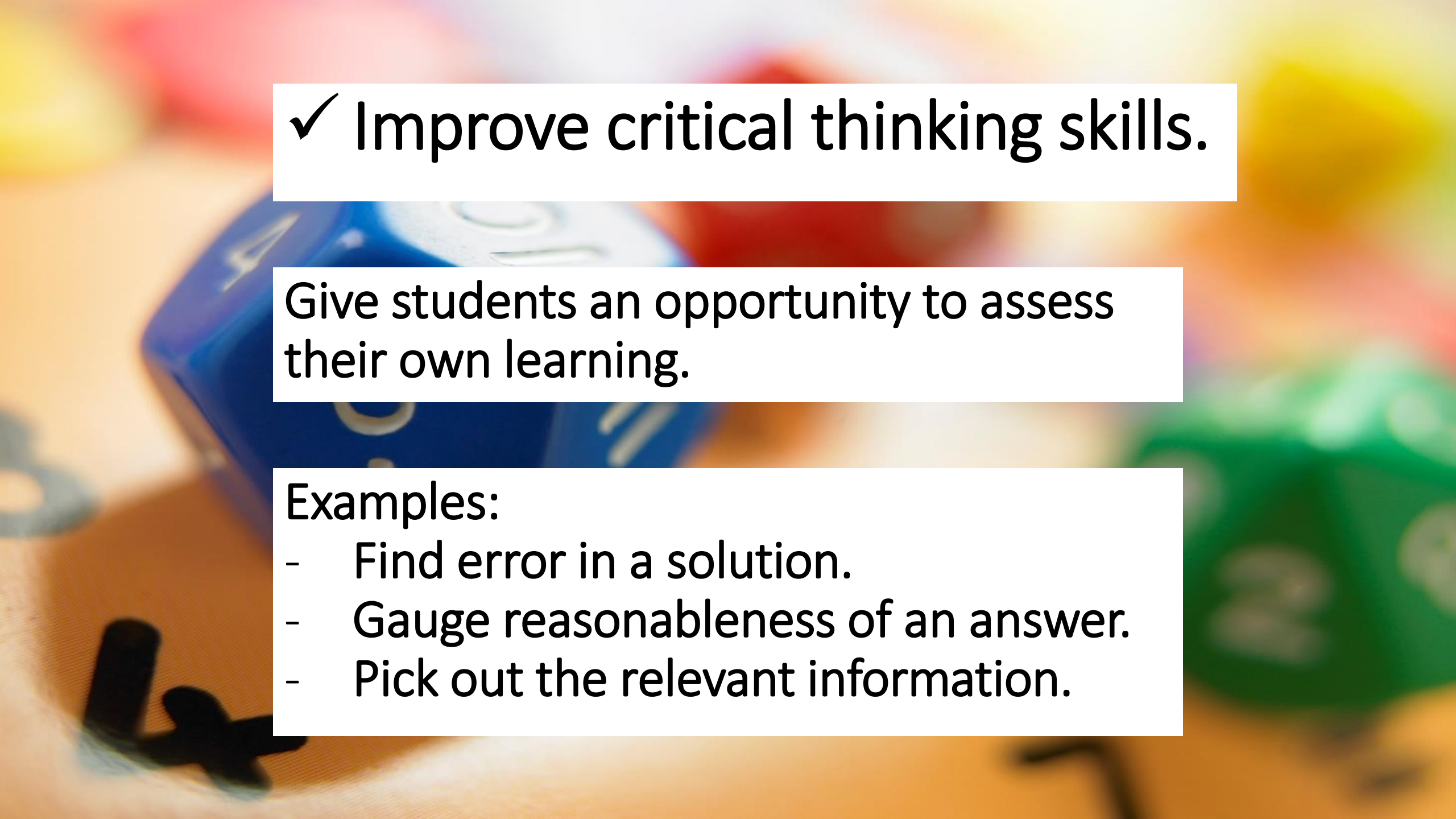
A background image showing three students (two men and one woman) sitting at a desk, smiling and engaged in conversation. The woman in the center wears glasses and a blue shirt. The man on the left wears a red and white plaid shirt. The man on the right wears a yellow shirt. They are in a bright, modern classroom or study area.

✓ Work on communication skills.

Give opportunities for students to communicate their thinking in a variety of ways: spoken, written, visual.

Use reading comprehension strategies (e.g. paraphrasing, connecting to prior knowledge, visualizing.)

Focus on vocabulary of math.

A blurred background image featuring a blue die with the number 4, a green die with the number 6, and a wooden ruler with black markings.

✓ Improve critical thinking skills.

Give students an opportunity to assess their own learning.

Examples:

- Find error in a solution.
- Gauge reasonableness of an answer.
- Pick out the relevant information.

In conclusion:

- ☐ Independent math learning requires many skills.
- ☐ Students need opportunities to build or improve these skills.
- ☐ UDL → how can we make math learning accessible?

Discussion and



Questions