Title: **"Growth Mindset: Enhancing Mathematical Learning"**
Session: #68, 408/409 Atlantic City Convention Center
Date: October 22, 2015

Description: Professional learning experiences for teachers were designed using resources such as *Mindset* by Carol Dweck and websites such as Mindset Works and youcubed. The learning experiences consisted of professional readings, videos, activities with students, and collegial collaboration and reflection of student activities. Qualitative data was collected to reflect on the mindset of our students towards mathematical learning.

Objective: During this session we will share the Growth Mindset learning experiences created for our teachers and students. We will share the anecdotal and qualitative data collected during the 2014-2015 school year for both teachers and students. We are hoping our experiences this year will enhance and promote a deeper level of mathematics learning in our students by influencing their mindset towards learning mathematics. At the conclusion of this session teachers will leave with a framework for embedding growth mindset activities into their classroom and suggestions for collecting similar data.

Focus on Math: We spend much of our time aligning curriculum to standards, ascertaining that we have the mathematical practices embedded in our lesson, double checking to make sure our assessments align to our learning objectives. If our students have a fixed mindset, it will inhibit their learning of mathematics no matter what we do. It would be advantageous to enhance the learning experiences in class with positive math norms and work towards instilling a growth mindset in both our teachers and students.

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"Growth Mindset: Enhancing Mathematical Learning"

1. Have teachers and/or students complete mindset pre-survey. (See **Growth Mindset Survey** Handout)

2. Teachers discuss classroom norms. (See **Positive Norms to Encourage in Math** Class Handout)

3. Teachers collaborate with students to create classroom norms.
    a. Post norms, sayings in classroom

4. Students watch video
https://www.youcubed.org/boosting-messages-from-how-to-learn-math-for-students/
(Success in math is all about your mindset. Having a growth mindset and believing you can learn anything if you work hard instead of a fixed mindset where you believe you are either good at math or not, will be important for success in school and life. Your brain is a muscle that gets stronger by practicing math.)

5. What feedback are teachers giving to students? (See **Growth Mindset Feedback** Handout)
    a. Have teachers choose 2 phrases per section to begin incorporating into everyday classroom language.

6. Communicate daily objective using student friendly and growth mindset language. (See **Communicating with a Growth Mindset** Handout)
    a. "Today we will make a connection between a quadratic equation and the intercepts of a parabola."
    b. "Today you will use what you know about square roots to solve an equation."
    c. "Today we will look at how patterns are changing."
    d. "Today we are going to represent a 3-dimensional figure by drawing its net. This will help us find the surface area of 3-dimensional figures."

7. Student Activity: Characteristics of a Successful Person (See **Student Mindset Activity** Handout)

8. Teacher Activity: Effective Effort in Math Class (See **Effort vs. Effective Effort Teacher/Student Activity** Handout)

9. Have teachers and/or students complete mindset post-survey.

10. Next Steps:
    - Identify triggers that provoke fixed mindset
    - Observe teachers/students to identify and discuss growth or fixed mindset language
    - Stay current with available resources

"Growth Mindset: Enhancing Mathematical Learning"

Resources

Videos

https://www.youtube.com/watch?v=2jDVd-nCEYc (Who is Carol Dweck)
https://www.youcubed.org/boosting-messages-from-how-to-learn-math-for-students/ (Boosting Message)
https://www.youtube.com/watch?v=pN34FNbOKXc (Eduardo Briceno-The Power of Belief -Mindset and Success)

Books

Dweck, Carol S. *Mindset: The New Psychology of Success*. New York: Random House, 2006. Print.

Articles

Briceno, Eduardo. "Effort, Grit or Insanity" Mindset Works. Mindset Works Inc., 24 Aug. 2014. Web. 15 Oct. 2015

Dweck, Carol. "Carol Dweck Revisits the 'Growth Mindset' Education Week. 23 Sept. 2015. Web. 15 Oct. 2015

Websites

https://www.youcubed.org/
www.mindsetworks.com

Growth Mindset Survey

* Required

1. **No matter who you are, you can change your intelligence a lot.** *
   Mark only one oval.

	1	2	3	4	5	
Stongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

2. **You have a certain amount of intelligence, and you really can't do much to change it.** *
   Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

3. **You can always greatly change how intelligent you are.** *
   Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

4. **Your intelligence is something about you that you cannot change very much.** *
   Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

5. **No matter how much intelligence you have, you can always change it quite a bit.** *
   Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

6. **You can learn new things, but you can't really change your basic intelligence.** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

7. **What grade are you in?**
Mark only one oval.

- ◯ grade 9
- ◯ grade 10
- ◯ grade 11
- ◯ grade 12

youcubed

Positive Norms to Encourage in Math Class

By Jo Boaler

1. Everyone Can Learn Math to the Highest Levels.
Encourage students to believe in themselves. There is no such thing as a "math" person. Everyone can reach the highest levels they want to, with hard work.

2. Mistakes are valuable
Mistakes grow your brain! It is good to struggle and make mistakes.

3. Questions are Really Important
Always ask questions, always answer questions. Ask yourself: why does that make sense?

4. Math is about Creativity and Making Sense.
Math is a very creative subject that is, at its core, about visualizing patterns and creating solution paths that others can see, discuss and critique.

5. Math is about Connections and Communicating
Math is a connected subject, and a form of communication. Represent math in different forms eg words, a picture, a graph, an equation, and link them. Color code!

6. Depth is much more important than speed.
Top mathematicians, such as Laurent Schwartz, think slowly and deeply.

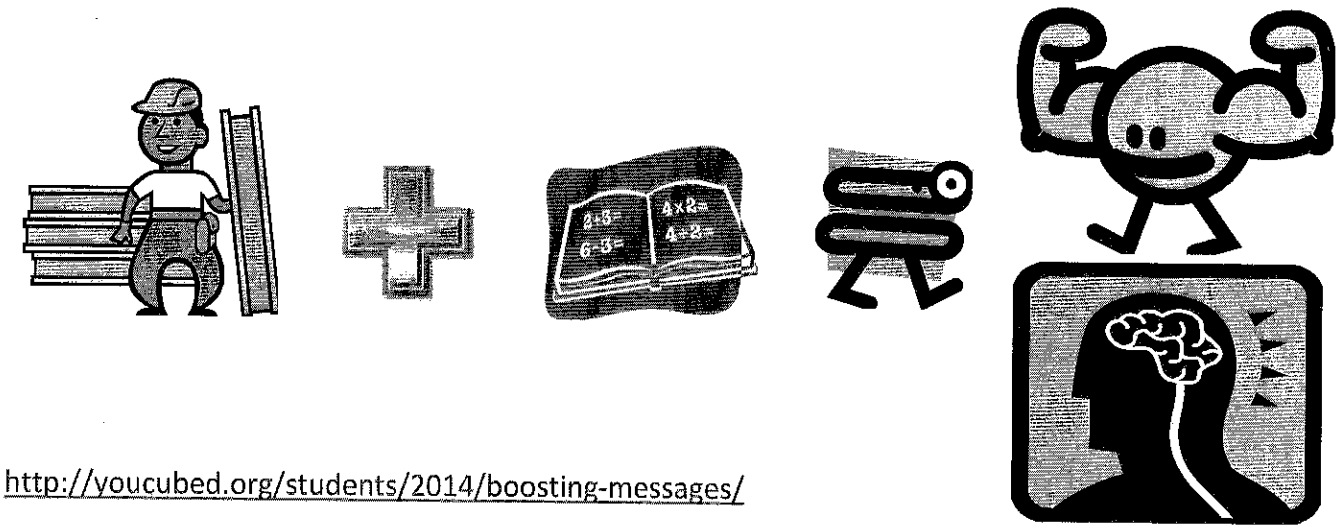
7. Math Class is about Learning not Performing
Math is a growth subject, it takes time to learn and it is all about effort.

The Positive Classroom Norms

- Everyone can learn math to the highest levels
- Mistakes are valuable
- Questions are really important
- Math is about creativity and making sense
- Math is about connections and communicating
- Math class is about learning not performing
- Depth is more important than speed

Mindset

Success in math is all about your mindset. Having a growth mindset and believing you can learn anything if you work hard instead of a fixed mindset where you believe you are either good at math or not, will be important for success in school and life. Your brain is a muscle that gets stronger by practicing math.



http://youcubed.org/students/2014/boosting-messages/

On this work sheet, answer the following questions.

What do you work hard at?

When are you successful?

Why might you be successful?

Growth Mindset Feedback

*As students begin to work on their learning objectives, growth minded language guides and motivates them to ensure that they remain **persistent, resilient, and focused** on the process of learning. It is important to give learners feedback about their progress and their results so they can specifically see their growth.*

Use these language frames when interacting with your students in the following situations.

When they struggle despite strong effort

- OK, so you didn't do as well as you wanted to. Let's look at this as an opportunity to learn.
- What did you do to prepare for this? Is there anything you could do to prepare differently next time?
- You are not there/here ***yet***.
- When you think you can't do it, remind yourself that you can't do it ***yet.***
- I expect you to make some mistakes. It is the kinds of mistakes that you make along the way that tell me how to support you.
- Mistakes are welcome here!
- You might be struggling, but you are making progress. I can see your growth (in these places).
- Look at how much progress you made on this. Do you remember how much more challenging this was (yesterday/last week/last year)?
- Of course it's tough –school is here to makes our brains stronger!
- If it were easy you wouldn't be learning anything!
- You can do it – it's tough, but you can; let's break it down into steps.
- Let's stop here and return tomorrow with a fresher brain.
- I admire your persistence and I appreciate your hard work. It will pay off.

When they struggle and need help with strategies

- Let's think about how to improve (the accuracy of) this section/paragraph/sentence/word choice/logic/description/problem/calculation.
- Let me add new information to help you solve this....
- Here are some strategies to figure this out.
- Describe your process for completing this task.
- Let's do one together, out loud.
- Let's practice (skill) so we can move it from our short-term to our long-term memory.
- Just try – we can always fix mistakes once I see where you are getting held up.
- Let me explain in another way with different words.
- What parts were difficult for you? Let's look at them.
- Let's ask ------ for advice—s/he may be able to explain/suggest some ideas/recommend some strategies.
- Let's write a plan for practicing and/or learning.
- If you make_____changes, we can reassess your score. Let's discuss a plan for you.

When they are making progress

- Hey that's a tough problem/task/concept that you've been working on for a while. What strategies are you using?
- I can see a difference in this work compared to____. You have really grown (in these areas).
- I see you using your strategies/tools/notes/etc. Keep it up!
- Hey! You were working on this for a while and you didn't quit!
- Your hard work is clearly evident in your process/project/essay/assignment.

When they succeed with strong effort

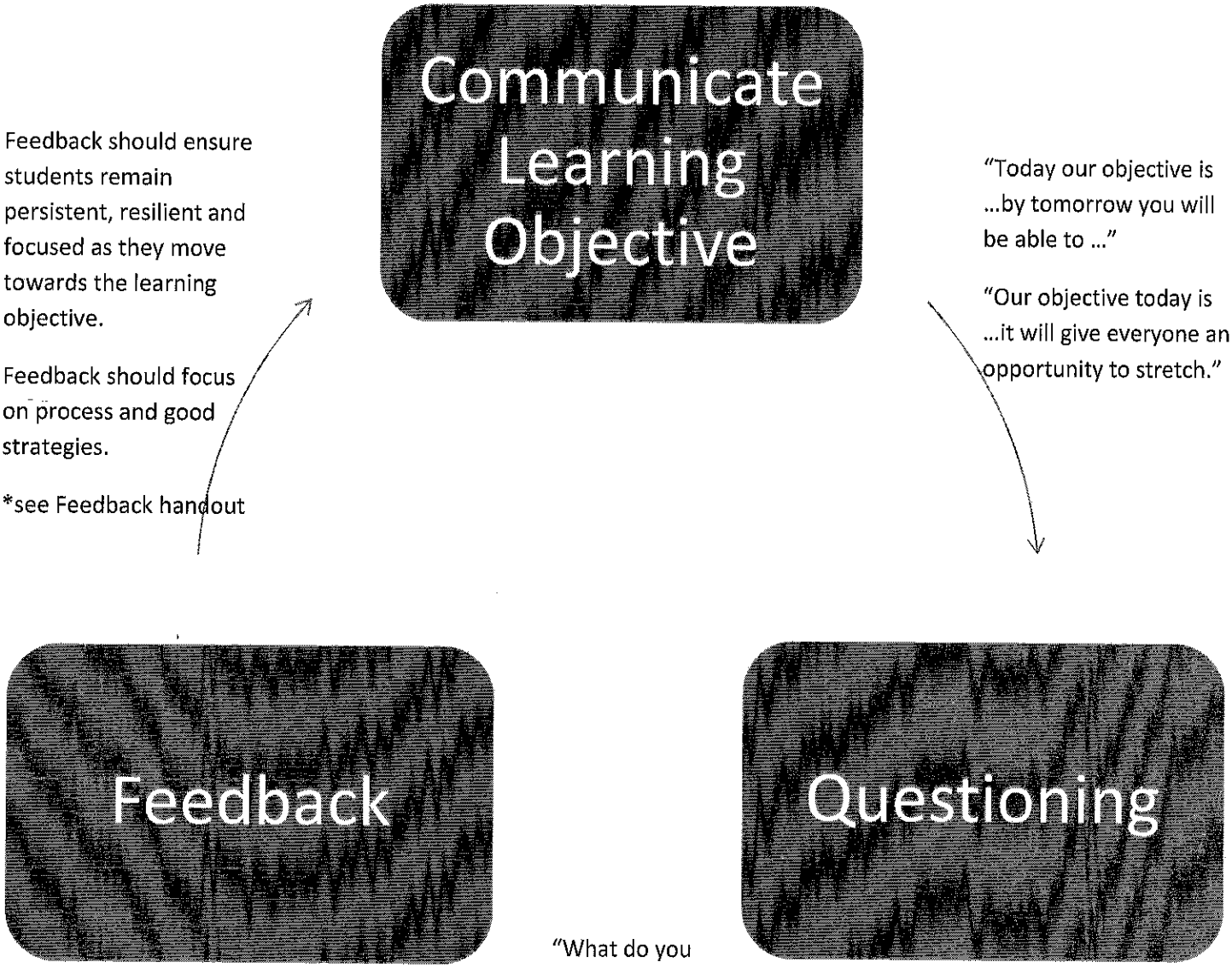
- I am so proud of the effort you put forth to/in/with_____.
- I am very proud of you for not giving up, and look what you have to show for it!
- Congratulations – you really used great strategies for studying, managing your time (behavior, etc.).
- I want you to remember for a moment how challenging this was when you began. Look at how far you have come!
- All that hard work and effort paid off!
- The next time you have a challenge like this, what will you do?
- What choices did you make that you think contributed to your success?
- It's exciting to see the difference in your work now when I compare it to your earlier work.
- I can see you really enjoyed learning_____.

When they succeed easily without effort

- It's great that you have that down. Now we need to find something a bit more challenging so you can grow.
- It looks like your skills weren't really challenged by this assignment. Sorry for wasting your time!
- I don't want you to be bored because you're not challenging yourself.
- We need to raise the bar for you now.
- You're ready for something more difficult.
- What skill would you like to work on next?
- What topic would you like to learn more about next?

To access more free resources, visit www.mindsetworks.com/free-resources/

Communicating with a Growth Mindset



Student Mindset Activity - Directions

(5 min)

1. Each student individually will brainstorm the characteristics of a successful person and use a small piece of paper to record. They should be encouraged to write as many characteristics that they can think of. As time is winding down, you may want to suggest that they are not limited to academic success, but can think of people that are successful in music, sports, politics, entertainment etc.

(20 min for steps 2 and 3)

2. Students now should be arranged in teams of four. Send the "Success Activity" doc to one of the students in the team. The column heading on the left is "Characteristics of a Successful Person", the column heading in the middle is "Criteria" and the column heading on the right is blank. The criteria column is filled in.
3. If you are using Google docs, each team should re-save the document prior to filling it in. The team can now use their brainstorm papers along with good conversation to complete the column on the left.

   Prompting questions/statements:
   What does _____look like?
   What do they do?
   Why do they____?
   How does it help them?

   If they are not sure what perseverance or another vocab word means, they can look it up. Let them be resourceful.

(20 min steps 4 and 5)

4. After they have completed the left hand column the team member that has been taking notes should share it with the other team members and yourself. Everyone then should take out their own Chrome book, open the document, and create a copy with their name. It is now their personal document. Once copied and open, have them type in a title for the 3rd column, "Characteristics of Me."

5. Encourage them to do a self-reflection on each criterion as it relates to them. They are focusing on themselves and the criteria. They do not have to limit the reflection to when they are successful or a specific aspect of their life. Encourage them to think of different aspects of their life and how they meet the criteria. This is their personal document and they do not have to share it with anyone.

Leave 3-4 minutes for **closure.** The question used was:
Why do you think we took a day off of math to do this activity?
Responses: "We were ahead of the other classes." "We have mid-terms coming up and it will help us with our studying." "So you can get to know us better." "So we can get to know ourselves better." "So you can use the information about our strengths and weaknesses to better group us."

Self-reflection is challenging and uncomfortable for many students. Praise them for their effort and thoughtfulness!

Day Two:

6. Each student receives a hard copy of the Top Hat organizer. It has the comparison Top Hat on one side and the reflection sheet on the other. They use their Criterion sheet to identify similarities and differences based on the criteria of themselves and a successful person.

7. Goal setting. Flip over the top hat and allow time for students to complete.

You are collecting their Top Hat/Reflection sheet.

WHAT YOU NEED:

1. Brainstorm slips. It is important for them to have their own thoughts written down so they can contribute.

2. Google Doc template. Share it with your recorder/reporter for each study team.

3. Hard copy of Top Hat with reflection sheet.

*** You may choose to not use the top hat organizer and go right to the reflection sheet. It will shorten activity to 1 to 1.5 days.***

We collected the reflection sheet and conferenced with students 10 weeks later to see how they were doing and what support they needed.

Think about a successful person(s). What are some of the characteristics of a successful person?

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Success Activity

Characteristics of a Successful person	Criteria	
	Organization	
	Motivation	
	Perseverance	
	Asks Questions	
	Takes on Challenges	
	Learns from Mistakes	
	Accepts Feedback and Criticism	

Name_____

Top Hat Organizer

Successful Person	Characteristics of Me
DIFFERENCES	
SIMILARITIES	

Reflection

1. A successful person is:

2. What 2 Criteria areas can you personally try to grow in during the 2nd semester? Circle two.

Organization	Motivation	Perseverance	Asks Questions
Takes on Challenges	Learns from mistakes	Accepts Criticism and Feedback	

3. What can you do to achieve growth in the areas?

4. What support will you need to achieve the growth?

Effort vs. Effective Effort Teacher Activity

1. Teachers think and ink individually on the following:

Effective Effort in Math Class is:	Effective Effort in Math Class is not:
•	•

2. Teachers read article "Effort, Grit or Insanity" by Eduardo Briceno, CEO Mindset Works

3. Teachers reflect on the article and add to their list from step 1.

4. Teachers are given the Effective Effort in Math Class Rubric. The Rubric has rows and columns labeled but the body is empty. They use their ideas from above to complete the body of the rubric. (I had teams of teachers responsible for specific criteria.) Ex. 3 teachers working collaboratively on "Taking on Challenges" and "Learning from Mistakes." Then teachers come back together as a department to complete the body of the rubric.

5. Teachers brainstormed how they might use the rubric with students to help them reflect on their effort.

Effort vs. Effective Effort Student Activity

Teachers used the rubric, article and comparison differently depending on their course. Some ideas:

1. Students read article, create the comparison, complete a task or assessment, and apply the rubric as a reflection piece.

2. Students read the article and apply the rubric as a reflection piece.

3. Students apply the rubric as a reflection piece after an assessment.

Effective Effort Comparison

Effective Effort in Math Class is:	Effective Effort in Math Class is not:
•	•

Effective Effort in Math Class is:	Effective Effort in Math Class is not:
• persistence • prepared for class • listening • trying things a different way • actively engaged • objective in mind • asking for help • explaining to others • keeping a growth mindset • focus on math • math talk • taking ownership • thinking before talking • completing, checking and correcting assignments • trying to make connections • multiple/different strategies • grit • sharing strategies • reflections on what is working/not working • breaking tasks down	• doing problems to get them done • doing the same thing over and over without seeking and applying feedback • technology distractions • giving up • copying others work • disorganization • off task behaviors •

Effort, Grit or Insanity

by Eduardo Briceno, CEO Mindset Works

If students are struggling, we want them to remain motivated, try harder, and stick with it. But what about the saying, "Insanity is doing the same thing over and over again and expecting a different result"? If a student has tried to learn something, didn't succeed, tried the same thing again and again, and never felt progress, is he likely to think that trying yet again will yield results? And is that motivating or demotivating?

George Washington had a lot of grit. He led the Continental Army during the American Revolutionary War when the British army had much greater resources, and more and better-trained soldiers. It took grit to lead the Continental Army for eight years and eventually win the war. But George Washington also sometimes quit, which seems at odds with having grit. He went into battles aiming to win, but when things weren't working in his favor, he sometimes decided to retreat. He would give up the near-term goal of winning the battle because he realized that pursuing that goal would yield large losses in the American army, thereby compromising the more important, long-term goal of gaining independence. He'd go back, regroup, think about a different strategy or tactic to try next, set a new goal, and go for it. If that didn't work, he'd try something else, always committed to the big aim. This is grit. It's the "perseverance and passion for long-term goals" (Duckworth, Peterson, Matthews, & Kelly, 2007, p.1087).

Often, students and adults don't recognize the difference between effort and effective effort. If we say "try harder", "study more", or "stick with it", students may think that they need to sit in front of their assignment for more time, continuing to do the same thing that hasn't worked for them in the past, rather than finding a more effective strategy to achieve their goal, such as trying to solve a simpler problem in as many ways as possible, breaking down the task into smaller pieces, drawing a picture and showing it to someone for feedback, drilling down on mistakes to understand them, setting specific learning goals at the appropriate level of challenge, and asking for help, among many others. We need to teach effective learning strategies, and to encourage students to share strategies with one another.

Effective effort involves reflecting on our approaches to work smarter, which is needed to achieve different outcomes. Teaching that to students, along with effective learning strategies and the understanding that we can change our abilities (a growth mindset), motivates them, as it gives them a path to success.

The same is true of us as educators. Sometimes we forget the need to reflect on our overall approaches. If what we have done in our classrooms hasn't worked in the past, do we have the grit to stick with our goal of reaching all students? Will we put in the effort to reflect on our approaches, and learn about and try different strategies, until we find a way to achieve our big, hairy, audacious goal?

If we are aware of the distinction between effort and effective effort, and ensure students are too, we can all work together on building our self-management and learning competencies to maximize our progress. Students then come to understand that we're not asking them to pound their head against a wall, but to learn more effective ways to learn, with a growth mindset, and that we're here to support them and to improve with them along the way. That motivates them, and it empowers them with the learning competencies needed to thrive in school and in life.

What is more important for schools to do than to develop students as motivated and effective learners?

Reference

Duckworth, A.L., Peterson, C., Matthews, M.D., & Kelly, D.R. (2007). Grit: Perseverance and passion for long-term goals. Personality Processes and Individual Differences, 92 (6). Retrieved from: http://www.sas.upenn.edu/~duckwort/images/Grit%20JPSP.pdf

Effective Effort Rubric

Effective Effort in Math Class Rubric			
	Fixed Mindset	**Mixed**	**Growth Mindset**
Taking on Challenges			
Learning from Mistakes			
Accepting Feedback and Criticism			
Practice and Applying Strategies			
Perseverance			
Asking Questions			
Taking Risks			

Effective Effort in Math Class Rubric			
	Fixed Mindset	**Mixed**	**Growth Mindset**
Taking on Challenges	You avoid challenges. If you are not sure how to start a math problem, you don't start it or immediately seek out help.	You might begin a problem right away without assistance if you are familiar with it.	You read and interpret the problem set. You think about what you already know, how it can help you and strategize how to move forward.
Learning from Mistakes	You don't pay attention to your mistakes and continue to make the same mistakes.	You recognize the mistake but do not make the effort needed to learn from the mistake.	You recognize, correct, and learn from mistakes in an effort not to make them again.
Accepting Feedback and Criticism	You do not listen or comprehend the feedback/criticism. You take it personally.	You listen and welcome the feedback but don't know what to do with the information.	You listen, rethink, retry, and appreciate the help.
Practice and Applying Strategies	You approach the problem with only one strategy.	You may try a new strategy but fall back to the one you know.	You are open to and use different strategies in approaching the problem.
Perseverance	You give up immediately.	You may try once then give up.	You try multiple times and are willing to take advice. You don't give up.
Asking Questions	You do not question for further understanding.	You question for correctness of answers; not for deeper understanding.	You ask questions to further your conceptual understanding; to help build connections between concepts.
Taking Risks	You do not take risks.	You take risks if they are safe.	You are willing to be awesome. Open to trying different strategies.