Dealing with Frustration

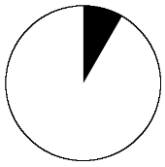
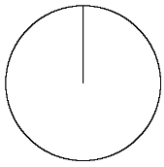
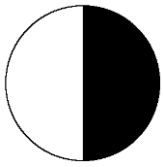
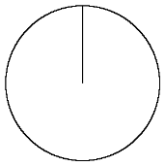
Program Type: Classroom Discussion	***Audience Type:*** Grades 3–8

Description: Brainstorm techniques for dealing with frustration and showing persistence during engineering activities. This discussion works best after students have experienced at least one challenging engineering activity.

LEARNING OBJECTIVES

- Students will learn productive ways to deal with frustration and overcome mental blocks.

TIME REQUIRED

Advance Prep	Set Up	Activity	Clean Up
			
5 minutes	**0 minutes**	**30 minutes**	**0 minutes**

SITE REQUIREMENTS

- None

PROGRAM FORMAT

Segment	Format	Time
Introduction	Instructor-led discussion	10 min
Dealing with Frustration	Large group discussion	15 min
Wrap-up	Large group discussion	5 min

SUPPLIES

Supplies	Amount	Notes
Large piece of paper	1	Chart pack or poster board
Markers	2–3	

ADVANCE PREPARATION

The facilitator should think about what they do when they are “stuck.” Think of a few strategies you use in your own life to deal with frustrating situations.

SET UP

None required.

INTRODUCTION

10 minutes

Let students speculate before offering answers to any questions. The answers given are provided primarily for the instructor's benefit.

Suggested script is shaded. Important points or questions are in **bold**. Possible answers are shown in *italics*.

Launch discussion by reminding students of something that many found difficult to do in a previous session.

Do you think the first design an engineer makes is usually the best?
It can take many tries before an engineer comes up with a design that will work.

Highlight that in previous sessions students persisted despite frustrations and were able to accomplish something in the end.

Ask students to share about a time that they were frustrated.

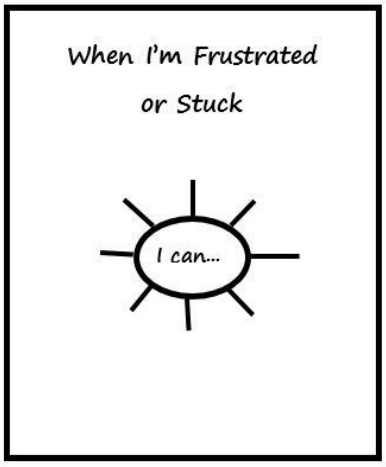
Today we are going to pool our knowledge and brainstorm some strategies for what to do when we get frustrated during an engineering activity.

GROUP ACTIVITY

Group Sharing

15 minutes

Draw a diagram on the chart or poster board:



What are some positive things you could do if you get frustrated when creating a design? *Stop, take a break, and calm down. Then look at neighbors' designs to get ideas, or ask them for help. Have a positive attitude!*

Take student input to build a web of suggestions for things to do when frustrated. Some examples are:

- Take a deep breath
- Look at what other people are doing
- Try again
- Ask for help
- Stretch
- Take a step back and look at the whole thing
- Pinpoint what the problem is
- Try a whole new idea!

Is it OK to use ideas from your neighbors? *Yes! Engineers often take existing ideas and improve on them, or find a new use for an old design. You are encouraged to look at what your neighbors are doing and use their ideas—their work might just lead to an even better idea!*

WRAP-UP

5 minutes

Which of these strategies do you already use in your life? Which of these do you not use but think could be easy to practice during our next engineering activity?

Keep the sign posted for future engineering activities; or, bring it back into the classroom for every session. Return to the list and keep adding things as you go through the various lessons.

Who is an Engineer?

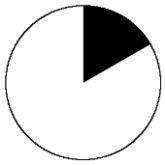
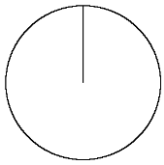
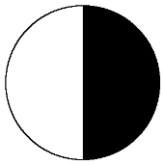
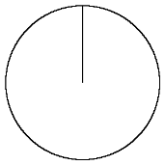
Program Type: Classroom Discussion	***Audience Type:*** Grades 3–8

Description: The goal of this discussion is to activate prior knowledge of engineering and challenge stereotypes about who can be an engineer.

LEARNING OBJECTIVES

- Students will learn that anyone can be an engineer and that engineers do not fit stereotypes.

TIME REQUIRED

Advance Prep	Set Up	Activity	Clean Up
			
10 minutes	**0 minutes**	**30 minutes**	**0 minutes**

SITE REQUIREMENTS

- None

PROGRAM FORMAT

Segment	Format	Time
Introduction: Draw an Engineer	Group activity	10 min
Engineer Cards	Group activity	15 min
Wrap-up	Large group discussion	5 min

SUPPLIES

Supplies	Amount	Notes
Engineer cards	1 set/group	In appendix
Blank paper	1/student	8.5 x 11
Markers or colored pencils	3–4/student	
Whiteboard	1	Or chart paper, chalkboard
Dry erase markers	At least 1	Or chalk or markers
Laminator	1	*(Optional)*

ADVANCE PREPARATION

- Print and cut out the engineer cards. If you prefer, laminate them for durability and reusability. Print enough sets so that each group can have 5–6 cards.

SET UP

None required

INTRODUCTION

10 minutes

Let students speculate before offering answers. The answers given are primarily for the instructor's benefit.

Suggested script is shaded. Important points or questions are in **bold**. Possible answers are shown in *italics*.

Prompt students to begin thinking about what they know about engineers. Create a list on the whiteboard or chart paper that captures their responses.

- **What do engineers wear?**
- **What do they look like?**
- **What tools do engineers use?**
- **Where do engineers work?**

Collaborative: With younger students and students who have very little familiarity with engineering, make a group sketch of what an engineer might look like.

Individual: With older students and students who have been exposed to engineering, distribute blank paper and give them five minutes to create individual sketches of an engineer and their environment. Have them share about their drawings in pairs or in small groups.

GROUP ACTIVITY

Engineer Cards

15 minutes

We are going to play a short game called "Who is an Engineer?" Your goal is to look at all these cards and decide who is an engineer and who is not.

Think of these two questions as you sort the cards:

Write on the board:
What does an engineer do?
What does an engineer need to have?

Divide the class into groups of 3-6. Pass out at least five cards to each group and instruct them to look at the photo without turning the cards over. If possible, have a facilitator at each group helps enforce this rule.

Discuss the questions on the board and sort the cards into two different piles: *Engineer* and *Not Engineer.*

When each group has finished sorting every card, let them turn the cards over and read the backs. Give them a few minutes to discuss the reveal: *All of the people pictured are engineers!*

Engineers use science, math, and creativity to solve problems for people and improve our world. They often work in teams and test out many different ideas before finding one that works best. They come from all backgrounds and can be any gender or age.

WRAP-UP

5 minutes

Ask for student observations. There is no correct answer. Let students guide the discussion.

Bring the whole group back together and ask students what their reactions were and what they learned.

Were you surprised by the results of this activity? Why or why not?

How did you decide if a person was an engineer or not?

Would you make any changes to the drawing you made of your engineer?

Bethany Foran is a Civil Engineer

I bring electricity to small towns all over the world. This is me holding a survey rod down in Ecuador while surveying the community for a water line.

A. Lee is a Civil Engineer

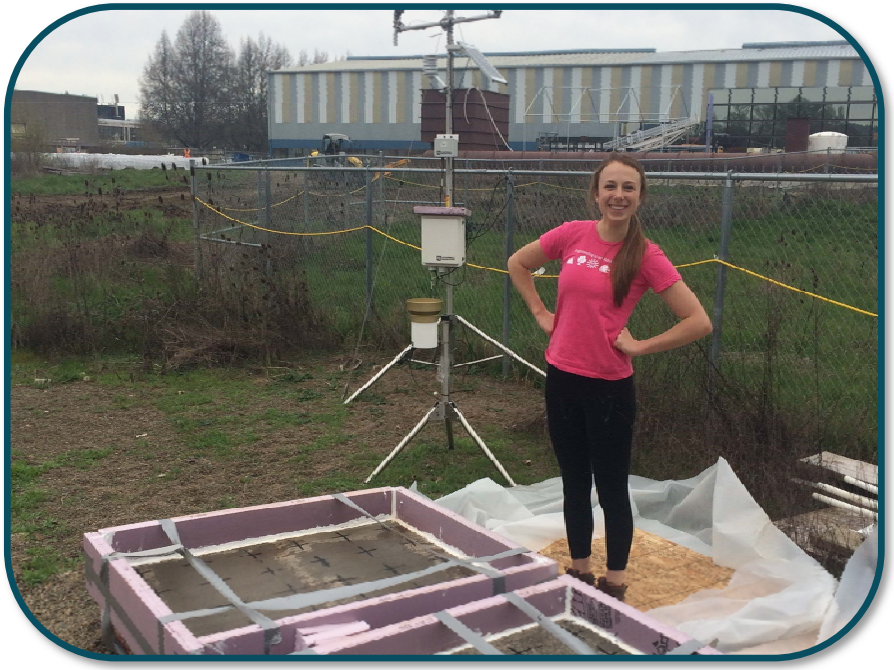
I design bridges to help people and fish get from place to place. I coordinate with other engineers who focus on roads, water, soils, and traffic.

Allison Loh is an Engineering

At Boeing, I manage the technicians who build planes. I design ways to make the process safer and quicker, while making sure the planes are as high-quality as always. As a manager, I'm also in charge of motivating my employees and helping them grow.

Brittany Stone and Joanne Shields are

We work with artists to de-sign art installations.



Marisol Martinez Escobar is a Human Factors Engineer

I conduct user studies such as surveys and interviews to understand how people use technology. The purpose is to create better technology that will be more useful to people.

Christine Baker is a Civil Engineer

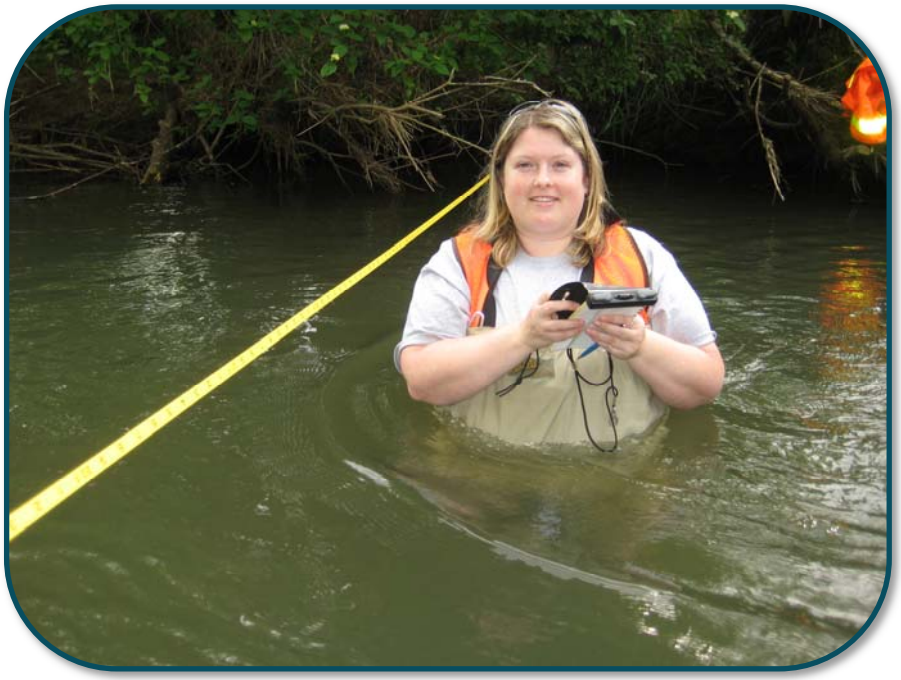
I help graduate students with research in the Concrete Materials Lab at Oregon State University. This is me working to develop computer tools that test the concrete on bridges to make sure it doesn't weaken and become unsafe.

Emily Harris is a Civil and Structural Engineer

I've worked to clean and control rain-water in cities, which helps keep our environment and community healthy and safe. I also work with buildings, making sure that their different parts are secure in case of an earthquake.

Grey Osten is a Software Engineer

I work full time as an app programmer. This keeps my skills sharp so I can focus on my passion, working to offset the gender imbalance in tech by teaching girls how to make their own apps at summer camp.




SLOCUM


HDR
08/21/2015 09:55

Lauren Krueger is an Electrical

I design the electrical systems for all types of buildings — from university buildings to apartments, even Disneyland! I am really passionate about renovating old buildings, which has fewer environmental impacts than making a new building.

Mauria P. is a Water Resources En-

I work in rivers and streams to provide habitat for fish and wildlife. I also help design bridges over rivers and streams that can handle flood events and provide safe structures for people to use every day.

Megan Tatara is an Electrical

I work on movable bridges, which allow cars and trains to travel across them but also move to allow tall ships to transport food and other daily goods into and out of communities.

Elizabeth Kusel is an Electrical

I study how sounds, especially from whales, travel underwater and it helps people understand and protect the oceans.

Shirley Chalupa is a Structural

I evaluate and check the life safety design for buildings people live and work in. Structural engineering is about providing people with the basic essentials of reliable shelter and comfort.

Raúl Bayoán Cal is a Mechanical

I use physics to figure out real-world problems. I'm currently doing lab experiments to improve our ability to predict where ash will spread after a volcano erupts so that communities can be better prepared.

Stephen Solovitz is a Mechanical

I use designs inspired by nature to build better tools for cooling electronics. I also do experiments to understanding how jets of volcanic ash move.

Trabajamos con artistas para diseñar instalaciones de arte.

Brittany Stone y Joanne Shields son ingenieros de diseño

En Boeing, administro a los técnicos que construyen aviones. Planifico formas de hacer el proceso más seguro y rápido, al mismo tiempo asegurándome que los aviones sean de la misma alta calidad de siempre. Como gerente, también me encargo de animar a mis empleados y ayudar-

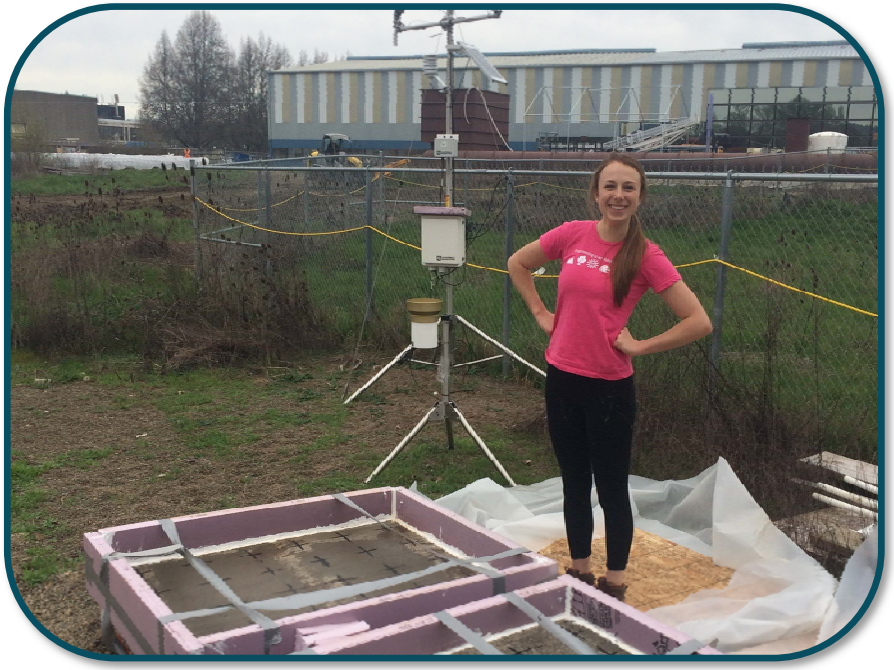
Allison Loh es gerente de ingenie-

Yo diseño puentes para ayudar a que las personas y los pescados se trasladen de lugar en lugar. Trabajo con otros ingenieros que se especializan en caminos,

A. Lee es ingeniero civil

Yo llevo electricidad a pueblos pequeños en todo el mundo. En esta foto salgo afirmando una vara de sondeo en Ecua-dor mientras trato de encon-trar una cañería de agua en el

Bethany Foran es ingeniero civil



Marisol Martínez Escobar es ingeniero de factores humanos

Yo realizo estudios de usuario, como encuestas y entrevistas, para entender cómo la gente utiliza la tecnología. El propósito de esto es crear tecnología que le servirá más a la gente.

Christine Baker es ingeniero civil

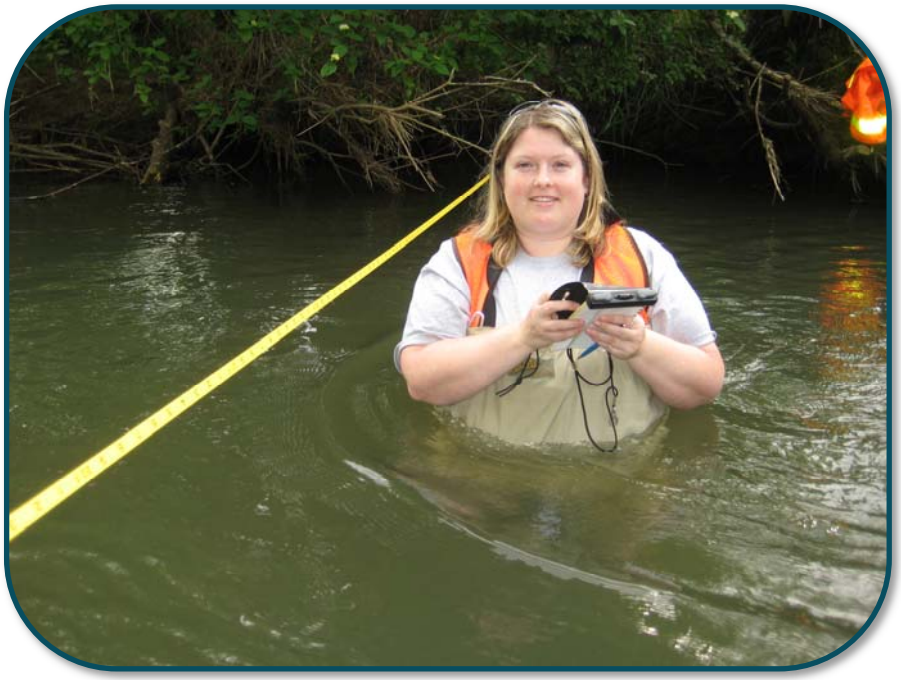
Ayudo a estudiantes de postgrado de Oregon State University con sus investigaciones en el laboratorio de materiales de cemento. En esta foto estoy trabajando para desarrollar herramientas informáticas que prueben el cemento de los puentes para asegurarnos que no se debiliten y

Emily Harris es ingeniero civil y

Trabajo para limpiar y controlar el agua de lluvia en las ciudades, lo que ayuda a mantener la salud y seguridad de nuestro medioambiente y nuestra comunidad. También trabajo con edificios, asegurándome que

Grey Osten es ingeniero de progra-

Trabajo como programador de aplicaciones. Esto mantiene mis habilidades afinadas para poder dedicarme a lo que me apasiona: mejorar el equilibrio de género en el área de la tecnología. Para esto, me dedico a enseñarle a niñas a crear sus




SLOCUM


HDR
08/21/2015 09:55

Lauren Krueger es ingeniero eléc-

Yo diseño sistemas eléctricos para toda clase de edificios — universidades, departamentos, ¡incluso Disneyland! Me encanta renovar edificios antiguos, ya que hacerlo ocasiona un menor impacto ambien-

Mauria P. es ingeniero de recursos

Yo trabajo en ríos y arroyos para brindarles un hábitat a los peces y a la vida salvaje. También ayudo a diseñar puentes sobre ríos y arroyos que puedan resistir aluviones y que sean estructuras

Megan Tatara es ingeniero eléctri-

Trabajo en puentes móviles, que dejan desplazarse a vehículos y trenes sobre ellos, pero que también se mueven para dejar pasar embarcaciones altas que transportan alimentos y otros productos desde y

Elizabeth Kusel es ingeniero eléc-

Estudio cómo los sonidos, especialmente los de las ballenas, viajan bajo el agua. Esto ayuda a que podamos entender y proteger mejor

Shirley Chalupa es ingeniero es-

Evalúo y reviso el diseño de seguridad de vida en los edificios en los que la gente vive y trabaja. La ingeniería estructural se basa en ofrecerle a las personas lo básico y esencial en comodidad y seguridad en el lugar

Raúl Bayoán Cal es ingeniero mecá-

Utilizo la física para resolver problemas. Actualmente hago experimentos de laboratorio para mejorar nuestra habilidad de predecir dónde caerán cenizas después de una erupción volcánica. De este modo, las

Stephen Solovitz es ingeniero

Utilizo diseños inspirados por la naturaleza para construir mejores herramientas para enfriar equipos electrónicos. También hago experimentos para entender cómo se

Fixed vs. Growth Mindset

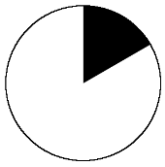
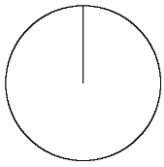
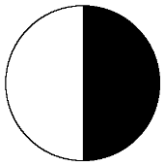
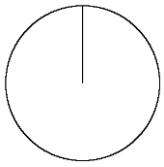
Program Type: Classroom Discussion	***Audience Type:*** Grades 3–8

Description: Encourage debate over fixed vs. learned abilities, with the final message being that success at engineering (along with most things) is learned, not innate, and skills can be improved with practice.

LEARNING OBJECTIVES

- Students will discuss the importance of a growth mindset and learn that skills and abilities are improved with practice.

TIME REQUIRED

Advance Prep	Set Up	Activity	Clean Up
			
10 minutes	**0 minutes**	**30 minutes**	**0 minutes**

SITE REQUIREMENTS

- Access to the internet, computer, projector and screen.

PROGRAM FORMAT

Segment	Format	Time
Introduction	Instructor-led discussion	10 min
Fixed vs. Growth Mindset	Large group discussion	15 min
Wrap-up	Large group discussion	5 min

SUPPLIES

Supplies	Amount	Notes
Computer, projector, and screen	1	*(Optional)*
"You Can Grow Your Intelligence" Handout	1/student	In Appendix *(Optional)*

ADVANCE PREPARATION

"I can't do it!" "Ugh, I'm so bad at engineering!" "I'm not a science person."

Chances are, you've heard students use phrases like these when they are frustrated with an activity. They are all examples of a **fixed mindset**—the belief that our brains have strengths and weaknesses that don't change over time. The opposite of this mindset is a **growth mindset**—the belief that brains are like muscles and able to change, grow, and improve with practice.

There is considerable research in the world of education about the power of promoting a growth mindset. We recommend reading through some resources and research to familiarize yourself with the topic. Teacher language when giving praise and setting up challenges can have significant outcomes on student performance.
A great starting place is this collection of resources by Edutopia: http://www.edutopia.org/article/growth-mindset-resources. You can choose to print out some written materials for students to take home or explore in class.

The facilitator should think of a time when they had to overcome a struggle by being persistent and practicing a new skill. You will have time to share about this experience.

SET UP

None required

INTRODUCTION

10 minutes

Let students speculate before offering answers to any questions. The answers given are provided primarily for the instructor's benefit.

Suggested script is shaded. Important points or questions are in **bold**. Possible answers are shown in *italics*.

Were all of us born with the abilities we have today? Are people born smart, skilled, athletic, or knowledgeable?

No. When we are born, we can't read, we can't eat solid foods, we don't even know how to walk, and we certainly don't know how to play sports or play an instrument. All of these skills are developed based on what people call a **growth mindset**: the idea that our brains grow and strengthen based on how we use them.

Think of a talented athlete, musician, or artist you have heard of. Were these people born with the ability to do what they do? How did their skills get to where they are today? *They practiced!*

OPTIONAL (5 min): Below are two videos, both less than three minutes long, that are great starting points as you examine this topic:

Khan Academy – "You Can Learn Anything" (2014)
https://www.youtube.com/watch?v=JC82Il2cjqA
(Duration 1:31)

Sentis – "Neuroplasticity" (2012)
https://www.youtube.com/watch?v=ELpfYCZa87g
(Duration 2:04)

The Khan Academy video is a general, very upbeat introduction to the concept of growth mindset and showcases a wide variety of examples of how we learn new skills through practice. In contrast, the Sentis video explains how pathways in the brain grow and become reprogrammed. These videos aren't redundant, and they can be easily shown together thanks to their short durations.

In the same way a soccer player must practice to get better, we can also continue to practice our own skills to get better at something we want to accomplish. If you have ever said, "I'm not good at math," it is because you have not developed those skills yet. You can "get good" at anything if you continue to try, fail, and learn from your mistakes. Our brains can learn anything!

Share with students a personal anecdote from your life that highlights a time when you struggled with something, but were able to practice and become better. Choose a story that involves hard work and touches on the strategies you used and the people who helped you. If you were able to show the videos, relate your story back to them.

GROUP ACTIVITY

Fixed vs. Growth Mindset

15 minutes

If there are multiple adults present, split students into groups so that there is at least one adult facilitator per group. Alternatively, do this activity as a whole-group discussion. Distribute the "You Can Grow Your Intelligence" handout from Brainology™ for students to read and take home.

Think of a time when you struggled with something challenging and you had to learn skills in the process. Maybe you were practicing a sport, or you wanted to get better at drawing. Perhaps you had to help with chores or cooking and didn't quite know how to do things at first. Do you have an example of how you practiced a growth mindset in your own life?

As students are sharing, create a list of characteristics of someone with a growth mindset on the board or chart paper.

Examples:

- *"Doesn't give up"*
- *"Tries new strategies"*
- *"Asks for help"*
- *"Doesn't get discouraged or embarrassed by failure"*

Ask students what else should be added to the list.

WRAP-UP

5 minutes

Ask for student observations. There is no correct answer. Let students guide the discussion.

Bring the whole group back together and discuss some stories, reviewing the difference between a fixed and growth mindset.

What abilities have you developed in life?
How did you get to the level you are at now?
What can you do to continue to get better at things you want to improve?