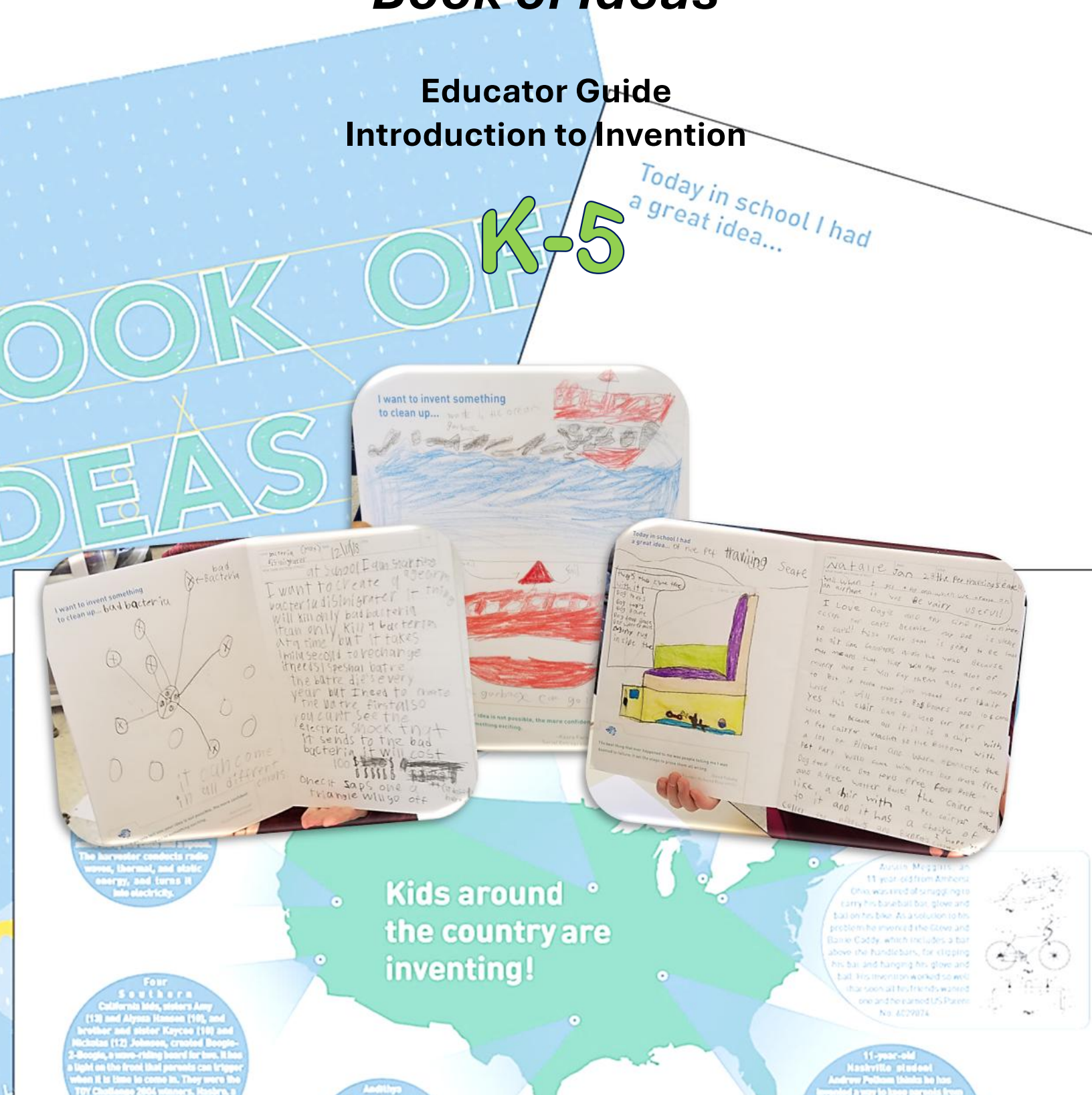
CreositySpace

Connecting Kids to STEM Through Entrepreneurship

Book of Ideas

Educator Guide
Introduction to Invention

K-5



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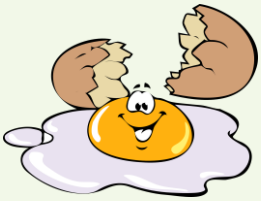

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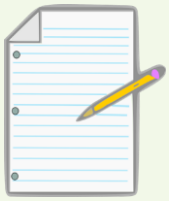

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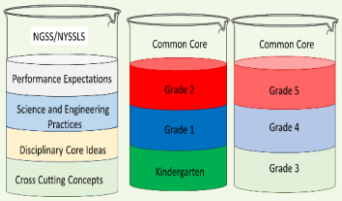


"Using the* Book of Ideas *as a center during our ELA block fosters creativity and independent thinking and provides students with a purpose to write."

— Susan H., Grade 3 Teacher

Welcome to CreositySpace

We're glad you're here.

CreositySpace educational materials have been developed with the philosophy that students learn better when what they are learning is put into a context relevant to them and are designed with three goals in mind:

1. Introduce students, their teachers, and family members to a variety of STEM topics.
2. Give students practice with tools and processes common to science & engineering.
3. Introduce students to a variety of STEM professionals and entrepreneurs.

To support these goals, CreositySpace programs and lessons typically follow a *Do-Learn-Do-Invent* format.

Do: Students are actively working independently or in groups on a challenge, experiment, or having a discussion.

Learn: "Formal" lessons are kept short (micro-lessons) and can involve videos or guided discussions when possible. We aim to keep the "lecturing" to a minimum.

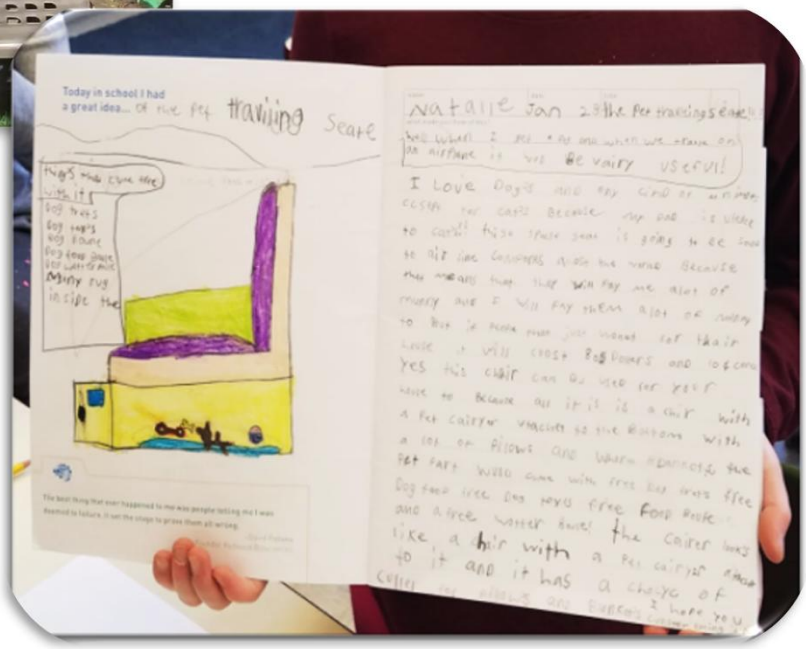
Invent: Since the bulk of the "Do" in this series involves students developing their own inventions or innovations, the "Invent" portion focuses on introducing students to "everyday" inventors of all ages.

Successful implementation of each CreositySpace unit is important to us, and to that end our company is committed to providing ongoing support to you—from brainstorming ideas and helping with an activity to answering questions around implementation.

Don't hesitate to reach out to us.

We hope *Book of Ideas* inspires and energizes your classroom to explore the intersection of science with the world around you. We welcome your feedback on what you like, would like to see, or even change. Feel free to reach out to us at Kath@CreositySpace.com.

Natalie and her *Pet Traveler Seat—Grade 3*



Lesson Support

Quick Start Lessons 	**What Are They**—The *Quick Start* lessons are brief lesson outline for introducing the *Book of Ideas* to your group. Each lesson outline includes: • A few **preparation** activities to pick from—to get your students excited and ready for the *Book of Ideas* • An **introduction** lesson outline for when you first pass out and have students start working in their *Book of Ideas* **Best (but not exclusively) Suited For**—The *Quick Start* lessons are perfect for teachers who already have some ideas about how they would like to use the Book of Ideas in their classroom but could use some help getting started.
Short Scripted Units 	**What Are They**—The *Short Scripted Units* are two 3- and 4-lesson series designed to provide more structure and support as you introduce your students to innovation and the *Book of Ideas* to your group. They are: • Helping your students see the inventor within, and • Mini innovation challenge. **Best (but not exclusively) Suited For**—The *Short Scripted Units* are best suited for teachers with young or inexperienced students, as well as teachers or after school program leaders who are working on a very tight timeline.
***À-la-Carte* Activities** 	**What Are They**—The *À-la-Carte* activities are a smattering of activity suggestions on ways to introduce and integrate innovation and the *Book of Ideas* into your classroom. **Best (but not exclusively) Suited For** —Classroom teachers, educational specialist, and after-school providers who are already fairly comfortable with science/STEM and/or innovation in general and who are looking for flexible ways to integrate the *Book of Ideas* into their current programming.

This Guide

This lesson guide, and the associated slides, are meant to support you and your students in their use of the *Book of Ideas*. **There is no wrong way to use the *Book of Ideas* and above all, it should be considered a conversation-starter and a great way to encourage creativity, communication, collaboration, and curiosity in your classroom.** That being said, sometimes knowing how to get started can be challenging, and this lesson guide provides support for just that.

Lesson scripting

Lesson scripting is provided in each section, either as detailed instruction or specific suggested language. It is included as a support but is not a requirement. If there is other language you would prefer to use or that you feel would work better for your students, feel free to use that instead.

Vocabulary

Not understanding the vocabulary associated with a topic area can make a topic intimidating. Be sure to check that students understand key vocabulary around invention throughout the sessions. Age-appropriate definitions of these words are provided in the in the lesson scripting as well as in the glossary of the *Book of Ideas*.

Videos

All video links are provided via YouTube. Please check that your building internet permissions allow for access to YouTube. If not, please contact kath@creosityspace.com for alternative options.

Text color guide

Different types of instructional information are presented in different colors.

- Black: general instruction
- Rust: preparation information
- Purple: scripting
- Green: headings
- Bright Blue: emphasis

Quick Start Lessons

If you're already full of ideas and ready to dive right into using the *Book of Ideas* in your classroom, please feel free to skip forward to the À-la-Carte Activities section. If you would prefer a bit of structure to start with, these ***Quick Start Lessons*** might be the thing for you.

To begin, please consider the following questions:

- What is the **first** thing you'd like to accomplish by using the *Book of Ideas* in your classroom?
- What best describes the learning and collaboration style among your students?

While there are almost as many answers to these questions as there are classrooms, we've selected some of the most common responses and assembled a brief lesson outline for introducing the *Book of Ideas* to your group. Each lesson outline includes:

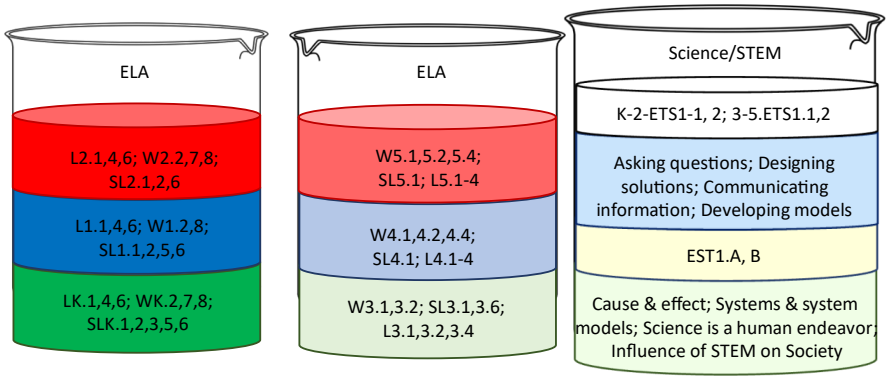
- A few **preparation** activities to pick from—to get your students excited and ready for the *Book of Ideas*
- An **introduction** lesson outline for when you first pass out and have students start working in their *Book of Ideas*

Once students have started working in their *Book of Ideas*, you can take your lesson direction from their ideas and interests keeping in mind some of the overarching goals of working with the *Book of Ideas* include:

- Giving students a comfortable space to describe, explore, and discuss their ideas
- Giving students a framework to practice the giving and receiving of constructive feedback
- Giving students an opportunity to build on their ideas—both individually and collaboratively—while fostering respect for different perspectives, interests, and skills
- Giving students a forum to demonstrate their knowledge and express their capabilities—especially for those who struggle with traditional evaluation methods

Key to Success: Students must have the opportunity to use their interests and ideas to determine the direction of their inventions.

The ELA and science standards supported by the activities described in this section are listed below. A full list of the standards can be found in the Education Standards section of this guide.



What is the first thing you'd like to accomplish by using the *Book of Ideas* in your classroom?

1. Integrate engineering concepts using innovation.

Preparation and introduction should focus on the engineering design process and the connection between engineering and the needs of the community.

Preparation

- Ask students what they know about the engineering design process. Essential questions or blank engineering design process templates (in Appendix) can be used as discussion prompts.
- Read and discuss Barrett and JD's story about E Ink. Focus on identifying parts of the engineering design process throughout the story.

Introduction

- Hand out the *Book of Ideas* and read through the innovation prompts together as a class.
- Have students select one prompt they like and spend 5–10 minutes working on their idea alone.
- After 5–10 minutes have them partner up with someone and share their ideas. Have the partner provide some feedback. (Suggestion: Pick a couple of feedback phrases from the *Useful Phrases for Having Constructive Discussions* section in the Appendix and have them use one of those phrases to provide the feedback.)
- Repeat this process a few times and then gather the group together to discuss how the last 30–40 minutes have mapped to the engineering design process.

2. Encourage collaboration and communication in the classroom.

Preparation and introduction should emphasize the collaborative nature of invention and entrepreneurship.

Preparation

- Show and discuss a video that emphasizes collaboration as critical to invention.
- Pick and discuss an entrepreneur quote that emphasizes collaboration.
- Participate in a warm-up challenge that focuses on collaboration to give students practice before they begin working with the *Book of Ideas*.

Introduction

- Hand out the *Book of Ideas* and read through the innovation prompts together as a class.
- Have students select one prompt they like and spend 5 minutes working on their idea alone.
- After 5 minutes have them partner up with someone **who picked the same prompt** and share their ideas. Have the partner provide some feedback. (Suggestion: Pick a couple of feedback phrases from the *Useful Phrases for Having Constructive Discussions* section in the Appendix and have them use one of those phrases to provide the feedback.)
- Have students go back to working on their ideas but repeat the feedback exercise a few more times.
- After a few rounds gather everyone together and have them discuss their thoughts on getting feedback and working together.
- The next time students work in their *Book of Ideas*, have them work in teams of two or three to collaborate on an invention.

3. Engage students in writing, presenting, and other ELA learning objectives.

Preparation and introduction should help students connect with their ideas and find value and confidence in those ideas.

Preparation

- Introduce students to innovation and the *Book of Ideas* via the Oli video. Discuss the value of all ideas—especially ones that seems different or "weird."
- Watch the Ideo video (better for older students). Discuss all the different communication skills needed to develop an idea or invention (reading, writing, drawing, speaking and listening, etc.).

- Using the *Book of Ideas* as a reward incentive, have students build up their stamina to work independently on writing or drawing (depending on age) up to 5 minutes undistracted.

Introduction

- Hand out the *Book of Ideas* and read through the innovation prompts together as a class.
- Have students select one prompt they like and spend 5 minutes working on their idea alone.
- After 5 minutes have them partner up with someone and share their ideas. Have the partner provide some feedback. (Suggestion: Pick a couple of feedback phrases from the *Useful Phrases for Having Constructive Discussions* section in the Appendix and have them use one of those phrases to provide the feedback.)
- Have the students continue working on their inventions with an end goal of presenting their inventions to the class. As students work toward their presentations, they should practice explaining their inventions to a partner (a new person) or in small groups. This is also a good opportunity for students to continue practicing the giving and receiving of productive feedback.

What best describes the learning and collaboration style of your students?

1. Collaborative and creative but sometimes have trouble focusing

Preparation and introduction should keep their level of excitement high while giving them some practice focusing.

Preparation

- Introduce students to innovation and the *Book of Ideas* via the Oli video. Discuss the value of all ideas—especially ones that seems different or "weird."
- Using the *Book of Ideas* as a reward incentive, have students build up their stamina to work independently on writing or drawing (depending on age) up to 5 minutes undistracted.

Introduction

- Hand out the *Book of Ideas* and read through the innovation prompts together as a class.
- Have students select one prompt they like and spend 5 minutes working on their idea alone.
- After 5 minutes have them partner up with someone and share their ideas. Have the partner provide some feedback. (Suggestion: Pick a couple of feedback phrases from the *Useful Phrases for Having Constructive Discussions* section in the Appendix and have them use one of those phrases to provide the feedback.)

2. Creative but quiet and not comfortable with group work

Preparation and introduction should generate excitement for invention with an emphasis on the benefits of collaboration.

Preparation

- Show and discuss a video that emphasizes collaboration as critical to invention.
- Pick and discuss an entrepreneur quote that emphasizes collaboration.
- Participate in a warm-up challenge that focuses on collaboration to give students practice before they begin working with the *Book of Ideas*.

Introduction

- Hand out the *Book of Ideas* and read through the innovation prompts together as a class.
- Have students select one prompt they like and spend 5 minutes working on their idea alone.
- After 5 minutes have them partner up with someone **who picked the same prompt** and share their ideas. Have the partner provide some feedback. (Suggestion: Pick a couple of feedback phrases from the *Useful Phrases for Having Constructive*

Discussions section in the Appendix and have them use one of those phrases to provide the feedback.)
- Have students go back to working on their ideas but repeat the feedback exercise a few more times.
- After a few rounds gather everyone together and have them discuss their thoughts on getting feedback and working together.

3. Shy and lacking in self-confidence

Preparation and introduction emphasize the possibilities and create an environment that is supportive of their ideas.

Preparation

- Introduce students to innovation and the *Book of Ideas* via the Oli videos.
- Pick and discuss the story of one or two of the young inventors featured in the front of the book.

Introduction

- Hand out the *Book of Ideas* and read through the innovation prompts together as a class.
- Have students select one prompt they like and spend 5 minutes working on their idea alone. **Join them in this activity with your own copy of the *Book of Ideas*.**
- After 5 minutes gather the students back together and ask if anyone is comfortable sharing their idea. If not, share your idea and ask for feedback. (Suggestion: Pick a couple of feedback phrases from the *Useful Phrases for Having Constructive Discussions* section in the Appendix and have them use one of those phrases to provide the feedback.)
- Have students go back to working on their ideas but repeat the feedback exercise a few more times.

Short Scripted Units

If you'd like a bit more instructional support as you work with the Book of Ideas, we've put together two short lesson series to get you started.

Helping Your Students See the Inventor Within

Great for K – 2, also suitable for 3 – 5

Students of all ages are natural inventors even if they don't always recognize these traits in themselves at first. The goal of these lessons is to help students connect with what they already do naturally to the invention in engineering design processes. Specifically, these lessons are designed to give students some experience with key first steps of the invention process. Specifically, these lessons are designed to guide younger students through:

- How to think about making something in their life better or different,
- How to think about a challenge or innovation prompt, and
- Practice respectfully giving and receiving feedback.

Mini Innovation Challenge

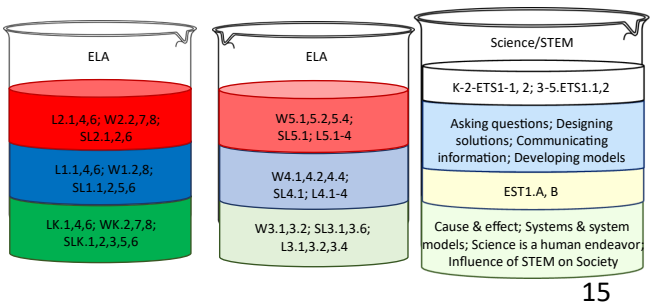
Great for 5 - 8, also suitable for 3 – 4 but lessons might need some extra time

The mini-innovation challenge is designed to give students some experience with all parts of the engineering design process: idea generation, initial design, test and/or feedback, redesign, and present.

- Lesson 1 includes an introduction to innovation in general and then some practice brainstorming.
- Lessons 2 & 3 focus on design, giving and receiving feedback respectfully, and then redesign based on feedback.
- Lesson 4 gives students the opportunity to do a short (30 – 60 sec) presentation on their design.

Once students have some experience with the engineering design process, it can be easier for them to take the lead on their own invention and design process.

The ELA and science standards supported by the activities described in this section are listed here. A full list of the standards can be found in the Education Standards section of this guide.



Outline - Helping Your Students See the Inventor Within

Lesson	Description	Learning Objective/Outcomes	General Flow
1	Improving or changing an object	Students understand what brainstorming is. Students apply the concept of brainstorming to create improvements/ solutions associated with a specific problem or challenge.	*Using new ideas to solve specific problems or challenges.* It can be difficult for students to connect and focus their natural idea-generating abilities to solving specific problems. In this lesson students work in groups to generate a list of improvements for a specific object. The class can work as a single group or in multiple smaller groups of 5 – 7 students. It is suggested that each group have an adult facilitator – especially at the kindergarten level – but this is optional.
2	Making something new	Students apply the concept of brainstorming to create improvements/ solutions associated with a generic problem or challenge.	*Using new ideas to solve general problems or challenges* As a second step towards gaining experience with focused idea generation and brainstorming, students will work on generating ideas and/or solutions for a more generic innovation prompt. Again, the class can work as a single group or in multiple smaller groups of 5 – 7 students. It is suggested that each group have an adult facilitator – especially at the kindergarten level – but this is optional.
3	Let's talk about it	Students learn and remember appropriate language to use when discussing ideas and opinions. Students apply appropriate language to small group discussions about their ideas and inventions.	*Respectfully discussing and building on ideas* It can be challenging for students (and adults sometimes 😊) to know how to discuss different ideas and opinions while still being respectful. It can also be challenging to receive feedback without feeling or getting defensive. In this lesson, students gain experience using specific phrases that help everyone give and receive feedback. This lesson is often best done in smaller groups so that students don't feel "picked on" in front of the entire class. It is highly recommended that students working on this for the first time or who might find this activity extra challenging have adult support in the beginning.

Lesson 1: Improving or changing an object

Key Learning Objectives	• Students understand what brainstorming is. • Students apply the concept of brainstorming to create improvements / solutions associated with a specific problem or challenge.
Necessary supplies	• Paper or a notebook where students can work on their improved object design. Alt—Printouts of the object to be improved. • Optional – *My STEM Stories™* notebook to read along about Anna and Andrea.

Timing	Instructional Activities
5 – 10 min	**Welcome and Introduction (Slides 1, 2, 3)** If this is your first lesson with the group, welcome them in and take a minute to introduce yourself—tell them a bit about you, your background and why you're excited to be working with them. You can also tell them that this lesson is kicking off a unit/series about inventions and inventing. Ask the group to share something that they know about innovation or inventing? (slide 2) This can be anything to start as you are just trying to get a sense for what they know about innovation and if they perceive themselves as someone who could be an inventor or innovator. It is possible they won't have anything to contribute, that is OK. If this happens just move to slide 3. To help organize the discussion and encourage the group to see themselves as inventors/innovators, direct the group discussion to fill out the table on slide 3. Some general/possible entries for the five categories are below. **What** (is invention) – the creation of a new or improved product or service **Why** (do we invent) – to solve a frustration/problem/challenge **When** (do people invent) – all the time! **How** (do people invent) – by thinking creatively, learning from others, trying new things. **Who** (invents) – everyone**!** ***If your group is struggling with this, that's OK, just move on and come back to it at the end of lesson 1 and again at the end of lesson 2.***

10 – 15 min	**Brainstorming - Improving an object (Slides 4, 5, 6, 7)** Most innovations and inventions start with someone trying to solve a challenge or alleviate a frustration. Since this concept might be a bit complex for younger students to start with, this lesson focuses on a first step—improving an object. Think about your group. What is something – an object or task – they all have experience with? It's a good idea to pick something specific this lesson that can be made more generic in the next lesson. For example: • Slide, swing → a piece of playground equipment • School bus → how you get to school • Hamster cage → pet toy or clean-up For the following two lessons we will use slides and playground equipment as the objects, but you can use anything you think would be relatable for your students (e.g., toys, bike, car, school bus, etc.). *Brainstorming* Organize your students into a single group or medium-sized groups based on what you think is best for them. Tell the group "For our first exercise with inventing we are going to think of all the ways we could make this basic slide better." Use slide 4 to create this list. If you don't have access to slides, then you can create a list on a whiteboard or with large chart paper. You will reference this list later on in the session, so make sure there is some way to recall it. If students are having trouble coming up with ideas, you can use the pictures on slides 5 – 7 as examples of different types of slides. Use one or more of those pictures to talk about different *features or characteristics* of slides and then return to creating the list of possible improvements on slide 4. Vocabulary time – After you are done creating your list it is time to introduce the group to the word **brainstorming**. If it helps, you can break the word into "brain" (the place where ideas come from) and "storming" (the word we use to describe extreme or intense weather). Brainstorming → intense/extreme ideas

10 – 15 min	**Design (Slide 4)** After the group has had some time to think about many of the ways they could make the slide better, it is time for them to start designing their new slide. Depending on your students, this can be done as a single group, in medium-sized groups, or individually. Tell the group "Now that we have a list of possible ways to improve the slide, it is time to PICK which ideas we want to use to make a better slide." If you are working as a class, help the group pick their favorite ideas. We would suggest doing this as a simple vote as later lessons will prepare students for discussing (and disagreeing) on ideas. If students are working individually, suggest they pick 1, 2, or 3 ideas they would like to incorporate into their slide designs. Have students spend 10 – 15 minutes drawing their new slides. They can draw on blank paper or use printouts of the example slide (or whichever example you are working from) for their designs. **At the end of this session collect the designs. Make sure students' names are on their design. These will be used in lesson 3 for feedback practice.**
Remaining time	**Innovator Profiles (Slides 8 and 9)** It is important that students have concrete examples of young inventors so that they can start to see themselves as inventors as well. The inventor profiles also serve as examples to reinforce the day's lessons – in this case improving an existing product. After you show each of these two inventor profiles, have the group reflect on: • What object was being improved? • What was the improvement? • What help and tools did they use to come up with their solution? **Innovator Profile – Chris Haas** https://www.youtube.com/watch?v=Px1v20R7Dgo • What is the object being improved? A basketball. • What is the improvement? A basketball with handprints on it that showed kids where to put their hands. • What help and tools did they use to come up with their solution? His dad helped him figure out how to shoot and where the hands should go.

	Innovator Profile - Andrea Sreshta & Anna Stork https://www.youtube.com/watch?v=8RR6shO-FHg • What object was being improved? Gas lamps needed after a disaster are unhealthy and unsafe. • What is the improvement? Using solar-powered lights are safer than gas lights and they are inexpensive and easy to ship. • What resources did they use to come up with their solution? Used their education and creativity and sought help from others.

Lesson 2: Making something new

Key Learning Objectives	• Students apply the concept of brainstorming to create improvements/ideas/ solutions associated with a generic problem or challenge.
Necessary Supplies	• Paper or a notebook where students can work on their improved object design. Alt—Printouts of the object to be improved. • Optional – *My STEM Stories™* notebook to read along about kid inventors.

Before this lesson read through your version of the My STEM Stories™ notebook and pick one or two kid inventor stories to read as a group at the end of the lesson.

Timing	Instructional Activities
5 min	**Recap on invention (Slide 11)** Start this discussion with a quick (2 – 3 minute) recap discussion about what innovation is. You can use slide 11 as a discussion prompt (no need to fill it all out) or pull up a copy of slide 3. The goal here continues to be to get students to see themselves as inventors/problem solvers. Also see if anyone remembers the word brainstorming (generating a lot of ideas related to a topic or challenge). Similar to the previous lesson, today's lesson has time for brainstorming and design. Organize your students in the group structure that you decided on and proceed with the lesson.
15 min	*Introducing a more generic innovation prompt* Tell the group "Today we're going to take our inventing to the next level. Last time we worked on finding a way to make a better slide. Today, we are going to have a bit more freedom and creativity, and we're going to work on **making a more fun piece of playground equipment.**" *Brainstorming* Today's brainstorming might be a bit harder or a bit chaotic, because the challenge or innovation prompt is more open ended. Students should be encouraged to share all the ideas they have about the challenge – in this case making a better piece of playground equipment.

	Use slide 12 to create this list. If you don't have access to slides, then you can create a list on a whiteboard or with large chart paper. You will reference this list later on in the session, so make sure there is some way to recall it. If students are having trouble coming up with ideas, you can use the pictures on slides 13 – 16 as examples of different types of slides. Use one or more of those pictures to talk about different *features or characteristics* of the playground equipment and then return to creating the list of possible types or features of playground equipment on slide 12.
10 – 15 min	**Design (Slide 12)** After the group has had some time to think about different or better playground equipment, it is time for them to start designing. Depending on your students, this can be done as a single group, in medium-sized groups, or individually. Tell the group "Now that we have a list of possible ways to improve the slide, it is time to PICK which ideas we want to use to make a better piece of playground equipment." If you are working as a class, help the group pick their favorite ideas. We would suggest doing this as a simple vote as later lessons will prepare students for discussing (and disagreeing) on ideas. If students are working individually, suggest they pick 1, 2, or 3 ideas they would like to incorporate into their slide designs. Have students spend 10 – 15 minutes drawing their new playground equipment. **At the end of this session collect the designs. Make sure students' names are on their design. These will be used in lesson 3 for feedback practice. If possible, it is ideal for you to also complete an invention design to use for the first round of feedback.**
Remaining Time	**Innovator Profile** For the remaining time read through a couple of the kid inventors profiled in the *My STEM Stories™* notebook. Discuss each invention using the following discussion prompts: • What was the object being improved? or What is the problem that was being solved? • How was it changed? Or What is the solution? • What help and tools resources did they use to come up with their solution?

Lesson 3: Let's talk about it

Key Learning Objectives	• Students learn and remember appropriate language to use when discussing ideas and opinions.
Necessary Supplies	• Designs from lesson 1 and 2 to use for feedback discussions • *My STEM Stories™* notebook with prompts for having constructive conversation and to read along about kid inventors.

Before this lesson:

- *Insert a picture of your playground equipment design on slide 23,*
- *Read through your version of the My STEM Stories™ notebook make sure you match the* Useful Phrases for Having Constructive Discussions *on slide 22 with the phrases in your notebook, and*
- *Pick one or two kid inventor stories to read as a group at the end of the lesson.*

Timing	Instructional Activities
5 min	**Recap on invention (Slide 18)** Start this discussion with a quick (2 – 3 minute) recap discussion about what innovation is. You can use slide 11 as a discussion prompt (no need to fill it all out) or pull up a copy of slide 3. The goal here continues to be to get students to see themselves as inventors/problem solvers. Also see if anyone remembers the word brainstorming (generating a lot of ideas related to a topic or challenge). You won't be doing any brainstorming today, but this is a good recap for future work with invention.
10 min	**Feedback Lesson (Slides 19 – 23)** To begin with, make sure students know what the word feedback means and when you might get or give it. Begin by asking them what they know about feedback and when is it a good time to give or receive feedback? (Slide 19). Wrap up the short discussion by going over the content on slide 20. Ask students what they think they need to keep in mind when they are giving or receiving feedback (Slide 21)? Make sure the discussion includes to be respectful and that they keep an open mind. Move on to slide 22 and give students some examples of useful phrases to use when giving feedback to help keep the discussion respectful. The last page in the *MY STEM Stories™* notebook includes a short list appropriate for your grade level. You might want to make some changes to the content on slide 23 so that it matches the phrases in the notebook.

10 min	**Feedback Round 1 (slide 23)** Describe your piece of playground equipment to the group and tell them you are asking for their feedback. Select 3 – 5 students for this task. Encourage them to say something nice then also say something constructive using one of the phrases. This should take about 2 – 4 min each person.
10 min	**Feedback Round 2 (Slide 24)** Have students work in pairs or small groups to practice giving and receiving feedback. Return to students their designs of modified slides and/or new playground equipment. It is highly recommended that students working on this for the first time or who might find this activity extra challenging have adult support in the beginning. Have them take turns explaining their innovation and then have the other person give feedback. Encourage everyone to say something nice then also say something constructive using one of the phrases. This should take about 2 – 4 min each person. Keep track of the time and then at the end have them go back to working on their innovations. After 1 round of feedback, let the students work on their inventions until there is about 5 min left in the session.
Remaining time	**Innovator Profile** For the remaining time read through a couple of the kid inventors profiled in the *My STEM Stories™* notebook. Discuss each invention using the following discussion prompts: • What was the object being improved? or What is the problem that was being solved? • How was it changed? Or What is the solution? • What help and tools resources did they use to come up with their solution?

Outline – Mini Innovation Challenge

Lesson	Description	Learning Objective/Outcomes	General Flow
1	Introduction to Innovation	Students understand what innovation is and how they can be a part of the innovation community, Students apply an innovation mindset to define specific problems and identify solutions to relevant challenges, and Students will gain experience with brainstorming processes.	*(Initial warm up activities will help the facilitator assess group understanding around innovation and invention.)* The session will open with a group brainstorming about things that they find frustrating. With help from the facilitator, students will recast 1 or 2 of these frustrations as specific problems that can be improved or solved with a new invention or innovation. Students are introduced to *the Book of Ideas* and the innovation prompts. They then participate in *Lightning Round Brainstorming* – which gives students a low-pressure way to practice brainstorming, invention, and design. Time permitting students pick their top innovation prompt to start working on. If time doesn't permit, this will kick off session 2. The session will include time to profile 1 – 2 STEM innovators or entrepreneurs
2 & 3	Design, Redesign and the Engineering Design Process	Students create initial designs/innovations, Students learn, remember, and apply tools and tips for giving and receiving respectful feedback, and Students analyze feedback on their innovations and create improved designs/innovations.	Throughout these two sessions students will: • work on their initial designs, • participate in 1 – 3 rounds of 1-on-1 or small-group feedback sessions, and • make adjustments to their designs based on the feedback. Lessons will focus on: • the Engineering Design Process • Respectful giving AND receiving feedback. Each session will include time to profile 1 – 2 STEM innovators or entrepreneurs
4	Presenting Your Invention	Students create a short presentation to describe their design or innovation, and Students deliver their presentations.	During the first half of the session students will finish up the current iteration of their invention and work on a 2 – 5 sentence description of their invention and the problem it solves (script template provided). During the second half of the session students will present their inventions to the group. Lesson will focus on: • Tips for oral presentations • Expectations of a gracious audience.

Lesson 1: Introduction to Innovation

Key Learning Objectives	• Students understand what innovation is and how they can be a part of the innovation community, • Students apply an innovation mindset to define specific problems and identify solutions to relevant challenges, and • Students will gain experience with brainstorming processes.

Timing	Instructional Activities
2 – 5 min	**Welcome and Introduction (Slide 1)** If this is your first session with the group, welcome them in and take a minute to introduce yourself—tell them a bit about you, your background and why you're excited to be working with them. You can also tell them that this unit will be focused on innovation and invention. **Listing Out Frustrations (Slide 2)** Most innovations and inventions start by someone trying to solve a challenge or frustration. To do this, one must be able to a) articulate (or list out) things that frustrate you and b) turn those frustrations into an actionable challenge (or problem) that you can solve. Today's session will focus on making sure everyone has some experience doing these two things so that everyone has the confidence they need to dive into inventing in sessions 2 – 4. Before diving straight into a lesson, start with some group brainstorming around things that frustrate them. We won't formally introduce the word *brainstorming* yet so for now the group is just "making a list" of their frustrations. Tell the group "This week we're going to focus on inventing, but first can anyone think of some things that frustrate them?" Use slide 2 to create this list. If you don't have access to slides, then you can create a list on a whiteboard or with large chart paper. You will reference this list later on in the session, so make sure there is some way to recall it. If students are having trouble coming up with ideas some common ones include clean my room, do the dishes, walk the dog, etc.

5 min	**Introduction to Innovation (Slides 3 and 4)** The goal of this next discussion is to make sure everyone understands what invention/innovation is and that they start to see themselves as someone who can be an inventor/innovator. Ask the group to share something that they know about innovation? (slide 3) This can be anything to start as you are just trying to get a sense for what they know about innovation and if they perceive themselves as someone who could be an inventor or innovator. It is possible they won't have anything to contribute, that is OK. If this happens just move to slide 4. To help organize the discussion and encourage the group to see themselves as inventors/innovators, direct the group discussion to fill out the table on slide 4. Some general/possible entries for the five categories are below. **What** (is invention) – the creation of a new or improved product or service **Why** (do we invent) – to solve a frustration/problem/challenge **When** (do people invent) – all the time! **How** (do people invent) – by thinking creatively, learning from others, trying new things. **Who** (invents) – everyone**!**
10 min	**Innovator Profiles (Slides 5 and 6)** It is important that students have concrete examples of young inventors so that they can start to see themselves as inventors as well. The inventor profiles also serve as examples to reinforce the day's lessons – in this case turning frustrations into actionable challenges. After you show each of these two inventor profiles, have the group reflect on: • What is the problem that was being solved? • What is the solution? • What resources did they use to come up with their solution? **Innovator Profile - Andrea Sreshta & Anna Stork** https://www.youtube.com/watch?v=8RR6shO-FHg • What is the problem that was being solved? Safe light options after a disaster or just in hard to serve locations. • What is the solution? Collapsable solar-power lights that are inexpensive and easy to ship.

	• What resources did they use to come up with their solution? Used their education and creativity and sought help from others. **Innovator Profile – Chris Haas** https://www.youtube.com/watch?v=Px1v20R7Dgo • What is the problem that was being solved? Kids didn't know how to shoot a basketball. • What is the solution? A basketball with handprints on it that showed kids where to put their hands. • What resources did they use to come up with their solution? His dad helped him figure out how to shoot and where the hands should go.
5-10 min	**Frustration Recast (Slide 7)** Now that the group has had a chance to see what some other inventors have done to address their frustrations or challenges, it is time for them to give it a try. Copy the frustration list from slide 2 to slide 7. Have the group pick one or two of their frustrations and recast as a challenge that is actionable (it might already be this way, but if not take a couple of minutes to do this). (Example – I hate feeding the dog →The dog's food gets everywhere when he/she eats, and I wish it didn't.) At the end, have the group pick their favorite frustration. This will be used for the next slide with the brainstorming exercise. **Brainstorming (Slide 8)** Ask the group if someone can tell you what brainstorming is – coming up with as many ideas around a challenge or topic or problem as possible. Remind the group that we don't judge ideas as good or bad in brainstorming, we're just trying to come up with as many ideas as possible. List out ideas from the group on the slide. **Don't take more than 5 minutes on this activity.**
2 min	**Plan for the Week (Slide 9)** Now that the entire group has some experience with invention, it is time to outline the plan for the week. Go over the schedule outlined on slide 9. Over the next few days you're going to have a chance to develop, work on, and present your own inventions. We'll give you this book [Show them the Book of Ideas] to use to keep track of your ideas.

	Day 1 (today) – Introduction to invention **Days 2 & 3** – Distribute the *Book of Ideas, w*ork on your inventions, give feedback to and get feedback from your classmates **Day 4** – Finish up your invention and present your idea to the group
Remaining time	**Lightning Round Brainstorming (Slide 10, Hand out scratch paper)** Assuming there are less than 15 minutes left in the session, use the remaining time for to give students a head start on their brainstorming. This can be done with some "lightning round" brainstorming. Lightning round brainstorming sessions are short brainstorming sessions after which students can share some of their ideas. The advantage to the short sessions is that if some people are stuck or find brainstorming hard, they only struggle for a short period of time before they get some support. *(Eventually, we will let students struggle a bit to learn perseverance, but right now we are more focused on making sure that everyone has a foundation of confidence.)* On slide 10 are all the prompts in the *Book of Ideas*. Read through them as a group. While you're doing this handout 1 – 2 pieces of scratch paper to each student. After you have read through all the prompts, **have the students each pick one** and spend 2 -3 minutes brainstorming **individually** all the things they can think about to address that prompt or challenge. They should write either the prompt (ideally) or the prompt number (alternative) on the top of their page. Writing down the full prompt will help them keep focused on it as they brainstorm. After 2 – 3 minutes, have the students share out some of their ideas. Depending on the time remaining, do a repeat session with a new prompt. If there are more than 15 minutes remaining at the start of this activity, only do two rounds of lightning brainstorming and then start in on Day 2 activities.

Lesson 2 & 3: Design, Redesign and the Engineering Design Process

Key Learning Objectives	• Students create initial designs/innovations, • Students learn, remember, and apply tools and tips for giving and receiving respectful feedback, and • Students analyze feedback on their innovations and create improved designs/innovations.

Lesson 2

Timing	Instructional Activities
5 min	**Welcome and Recap (Slide 12 and 13)** Remind students of the plan for the week (slide 12). **Day 1** – Introduction to invention **Days 2 (today) & 3** – Distribute the *Book of Ideas, w*ork on your inventions, give feedback to and get feedback from your classmates **Day 4** – Finish up your invention and present your idea to the group Then have a quick (2 – 3 minute) recap discussion about what innovation is. You can use slide 13 as a discussion prompt (no need to fill it all out) or pull up a copy of slide 4. The goal here continues to be to get students to see themselves as inventors/problem solvers. **The Engineering Design Process (Slides 14 – 16)** This is a good time to formally introduce students to the Engineering Design Process (EDP). The Engineering Design Process is a series of steps that are very similar in all creative and/or iterative processes – engineering design, writing, art, etc. Go over the steps on slide 14 and point out to the group that the "Engineering Design Process is just a formal (or fancy) title for something they do all the time. You can use slide 15 to show them that is similar to the processes they use in art or writing – just with science and engineering. On slide 16 you should take a minute to point out the final step in the cycle is feedback – we'll talk a bit more about that later – and that it is a key step in keeping the creative innovation cycle going.

3 - 5 min	**Innovator Profile - Serg Albino & Ian Doromal (Slide 17)** Click on the picture to load the YouTube video (https://youtu.be/8I3FVFclvss). After the video reflect with the group by having them answer the following things: • What is the problem that was being solved? Harmful chemicals in mud and soil in the lakes. • What is the solution? A special spear that is made from a material that acts like a chemical sponge to soak up all the bad chemicals. • What resources did they use to come up with their solution? The idea was first developed at NASA.
20 min	**Invention Time! (Slide 18)** If you haven't already, hand out the *Book of Ideas*. Students should pick one innovation prompt and start working INDIVIDUALLY on an invention or innovation. The prompt they pick does NOT need to be the one they worked on during the lightning brainstorming (but it can be). They should try to work solidly for 15 – 20 minutes. They can switch prompts if they want.
3 - 5 min	**Innovator Profile and Feedback Lesson (Slides 19 – 23)** After students have had some time to work on their inventions, give them a break with another innovator profile and a quick lesson on feedback. **Innovator profile: Alya Hutchinson (Slide 19)** Click on the picture to load the YouTube video (https://www.youtube.com/watch?v=LmEbjC0xY60). After the video reflect with the group by having them answer the following things: • What is the problem that was being solved? The dangers associated with chopping kindling. • What is the solution? The Kindling Cracker is a product that makes the ax head stationary and allows you to pound the wood while keeping fingers well clear and out of danger. • What resources did they use to come up with their solution? The idea was first developed when Alya's mom cut her hand chopping wood. YouTube is full of great reviews – which are a good intro to the feedback section. Show a video review (https://www.youtube.com/watch?v=4-RhakR3Hg8) and then ask the students: • What did you notice? *Often both positive observations/experiences and negative experiences were mentioned.*

	• How might these reviews be helpful to Ayla? *They could help her make changes to improve her product.* **Feedback Lesson (Slides 20 – 23)** To begin with, make sure students know what the word feedback means and when you might get or give it. Begin by asking them what they know about feedback and when is it a good time to give or receive feedback? (Slide 20) Wrap up the short discussion by going over the content on slide 21. Ask students what they think they need to keep in mind when they are giving or receiving feedback (Slide 22)? Make sure the discussion includes to be respectful and that they keep an open mind. Time and interest permitting, revisit some of the product reviews or product improvements made with the Kindling Cracker (e.g., between version 1 and the XL – which basically got bigger so that larger logs could be used). Move on to slide 23 and give students some examples of useful phrases to use when giving feedback to help keep the discussion respectful. If you printed out the feedback sheet from the appendix, hand it out now.
5 – 10 min	**Feedback Session (Slide 24)** Have the students each find someone with a different innovation prompt. Have them take turns explaining their innovation and then have the other person give feedback. Encourage everyone to say something nice then also say something constructive using one of the phrases. This should take about 2 – 4 min each person.
Remaining Time	After 1 round of feedback, let the students work on their inventions for the rest of the session.

Lesson 3

Timing	Instructional Activities
5 min	**Welcome, Recap, Innovator Profile (Slides 26, 27)** Remind students of the plan for the week (slide 26). **Day 1** – Introduction to invention **Days 2 & 3 (today)** – Distribute the *Book of Ideas, w*ork on your inventions, give feedback to and get feedback from your classmates **Day 4** – Finish up your invention and present your idea to the group **Innovator profile: Alex Deans (Slide 27)** Go through the innovator profile and after student will have time to get reacquainted with their inventions. Click on the picture to load the YouTube video (https://youtu.be/EGPo7gnvlhE?si=ZVIUkA7hDrugxPz6). After the video reflect with the group by having them answer the following things: • What is the problem that was being solved? Lack of independent mobility for blind or visually impaired people. • What is the solution? Th iAid device that scans your surroundings and then points you in a safe direction. • What resources did they use to come up with their solution? A lot of tinkering and creativity but also talked a lot with people who needed this product.
10 – 20 min	**Invention Refresh** Give students 5 - 10 minutes to get reacquainted with their inventions. If a lot of students want to start in on a new innovation prompt, then give them up to 20 minutes to work on it before the next round of feedback.
2 - 5 min	**Feedback Reminder (Slides 28 & 29)** If necessary, give a quick refresher on feedback (Slide 28) and phrases for having constructive discussions (Slide 29 and handout)
5 – 10 min	**Feedback Session 2 (Slide 30)** Have the students each find someone with the same innovation prompt (if possible).

	Have them take turns explaining their innovation and then have the other person give feedback. Encourage everyone to say something nice then also say something constructive using one of the phrases. This should take about 2 – 4 min each person. Keep track of the time and then at the end have them go back to working on their innovations. After 1 round of feedback, let the students work on their inventions until there is about 5 min left in the session.
15 – 20 min	**Invention Time** After 1 round of feedback, let the students work on their inventions until there is about 5 min left in the session.
Final few minutes	**Optional – Sneak Peek on Presentation (Slide 31)** Time permitting, and if you think it would be helpful, give the students a sneak peek at the script they can use to present their invention to the group. **From a curriculum perspective the presentation is optional. There is a lot of value in having students present their ideas, but based on the group, this might not be possible. You as the instructor can determine if students have had enough time to work on their inventions and if the presentation is to be optional or required.**

Lesson 4: Presenting Your Invention

Key Learning Objectives	• Students create a short presentation to describe their design or innovation, and • Students deliver their presentations.

Timing	Instructional Activities
5 min	**Welcome and Recap (Slide 33)** Remind students of the plan for the week (slide 33). **Day 1** – Introduction to invention **Days 2 & 3** – Distribute the *Book of Ideas, w*ork on your inventions, give feedback to and get feedback from your classmates **Day 4 (today)** – Finish up your invention and present your idea to the group If you are doing presentations, then proceed through the following lessons. If you would prefer to have your group continue working on their inventions, then you can let them do that for the entire session. Be sure to include at least 1 formal feedback session.
20 min	**Final Touches and Presentation (Slide 34)** If possible, print out a copy of the presentation script (available in the Appendix) for each student. Take the next 20 minutes and finish up your inventions and think about what you want to say to the group. If possible, hand out printouts of the script template so that they can fill it out. **Students should try to keep their presentations to 0.5 – 2 min (30 – 120 sec)**
Remaining 30 min	**Have Students Present Their Inventions** Don't forget to remind the group what it means to be a respectful audience. Commend each student for presenting their invention. It takes a lot of courage to share your ideas with the world!

À La Carte Activities

Introduction Activities

The following few pages outline some introductory activities that you can use with your students to get them excited to be thinking about innovation and inventions.

Pick the tools that work for you!

You do not need to use all these introductory tools, but instead pick the ones that enable you to get a feel for what your students know and what they are interested in. These introductory tools and activities are also a good way to check in with your students throughout the unit to see how they are doing, what concepts they may be struggling with, and/or how their interests are developing.

Start with an Essential Question or Discussion Prompt

- How can I find a solution to challenges or problems in my life or community?
- What do I do with an idea?

Watch and Discuss an Introductory Video

- Have Oli introduce your students to the *Book of Ideas*. https://www.youtube.com/watch?v=AkELh9qAwUY (2:04 min, no ad)
- Watch this video on ideas then discuss as a class students' thoughts on important takeaways. https://www.youtube.com/watch?v=5Uh1KxcpWz0&feature=youtu.be *(Note: There may be a short ad before the video.)*
- Watch a video on collaboration and then discuss as a class.
  - https://www.youtube.com/watch?v=W6EgoiPxNDs (~ 15 min) This video about Ideo and their shopping cart design project emphasizes both collaboration and communication.
  - https://www.youtube.com/watch?v=Fd_nkBHgX8s (~ 7 min, short ad to start) JP, an engineering student from Brazil, talks about the importance of working with a team to solve problems.
  - https://www.youtube.com/watch?v=ga1_a4qw-As The video is a bit fast paced so be prepared to stop and discuss if you are working with younger or ELL students. *(Note: There may be a short ad before the video.)*

Read About and Discuss Invention and Innovation

- Pass out the *My STEM Stories*™ notebooks and read the introduction or entrepreneur story.
- Read and discuss a story about inventing (some examples are provided in the Appendix).
- Read about one or more of the young inventors featured on the inside cover of the *Book of Ideas* (also printed in the *My STEM Stories*™ notebooks).
- Pick an entrepreneur quote from the *Book of Ideas* and have your students discuss what they think it means to them.

Warm-Up Activities

- Engineering Design Process Discussion

  In small groups or as a class discuss the engineering design process. Have the students think about and discuss what each step means to them and examples of actions or activities that they would expect to see in each step. Blank templates based on the cycles illustrated in the introduction sections are provided in the Appendix which can be used as an engineering design process template, PIC, or anchor chart.

- Team and Collaboration Building Challenges

  Give students a challenge that is familiar to them but a bit hard to complete individually. Some examples include puzzles, scavenger hunts, and writing a story from a picture. They must spend the first 5 minutes working on it alone. After that, allow them to work on it as a team. When they are done gather everyone together to discuss the benefits and challenges of working as a team. Did the benefits outweigh the challenges? If so, why? If not, why not?

ELA-Focused Lessons

*In this section we've outlined several different ways you **could** use the* Book of Ideas *in your classroom to support a number of ELA-focused learning objectives.*

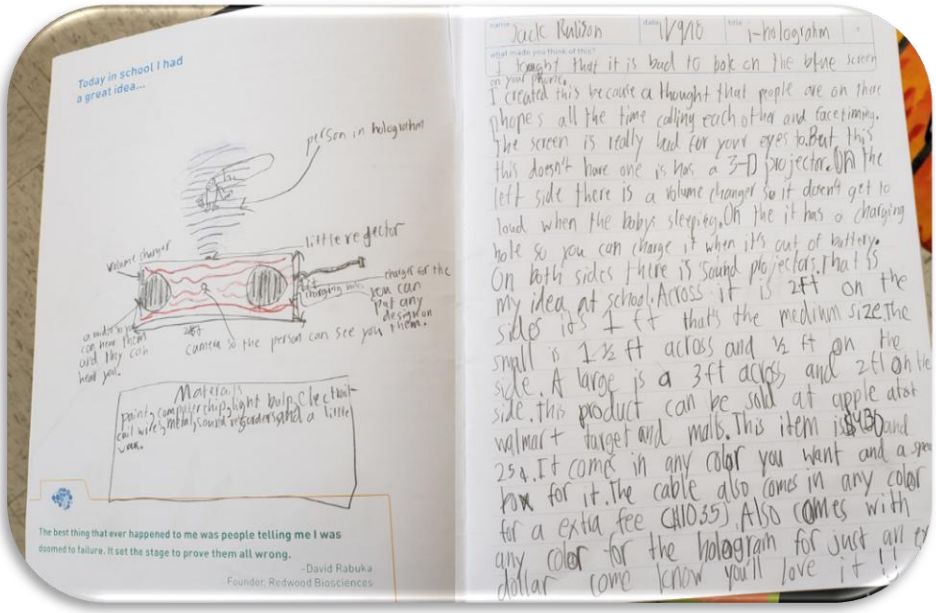
Depending on the age and/or focus level of your students you may choose to give them more or fewer options with regard to how they explore their ideas (e.g., which innovation prompt they work on, if they work alone, in pairs, or in small groups, etc.).

In the end, we hope you feel comfortable using the Book of Ideas *in the way that works best for your students and you.*

Use the *Book of Ideas* to give students a purpose to write.

Students love to share their ideas. Giving those ideas a place to shine shows that they have value and provides students with a purpose to write. Some simple ways to use the *Book of Ideas* as a creative writing tool include:

- Using it as a center during ELA
- Using it as an activity during a break in instructional time
- Using it as a group activity where students work together to determine a solution to the innovation prompt
- Giving students a chance to present and discuss their ideas and inventions *(Note: This is a great introduction to the engineering design process, as students can gather peer feedback to improve their designs.)*



Use innovation and entrepreneur stories as meaning and relatable content to practice reading comprehension.

(For younger students you can read together out loud and discuss.)

1. Have the students read through the introduction and answer the following writing prompt.

   "You can't hold an idea in your hand like you can money or jewelry; however, ideas still have a lot of value."

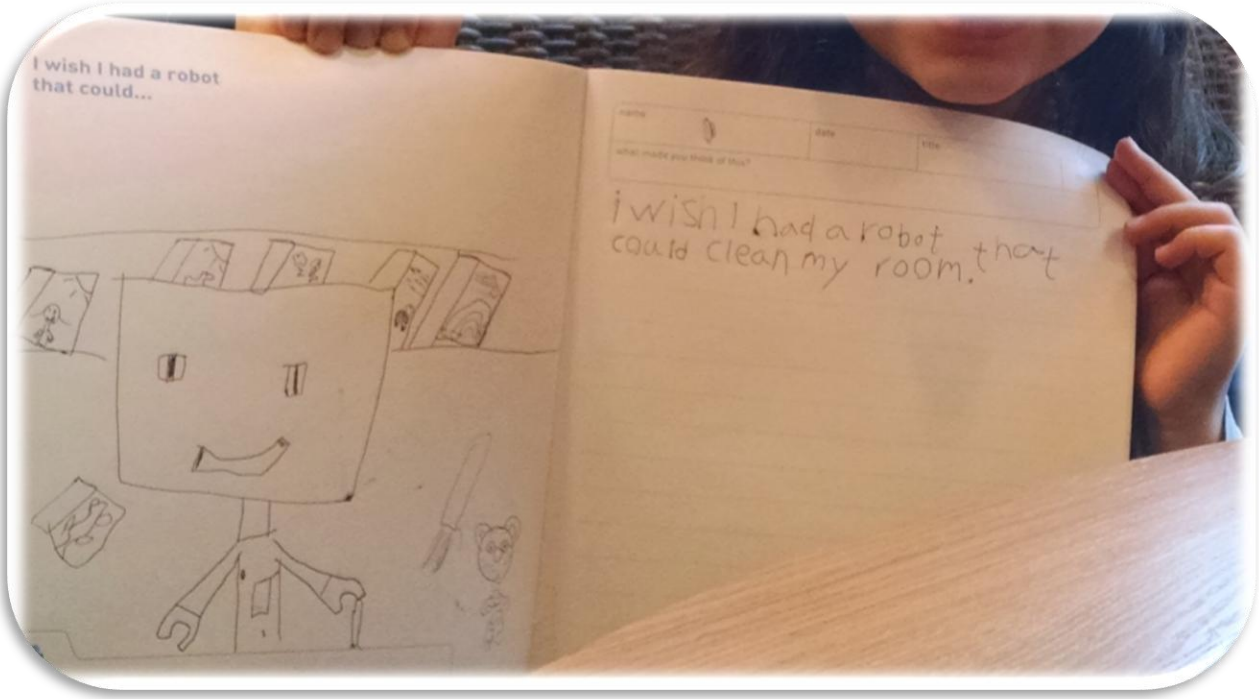
   Explain why you think the previous statement is true or not true. Use examples from the introduction to support your answer.

2. Have the students read through one or more entrepreneur stories and answer the questions about the following statement.

   "When you are working on a new product or idea it is important to have a lot of different ideas and perspectives."

   Do you agree or disagree with that statement and why? Do you think the various entrepreneurs would agree or disagree with that statement? Make sure you justify your answer.

3. Identify a portion of the entrepreneur or kid inventor stories that illustrates each of the vocabulary words.



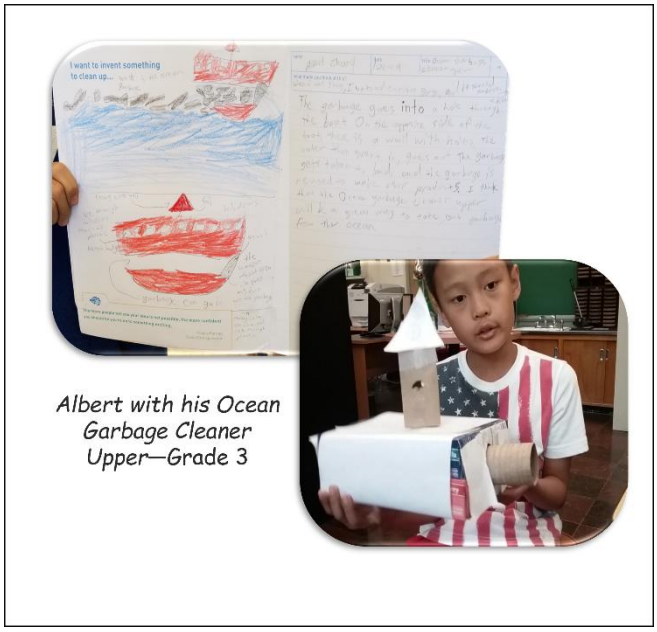
Science-Focused Lessons

*In this section we've outlined several different ways you **could** use the* Book of Ideas *in your classroom to support a number of science-focused learning objectives.*

Use the *Book of Ideas* to combine social studies with science and engineering.

(For younger students you can read together out loud and discuss.)

- New innovations won't take hold if they don't solve an actual problem—and the more problems they solve the better. Have your students write about or discuss two or three other ways the ideas and innovations they create in their *Book of Ideas* can be used, in addition to addressing the original prompt or question.
- Every new idea and invention is built on the events, ideas, and inventions that came before it. Have your students research three to five previous events/ideas/inventions that helped them come up with their idea. Have them create a timeline and explain how everything on the timeline is connected.
- As the students work on their inventions it is good to carve out some time for them to discuss their inventions with another student or team. Students should be reminded about the difference between constructive feedback and nonconstructive feedback.
    - **Writing Exercise:** Have the students write down the comments made about their inventions. Have them discuss if they will or will not incorporate the feedback and why.



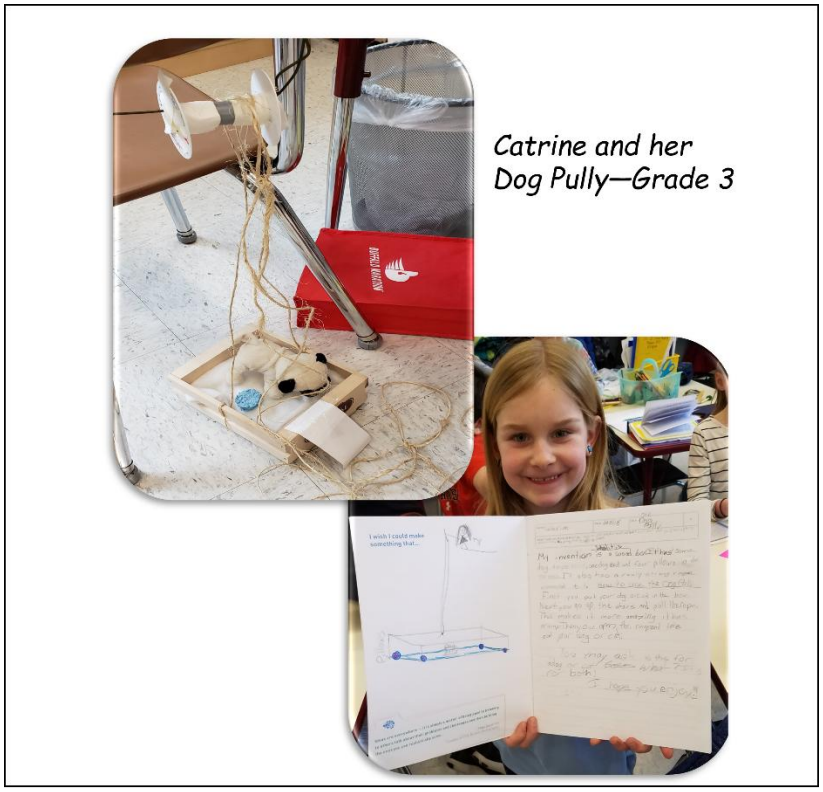
Albert with his Ocean Garbage Cleaner Upper—Grade 3

Makerspace-Focused Lessons

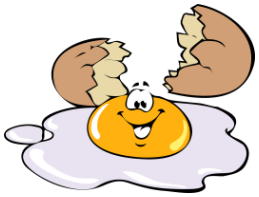
Use the *Book of Ideas* in Your Makerspace

- Some students dive into a makerspace or table of invention supplies with reckless abandon. While we applaud this initiative and creativity, it can be hard for teachers to use this level of engagement to support core content learning objectives. By pairing the makerspace enthusiasm with the *Book of Ideas*, students can leverage that energy as they practice their writing, critical thinking, model development, communication skills, and more.
- Conversely, while some people find a blank slate energizing and motivating, others find it a bit intimidating. The same can be said for a makerspace with its endless possibilities and focus on more freeform creativity. The innovation prompts and kid inventor examples in the *Book of Ideas* provide inspiration and open-ended suggestions to help provide that creative spark some students need.

If you're interested in additional lesson support for your makerspace activities, please check out our Makerspace Packs.



Teacher Resources

Teaching with CreositySpace 	Learn more about innovation-based instruction. Innovation and entrepreneurship can be powerful tools for centering instruction around student ideas, leading to increased student engagement and self-confidence while improving overall student outcomes.
What's Inside Your Class Pack 	Your *Book of Ideas* Class Pack comes with: • Individual student copies of the *Book of Ideas* • Individual student copies of the *My STEM Stories™* notebooks • Printed Educator Guide • Access to a variety of digital resources
Reading and STEM Content 	This section contains: • General introduction to innovation, • Vocabulary related to invention and entrepreneurship with grade-appropriate definitions, • Text associated with the entrepreneur stories contained in the My STEM Stories™ notebooks, and • Background on the engineering design process.

Welcome to Innovation-based Instruction

Innovation and entrepreneurship can be powerful tools for centering instruction around student ideas, leading to increased student engagement and self-confidence while improving overall student outcomes. Innovation-based instruction requires that the classroom become a collaborative learning environment - where both students AND teachers experience the joy of learning new things.

We know our curriculum might look a little different from what teachers are used to, but it was developed with the philosophy that students learn better when what they are learning is put into a context that is relevant to them.

With a focus on **student-led, inquiry-based** discovery, each unit features a variety of real-life STEM entrepreneurs, their personal stories, and details about the technologies and businesses they are developing. With that as the anchor, CreositySpace connects the applications back to the relevant elementary-level science topics and creates lessons that can be delivered in science, ELA, math, social studies, and art classes.

How do we do this?

CONNECT students to, and help them see value in, their ideas and interests with the ***Book of Ideas***.

ENGAGE students by giving them a space where they can be free to express and develop their ideas while practicing their writing skills in an authentic and supportive setting, all the while giving teachers a chance to assess where students are with their **thinking, interests, and misconceptions**.

TRANSFORM students' self-confidence and proficiency with writing and science as they build **foundational skills** through the collaborative engagement with their peers, teachers, and mentors.

Since one can never predict the exact path a student's mind will explore, the CreositySpace team is always available to provide additional support and content should your students' questions take you down an unfamiliar road.

Integrating Innovation and CreositySpace into Your Classroom

The CreositySpace *Educator Guide* is your resource to engage your classroom in student-directed inquiry-based discovery. **You decide what exact sequencing works best for your classroom.** We provide the tools and content designed to leverage your students' natural creativity and curiosity. The *Book of Ideas* can be used in a variety of ways, including:

- A center during ELA
- An activity during a break in instructional time
- A group activity where students work together to determine a solution to the innovation prompt
- A chance for students to present, and discuss, their ideas and inventions

In addition, the *Book of Ideas* is a good way to **provide some structure around newly forming in-school makerspaces.**

Ongoing Support

Successful implementation of each CreositySpace unit is important to us, and to that end our company is committed to providing ongoing support to you—from brainstorming ideas and helping with an activity to answering questions around implementation. Don't hesitate to reach out to us via email at Kath@CreositySpace.com.

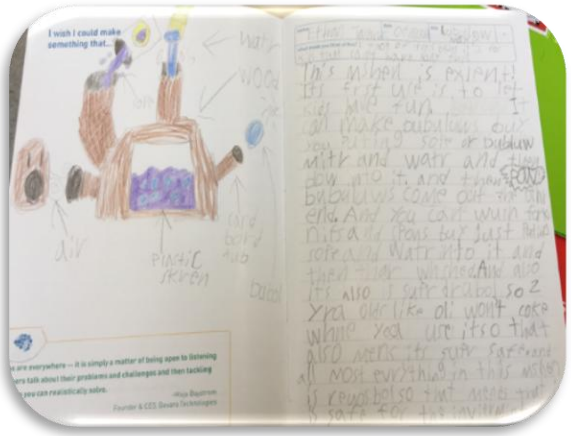
Welcome to Your *Book of Ideas* Class Pack

Getting kids to connect to and see value in their ideas is a key ingredient in teaching STEM and to fostering student confidence. This is why CreositySpace created the *Book of Ideas*.

Similar to a real inventor's notebook, the *Book of Ideas* was designed to encourage kids to write down or draw, explore, and discuss their own ideas and inventions. Pages include a title block, quotes from entrepreneurs and innovators, short design prompts, and a list of inventions and businesses started by kids.

The *Book of Ideas* is NOT about the right answer, perfect spelling, or fitting into a predetermined box. **The *Book of Ideas* IS about:**

- giving students the opportunity to explore and express their ideas in a way that works for them;
- providing a forum in which students may work independently, as well as collaboratively, and practice giving and receiving respectful feedback; and
- offering an exciting way for students to show you the ideas, big wonderings, and solutions on their minds and giving you additional insight on how to engage every learner.



The Educator Guide

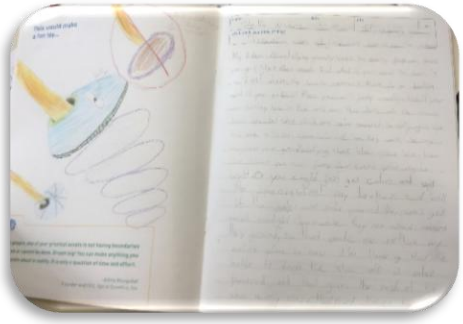
The CreositySpace *Educator Guide* is your resource to engage your classroom in student-directed, inquiry-based discovery. We provide the tools and content designed to leverage your students' natural creativity and curiosity and you decide what exact sequencing works best for your classroom.

***My STEM Stories*™ student notebook**

Reading Level A Reading Level C

The introductory text, vocabulary, and entrepreneur story have been combined to form a ***My STEM Stories***™ student notebook. There are six versions of the *My STEM Stories*™ notebook—one each for K through 5—targeting different reading levels. The reading level A notebook also comes with a *Teacher Version* of the notebook for the option to give a richer group reading experience.

There is no wrong way to use the *Book of Ideas* in your classroom.



Above all, it should be considered a conversation-starter and a great way to encourage creativity, communication, collaboration, and curiosity in your classroom.

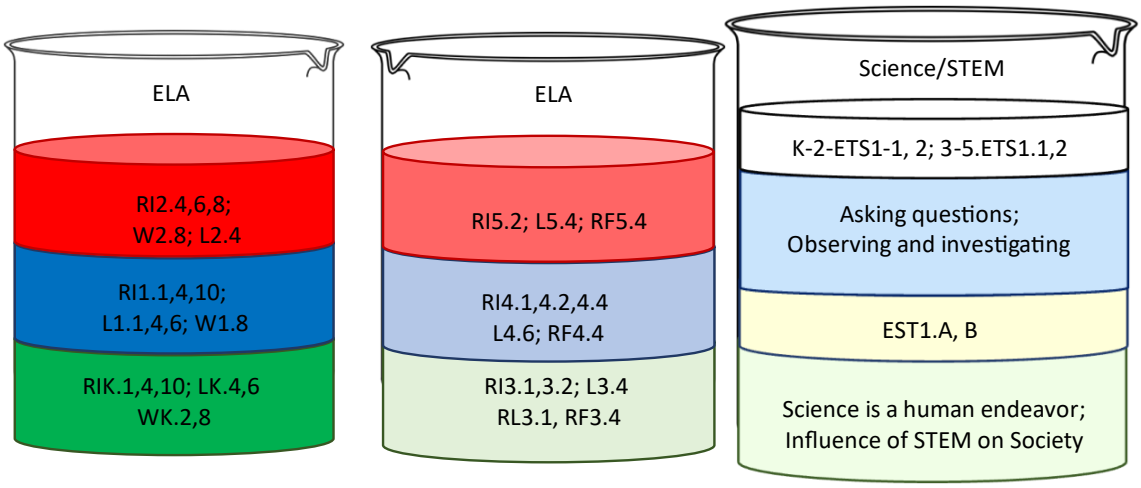
Reading and STEM Content

Welcome to Ideation and Innovation

Welcome to **ideation and innovation**. *This introduction provides of an overview of the importance of ideas—all ideas—to invention and technology development. You can use it as an introduction for your students (see the À-la-Carte Activities section) or as an additional opportunity for students to practice their reading. Depending on the reading level of your students, and the goals and time constraints of your classroom or program, you may choose to do one of the following:*

- *Read the introduction out loud to students.*
- *Use the introduction text as guided reading.*
- *Have students read the introduction on their own should they choose.*
- *Have students read through the introduction in small groups.*

The ELA and science standards supported by the activities described in this section are listed below. A full list of the standards can be found in the Education Standards section of this guide.



Kindergarten Reading Level

Note: Teacher version of the My STEM Stories™ *notebooks includes full text from grades 1, 2 reading level.*

Have you ever had an idea? Ideas are valuable!

Ideas can create new ideas. New inventions need a lot of ideas.

Inventors write or draw their ideas in a notebook. Your ideas are protected by **intellectual property laws**.

Grades 1, 2 Reading Level

Have you ever had an idea? I bet you have! Maybe it was for something new to play with on the playground. Maybe it was something to make it easier to make your bed or clean your room. How do you know if your idea is valuable? Would you believe me if I told you that ALL ideas are valuable?

It's true!

Even if a single idea does not turn into an invention, it is still valuable. Ideas are valuable because they all do at least one thing—they help create new ideas! And those ideas help create even more new ideas. Just like wood, nails, hammers, and saws are the tools that help build a house, ideas are the tools that create new inventions. Just like you need a lot of wood and nails for a single house, a single invention needs many, many, many ideas.

Did you know that many inventors carry a small notebook so they can write down their ideas as soon as they think of them? They know that every single idea is valuable, and they do not want to forget them. They know that even if they cannot use their idea right away, they might be able to use it in the future—either as it is, or as a spark for a new idea.

Has someone ever tried to copy your answer on a test? If so, how did that make you feel? I am guessing you did not like it. Just as teachers have rules to keep students from copying answers on tests, communities and governments have laws to keep people from copying ideas. **Intellectual property laws** are the rules that keep people from copying each other's ideas. Intellectual property laws are designed to protect ideas and inventions. These laws are complicated and are always being updated. People who work in this field must understand the rules of the law and the science and engineering of the idea or invention.

Grades 3, 4, 5 Reading Level

We all come up with ideas. Sometimes they are about something we wish we had to play with (like a cool piece of playground equipment). Other times they are about something we wish we could change (like how we could make it easier to clean our room). But how do you know if your idea has value? Would you believe me if I told you that ALL ideas have value?

It's True!

Even if an individual idea may never become something you can hold in your hand, or turn into a product or service, it still has value. This is because all ideas are sure to do at least one thing—they lead to new ideas. And those ideas lead to even more new ideas!

New ideas are what drive innovation and inventions like rain and sunlight help make new plants. Just like you need a lot of rain and sunlight for a single plant, a single invention is the result of many, many, many ideas.

Did you know that many famous (and many not so famous) inventors carry a small notebook with them? This is so they can write down their ideas as soon as they think of them. They know that every single idea they have has value. They know that all ideas deserve to be written down, so they aren't forgotten. They know that even if they can't use their idea right away, they might be able to use it in the future—either as it is, or as the spark for another idea.

As early as 500 BCE, people wanted to protect their ideas and inventions. They wanted to encourage new ideas but also wanted to stop others from imitating or copying their ideas.

Giving value to an idea is an important part of **intellectual property law**. Intellectual property laws are designed to protect ideas and innovations. However, they are complicated and continually being updated as new innovations are created that don't fit old patterns. Professionals who work in this field must have a good understanding of law, business, and technology.

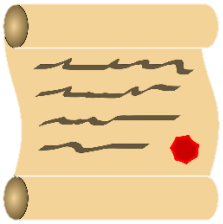
Vocabulary: Innovation

The table below contains some vocabulary words that go with the Book of Ideas. *The* My STEM Stories™ *notebooks contain the vocabulary words with the definition included and a place for students to write or draw a definition that works for them (they need to figure out a simpler definition or appropriate picture).*

It may be helpful to introduce one or two vocabulary words each day. There is also a glossary at the end of the Book of Ideas *with additional vocabulary words.*

For younger students or English language learners, some guided language acquisition design (GLAD) strategies are also suggested. However, feel free to develop your own or challenge your students to create something that works for them. Note: GLAD is a visual-, auditory-, or movement-based way to help learners remember and understand academic vocabulary.

Term	Definition & Simplified Definition	GLAD Strategies	Picture
Brainstorming	Brainstorming is collecting a lot of ideas to solve a problem. — Coming up with a lot of ideas	Say—Sharing our ideas. Gesture—Have students form groups of three or four and do their idea gesture together.	
Creative Thinking	Creative thinking is when you are trying to solve a problem or think about something in a new way. — Using your imagination to come up with new ideas	Say—Creative thinking: thinking differently. Gesture—Have the students do a silly dance.	

Term	Definition & Simplified Definition	GLAD Strategies	Picture
Intellectual Property	Intellectual property is a law that protects inventions. — The legal name for your ideas and inventions	Say—Keeping my ideas safe. Gesture—In pairs have one student look over as if they are copying their neighbor's paper, and then have the other student shake their head and wag their finger to say "no."	
Inventor	An inventor is a person who comes up with a new way to solve a problem. — Someone who makes something new	Say—Someone who makes something new. Gesture—Building something.	
Entrepreneur	An entrepreneur is someone who creates a new business. — Someone who owns their own business	Say—Entrepreneur: someone who owns their own company. Gesture—Sell something.	

Let's Meet Some Entrepreneurs

Entrepreneurs are relatable role models who show kids how to use science to transform their community and world. They demonstrate that science is more about creativity, asking questions, and finding solutions.

Innovation and entrepreneurship create a space for all learners. They change science from an elite or isolated activity done by a few into a tool that is accessible by everyone to solve problems that are important to them.

The My STEM Stories™ *notebooks contain two longer entrepreneur stories (text provided in the next few pages) as well as the text to the kid inventor/entrepreneur vignettes found in the front cover of the* Book of Ideas.

Andrea Sreshta and Anna Stork,

Co-Founders of LuminAID

Kindergarten Reading Level

Note: Teacher version of the My STEM Stories™ *notebooks includes full text from grades 1, 2 reading level.*

Andrea Sreshta and Anna Stork met at college in New York City.

There was an earthquake in Haiti. People in Haiti needed help.

Andrea and Anna invented a light that uses energy from the sun.
It was easy to get this light to people in need. This light is safe and easy to use.

Grades 1, 2 Reading Level

The Challenge: In 2010 Anna and Andrea were architecture students in New York City. During this time, they heard about a very big earthquake in Haiti. They wondered what they could do to help the people who had lost their homes. They also wondered what they could do to help the rescuers. They heard that people needed food, water, and shelter. They also heard that people needed light at night. They heard it was dangerous at night because there were no streetlights or building lights—there were no lights anywhere.

The Solution: Andrea and Anna designed an inflatable solar-powered lantern. In 2015, they pitched their product on *Shark Tank* and received offers from all five investors! This has helped them get their lantern to people in more than 100 countries. Anna and Andrea's invention is inexpensive. It also packs flat to make shipping easier. This is very helpful for places affected by

natural disasters or other emergencies. LuminAID's lantern replaces candles or kerosene lamps, which can cause fires.

The light battery can be recharged using the small solar panel on the top of their lantern. There is a built-in USB port to recharge your cellphone or tablet. LuminAID can also be used by people who enjoy hiking and camping in remote areas.

Grades 3, 4, 5 Reading Level

The Challenge: Anna and Andrea were architecture students in New York City in 2010 when they heard about a massive earthquake in Haiti. They wondered what they could do to help the people affected and rescuers. In addition to the need for food, water, and shelter, they heard about increasingly dangerous night conditions caused by the lack of reliable sources of electricity. This inspired them to turn their attention to light.

The Solution: The two students turned innovators and entrepreneurs designed an inflatable solar-powered lantern. In 2015, they pitched their product on *Shark Tank* and received offers from all five investors, which has helped them get their lantern to people in more than 100 countries.

Anna and Andrea's invention is inexpensive and packs flat to make shipping thousands of lights to areas affected by natural disasters or other emergencies easy. The light battery can be recharged using the small solar panel on the top of their lantern. There also is a built-in USB port to recharge your cellphone or mobile device. LuminAID's lantern replaces reliance on candles or kerosene lamps, which can cause fires and contribute to unhealthy indoor air quality—and can't charge their devices. LuminAID not only helps people who lose power or rely on unsafe sources to provide light but also those who enjoy hiking and camping in the outdoors and remote areas.

JD Albert and Barrett Comiskey,

Co-Founders of E Ink

Kindergarten Reading Level

Note: Teacher version of the My STEM Stories™ *notebooks includes full text from grades 1, 2 reading level.*

JD Albert and Barrett Comiskey met at college. JD and Barrett wanted to invent electronic paper.

Can you imagine electronic paper? JD and Barrett tried a lot of different ideas.

Some ideas they tried did not work. Some ideas they tried were protected by **intellectual property laws**.

Then they tried an idea using rubber bubbles and special sand! That idea worked!

People from all over the world came to help them grow their business.

After 10 years Barrett and JD decided to try something new. Barrett has started many other companies. JD helps other people with their ideas.

Grades 1, 2 Reading Level

JD Albert and Barrett Comiskey met when they were in college in Cambridge, Massachusetts. Even though they were studying different subjects—JD was studying mechanical engineering while Barrett was studying math—they both joined the MIT Media Lab. The MIT Media Lab is an organization that focuses on bringing together ideas and ways of doing things that people normally don't think go together. (Read more about the MIT Media Lab here: https://www.media.mit.edu/about/mission-history/.)

At the Media Lab, JD and Barrett had the idea to make electronic paper. Electronic paper is something that would feel like paper but would work like a tablet. They also wanted it to be thin, light, and something you could bend or fold.

JD and Barrett tried out a lot of different ideas. One idea was to make tiny balls the size of a piece of birdseed. These balls were white on one side and black on the other. Electricity would make the balls spin around so the black side would show any writing on the paper. Unfortunately, it was very hard to make the number of balls they would need for their electronic paper. They also discovered that someone else already thought of the idea and had a patent. A patent is sort of like a note from the government saying that you are the only one who can use an idea. So, they had to think of something new!

JD and Barrett were sad that they had to start over again, but that didn't stop them. They went to the library and to the lab to research and test new ideas. Their success came when they combined ideas from medicine and physics. They created electronic paper using very small

rubber “bubbles” and special sand! Inside the rubber bubbles there was liquid and very small pieces of special colored sand-like material. This sand-like material could move around inside the bubble, or “microcapsule,” and allow you to write different things on the electronic paper.

JD and Barrett tested their idea and shared it with people they knew. They decided to start a company called E Ink and asked people from around the world to join their company and help them turn their idea into a product. They hired people from India, China, England, and Canada to help them. Everyone worked together sharing ideas, successes, and even failures. Sometimes, when they had to solve a really hard problem and needed more ideas they would work with other companies.

After years of hard work, JD, Barrett, and the team at E Ink started selling their electronic paper! The first product didn’t look exactly as they imagined it back in the MIT Media Lab, but that was OK. They had invented something totally new even if there was still a lot of room for improvement.

After working on their inventions and company for almost 10 years, both Barrett and JD decided to try something new. Barrett went to business school and has since started many new companies. JD wanted to help other people with their ideas. He works as an engineer and also teaches new inventors at the University of Pennsylvania.

Listen to JD, Barrett, and their professor from MIT talk about the E Ink journey here: https://www.youtube.com/watch?v=lOSCkHrllT4.

Grades 3, 4, 5 Reading Level

JD Albert and Barrett Comiskey met when they were in college in Cambridge, Massachusetts. Even though they were studying different subjects—JD was studying mechanical engineering while Barrett was studying math—they both joined the MIT Media Lab. The MIT Media Lab is an organization that focuses on bringing together ideas and ways of doing things that people normally don’t think go together.

Read more about the MIT Media Lab here: https://www.media.mit.edu/about/mission-history/.

While they were at the Media Lab, JD and Barrett got the idea that they wanted to make electronic paper. Electronic paper is something that would feel like paper but would work like a tablet. They also wanted it to be thin, lightweight, and flexible so you could roll it or fold it as you would a newspaper.

They tried out a lot of different ideas. The first idea they tried was to make tiny balls the size of a piece of birdseed. These balls were white on one side and black on the other. Electricity could make them spin around so that the black side would show any writing on the paper. However, when they ran more experiments with them, they figured out that it was going to be very hard to produce these little balls on a large scale. They also discovered that someone else already thought of the idea and had a patent. A patent is like a note from the government saying that you are the only one who can use a specific idea for 20 years. So, it was back to the drawing board!

JD and Barrett were a little disappointed that they had to start over again, but that is how it goes sometimes. They went back to the library and back to the lab to research and test new ideas. In the end, they discovered that when they combined two ideas from different areas of science—medicine and electronics—they could create a new way to make electronic paper that no one had ever thought of before. Their idea was to make very small rubber "bubbles," and inside they would put some liquid and very small pieces of special colored sand-like material. This sand-like material could move around inside the bubble, or "microcapsule," and allow you to write different things on the electronic paper.

JD and Barrett tested their idea and shared it with people they knew. Eventually, they decided to start a company called E Ink and asked people from around the world to join their company and help them. They hired people from India, China, England, and Canada to help them improve their idea and to turn their idea into a product. Everyone worked together sharing ideas, successes, and even failures. Sometimes, when they had to solve really hard problems and needed more ideas and different perspectives, they would form collaborations with other companies.

After years of hard work, JD, Barrett, and the team at E Ink started selling their electronic paper! The first product didn't look exactly as they imagined it back in the MIT Media Lab, but that was OK. They had invented something totally new even if there was still a lot of room for improvement.

After working on their inventions and company for almost 10 years, both JD and Barrett decided to try something new. Barrett went to business school and has since built a number of new companies. JD wanted to help other people with their ideas and splits his time between consulting as an engineer and teaching new inventors at the University of Pennsylvania.

Listen to JD, Barrett, and their professor from MIT talk about the E Ink journey here: https://www.youtube.com/watch?v=lOSCkHrllT4.

The Engineering Design Process

Despite what the name might suggest, the **engineering design process** is really no different than any creative or iterative process. You would follow the same basic steps if you were writing a story or painting a picture.

Step 1: Start with a question, problem, or goal.

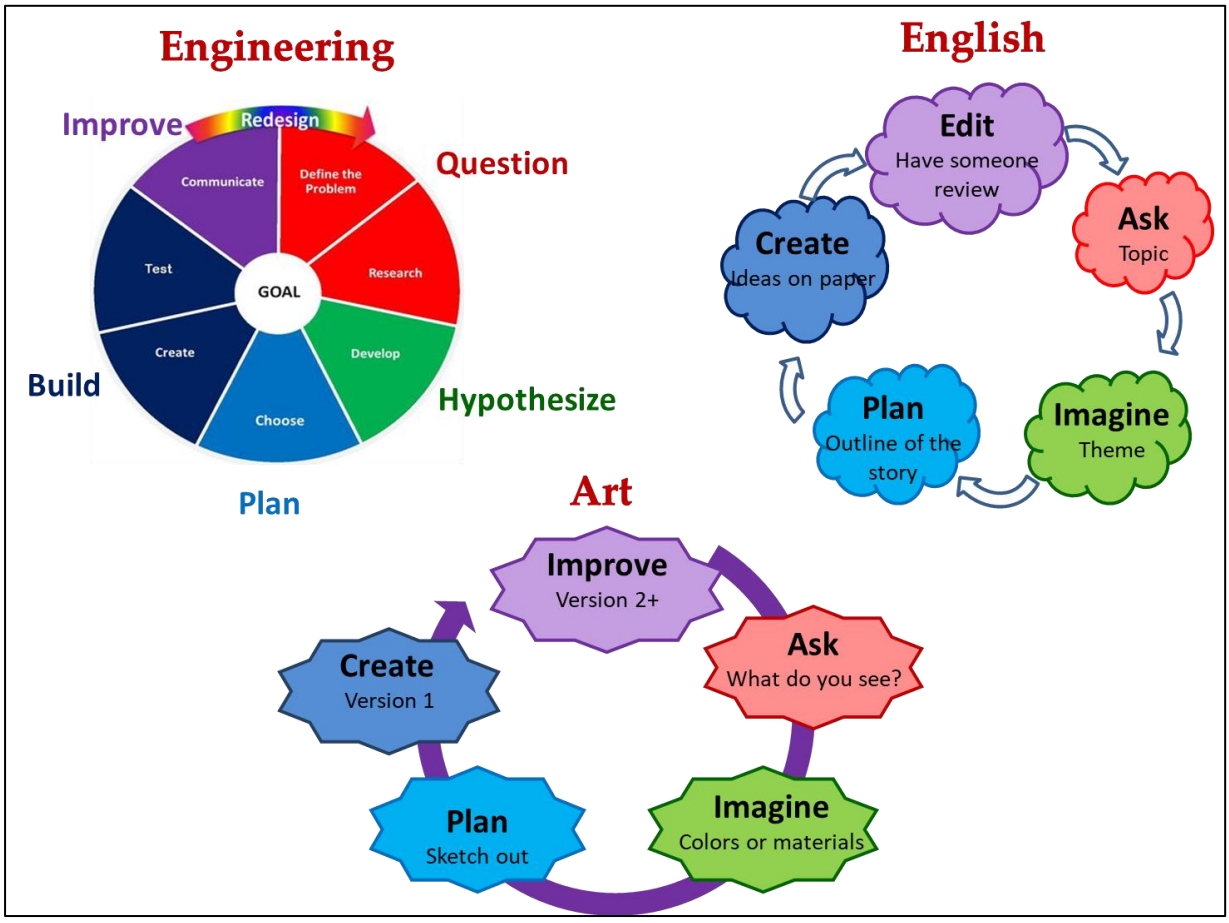
Step 2: Think about all the possibilities.

Step 3: Decide which ideas from step 2 you want to use.

Step 4: Create your first draft/prototype/version.

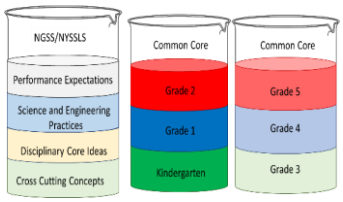
Step 5: Get feedback and improve your design.

Under some circumstances the words used to describe a step might be different, but the general goals of each step are the same.



Appendix

Digital Resources 	Digital Resources include: • Access to CreositySpace created digital content (lesson slides, videos, worksheets, etc.) • Links to online videos and websites • List of recommended books and field trips.
Handouts 	Handouts include • Slide pictures • Useful phrases for having constructive discussion • Presentation script

Standards & Other Instructional Tools
 
	This section contains:
	• Science standards alignment
	• Common Core ELA standards alignment
	• Instructional support documents
	  ○ Useful phrases for having constructive discussions
	  ○ Cooperative learning strategies (A. Venegas)
	  ○ ELPS scaffolds (N. Balayan, 2019)
	  ○ Multidimensional strategies that support English language development
	  ○ Engineering design process templates

Digital Resources

Access to CreositySpace created digital content (e.g., Lesson slides, CreositySpace videos, various handouts, etc.)

- Please review our short tutorial video at https://creosityspace.com/resources/
- To access the digital materials, please register your unit by emailing kath@creosityspace.com with the registration code provided in the front of this educator guide.
- At that point you can also schedule a complimentary online information session to support implementation of the Book of Ideas in your classroom.

Additional Teacher and Classroom Resources

Note: All links were confirmed as working at the time this Educator Guide was created. If you find a link that doesn't work, let us know so we may find a suitable—and working—link.

Books

Kids Inventing: A Handbook for Young Inventors. Casey, Susan. Jossey- Bass, 2005.
The Klutz Book of Inventions. Cassidy, John. Boyle, Brenda. Klutz, 2010.
Design Technology: Children's Engineering. Dunn, Susan and Rob Larson. Falmer Press, 1990.
Constructions for Children: Projects in Design Technology. Eichelberger, Barbara and Connie Larson. Dale Seymour Publications.
Mistakes That Worked: 40 Familiar Inventions and How They Came to Be. Jones, Foltz Charlotte. Doubleday, 1991.
How to Think Like a Scientist: Answering Questions by the Scientific Method. Kramer, Stephen P. Thomas Y. Crowell, 1987.
A Native American Thought of It: Amazing Inventions and Innovations. Landon, Rocky. Annick Press, 2008
Inventor's Workshop. McCormack, Alan J. Belmont, Pitman Learning, Inc. 1981.
African-American Inventors. McKissack, Pat and Frederick L. McKissack. Millbrook Press, 1994.
WakerUppers: A Spirited Collection of Thinking Activities. Rasmussen, Greta. Dale Seymour Publications.
Resource of Creative and Inventive Activities. Rowland, Dr. Elizabeth and Dr. Leonard Molotsky. Richardson, TX: National Inventive Thinking Association, 1994. (For teachers)
The Unconventional Invention Book. Stanish, Bob. Good Apple, Inc., 1981.
Build a Better Mousetrap. Striker, Susan. Holt, Rinehart & Winston, 1983.
Be an Inventor. Taylor, Barbara. Harcourt Brace, 1987.
Brainstorm: The Stories of Twenty American Kid Inventors. Tucker, Tom and Richard Loehle. Farrar Straus & Giroux, 1995.
100 Inventions That Shaped World History. Yenne, Bill. Bluewood Books, 1993.
The Chinese Thought of It: Amazing Inventions and Innovations. Ye, Ting-xing. Annick Press, 2009.
Mistakes That Worked 40 Familiar Inventions & How They Came To Be (Turtleback School & Library Binding Edition) by Charlotte Foltz Jones

PICTURE BOOKS

The Invention Of Hugo Cabret Story of a thieving orphan who tends the clocks in a Paris train station and unlocks the mystery his deceased father leaves behind won the 2008 Caldecott Medal, but it sounds familiar to you because it inspired Martin Scorsese's Oscar-winning 2011 film, *Hugo*. Get introduced to engineering and filmmaking in one shot.

Rosie Revere, Engineer The Godmother of maker women was World War 2's Rosie "We Can Do It!" The Riveter, whom the title character of this book is lucky enough to have as a great-great aunt. Rosie (the younger) is too shy to talk about her passion for inventing, but is motivated by a timely visit from Rosie (the elder) to pursue her dreams, attempt to build a flying machine, and start wearing a polka-dotted scarf around her head.

Marvelous Mattie: How Margaret E. Knight Became An Inventor *This is the story of* the lesser known Knight, aka "The Lady Edison," whose story reads like a real-life *Rosie Revere*. As a child she built her mother a foot warmer. At 12 she designed safer looms that saved textile workers' lives. After that went uncredited, she continued inventing as an adult and fought to become the first woman ever granted a U.S. patent.
Papa's Mechanical Fish This is the tale of a bumbling inventor who builds his greatest creation thanks to his inquisitive daughter. The real Philips designed early submarines and tested them by taking his family picnicking under Lake Michigan. Most of his inventions were never produced, nor was a Disney movie about his life; only one of those things seems reasonable.

Hello Ruby: Adventures In Coding The story sees Ruby befriending anthropomorphized programming languages in her quest to find 5 hidden gems and introduces coding basics through storytelling and activities.
If I Built A Car A young boy named Jack details all the fantastical elements of his dream car, and really should be getting a job offer from Google pretty soon because his design blows way past driverless. The writing and illustration is Dr. Seuss-meets-*Popular Mechanics*-meets *The Jetsons*, so you'll either lap up the nostalgia or get really annoyed that we still don't have flying cars.

Coppernickel, The Invention This book explores many ideas at once — invention, adventure, art — much like the overactive imagination of the titular protagonist, a bird named Coppernickel. Luckily, his trusty best friend, Tungsten the dog, is there to keep him grounded after a blank page at the end of a book of inventions inspires him to build an overly complex elderberry-picking machine.

Videos
Videos on innovation and entrepreneurship
https://youtu.be/5Uh1KxcpWz0 A short video on brainstorming.
https://www.youtube.com/watch?v=loqjxh_MDCM A video of some top kid entrepreneurs. (4:98 min, 15 sec ad)
http://www.slideshare.net/jamilkhatib/intelectual-property-rights-for-kids An additional slide show that discusses the different types of intellectual property law.
https://www.youtube.com/watch?v=QR_CfFuDWQ8 Short video on kid inventors (*The Ellen Show*). (2:57 min, 53 sec ad)
https://www.youtube.com/watch?v=c53QzWKuLpg Short video from the White House Science Fair. (4:23 min, no ad)

Videos on collaboration
https://www.youtube.com/watch?v=ga1_a4qw-As (3:10 min) How collaboration leads to great ideas. A bit fast paced so be prepared to stop and discuss if using for younger or ELL students.

Articles
http://www.forbes.com/sites/susanadams/2013/03/05/4-steps-to-successful-brainstorming/#367b39eb388f Great article on breaking down brainstorming into four steps.
http://www.educateip.org/index.php/curriculum Resources to educate kids on the rules and rights of IP. Aimed toward older kids but a good reference for teachers.
http://kidpreneurs.org/ A book about teaching kids the details of entrepreneurship.
https://www.entrepreneur.com/article/252004 A short article and neat infographic/poster that teaches students about key entrepreneurship skills (like resilience, industriousness, and self-confidence).

Articles on Young Entrepreneurs
http://www.businessnewsdaily.com/5051-young-entrepreneurs.html
https://www.theguardian.com/technology/2015/jan/25/silicon-valley-wonder-kid-lego-entrepreneur-braille-printer
https://www.theguardian.com/sustainable-business/five-young-entrepreneurs-how-started-business
https://www.theguardian.com/small-business-network/2015/jul/16/meet-teen-entrepreneurs-juggling-

homework-running-business
http://inhabitat.com/19-year-old-student-develops-ocean-cleanup-array-that-could-remove-7250000-tons-of-plastic-from-the-worlds-oceans/
http://www.mnn.com/green-tech/research-innovations/blogs/boy-discovers-microbe-that-eats-plastic
https://thewomensalzheimersmovement.org/alzheimers-app-emma-yang-timeless/

Websites
http://www.uspto.gov/kids/ The kids' section for the US Patent and Trademark office. Games, videos, activities, etc.
http://bizkids.com/ Website with a number of videos/shows about kids.

Handouts

Useful Phrases for Providing Constructive Feedback

Asking Clarifying Questions

Can you give an example?

Can you please explain your thinking?

Could you say that one more time?

Adding to an Idea

I agree, and I have an addition: _____.

I believe this is true because _____.

Yes, that makes sense, and I would also like to add _____.

Respectfully Disagreeing with an Idea

Could you explain, because I have a different idea?

I disagree with that idea because _____.

Slide

Useful Phrases for Providing Constructive Feedback

Asking Clarifying Questions

Can you be more specific?

Why do you think that happened?

Can you please explain your thinking?

Can you give me another example, so I can understand?

Adding to an Idea

I agree, and I have an addition: _____.

I believe this is true because _____.

Yes, that makes sense, and I would also like to add _____.

Respectfully Disagreeing with an Idea

Could you explain, because I have a different idea?

I respect your opinion and _____.

I see your reasoning and disagree with some of the idea because ____.

Presentation Script

Hi, My name is_____. Today I will tell you about the _____.
(enter the name of your invention or solution).

Today I'm going to tell you about _____ which
(enter the name of your invention or solution)

_____
(describe what the invention does in 1 sentence)

_____

_____

_____

The _____ has the following features
(enter the name of your invention or solution)

_____
(describe your solution in a bit more detail 1- 3 sentences)

_____

_____

_____

Thank you for your time and attention.

Education Standards and Other Instructional Tools

Don't see the standards for your school district? Contact us at Kath@creosityspace.com.

Common Core ELA Standards

Kindergarten

Reading Informational Text:
CCSS.ELA-LITERACY.RI.K.1With prompting and support, ask and answer questions about key details in a text.
CCSS.ELA-LITERACY.RI.K.4 With prompting and support, ask and answer questions about unknown words in a text.
CCSS.ELA-LITERACY.RI.K.10 Actively engage in group reading activities with purpose and understanding.

Writing:
CCSS.ELA-LITERACY.W.K.2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
CCSS.ELA-LITERACY.W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).
CCSS.ELA-LITERACY.W.K.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

Speaking & Listening:
CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about *kindergarten topics and texts* with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.K.2 Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
CCSS.ELA-LITERACY.SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
CCSS.ELA-LITERACY.SL.K.5 Add drawings or other visual displays to descriptions as desired to provide additional detail.
CCSS.ELA-LITERACY.SL.K.6 Speak audibly and express thoughts, feelings, and ideas clearly.

Language:
CCSS.ELA-LITERACY.L.K.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CCSS.ELA-LITERACY.L.K.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on kindergarten reading and content.
CCSS.ELA-LITERACY.L.K.6 Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

Grade 1

Reading Informational Text:
CCSS.ELA-LITERACY.RI.1.1 Ask and answer questions about key details in a text.
CCSS.ELA-LITERACY.RI.1.4 Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
CCSS.ELA-LITERACY.RI.1.10 With prompting and support, read informational texts appropriately complex for grade 1.

Writing:
CCSS.ELA-LITERACY.W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
CCSS.ELA-LITERACY.W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

Speaking & Listening:

CCSS.ELA-LITERACY.SL.1.1 Participate in collaborative conversations with diverse partners about *grade 1 topics and texts* with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.1.2 Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
CCSS.ELA-LITERACY.SL.1.5 Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
CCSS.ELA-LITERACY.SL.1.6 Produce complete sentences when appropriate to task and situation. (See grade 1 Language standards 1 and 3 here for specific expectations.)

Language:

CCSS.ELA-LITERACY.L.1.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CCSS.ELA-LITERACY.L.1.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on *grade 1 reading and content*, choosing flexibly from an array of strategies.
CCSS.ELA-LITERACY.L.1.6 Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., *because*).

Grade 2

Reading Informational Text:

CCSS.ELA-LITERACY.RI.2.4 Determine the meaning of words and phrases in a text relevant to a *grade 2 topic or subject area*.
CCSS.ELA-LITERACY.RI.2.6 Identify the main purpose of a text, including what the author wants to answer, explain, or describe.
CCSS.ELA-LITERACY.RI.2.8 Describe how reasons support specific points the author makes in a text.

Writing:

CCSS.ELA-LITERACY.W.2.1 Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., *because*, *and*, *also*) to connect opinion and reasons, and provide a concluding statement or section.
CCSS.ELA-LITERACY.W.2.2 Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.
CCSS.ELA-LITERACY.W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
CCSS.ELA-LITERACY.W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Speaking & Listening:

CCSS.ELA-LITERACY.SL.2.1 Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups.
CCSS.ELA-LITERACY.SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
CCSS.ELA-LITERACY.SL.2.6 Produce complete sentences when appropriate to task and situation in order to provide requested detail or clarification. (See grade 2 Language standards 1 and 3 here for specific expectations.)

Language:

CCSS.ELA-LITERACY.L.2.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CCSS.ELA-LITERACY.L.2.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 2 reading and content, choosing flexibly from an array of strategies.
CCSS.ELA-LITERACY.L.2.6 Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using adjectives and adverbs to describe (e.g., *When other kids are happy that makes me happy*).

Grade 3

Reading Informational Text:
CCSS.ELA-LITERACY.RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
CCSS.ELA-LITERACY.RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.

Writing:
CCSS.ELA-Literacy.W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons.
CCSS.ELA-Literacy.W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Speaking & Listening:
CCSS.ELA-LITERACY.SL.3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.
CCSS.ELA-Literacy.SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

Language:
CCSS.ELA-LITERACY.L.3.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CCSS.ELA-LITERACY.L.3.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
CCSS.ELA-LITERACY.L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Reading Literature:
CCSS.ELA-LITERACY.RL.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

Reading Foundation:
CCSS.ELA-LITERACY.RF.3.4 Read with sufficient accuracy and fluency to support comprehension.

Grade 4

Reading Informational Text:
CCSS.ELA-LITERACY.RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
CCSS.ELA-LITERACY.RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

Writing:
CCSS.ELA-LITERACY.W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
CCSS.ELA-LITERACY.W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
CCSS.ELA-LITERACY.W.4.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

Speaking & Listening:
CCSS.ELA-LITERACY.SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

Language:
CCSS.ELA-LITERACY.L.4.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CCSS.ELA-LITERACY.L.4.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
CCSS.ELA-LITERACY.L.4.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
CCSS.ELA-LITERACY.L.4.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.
CCSS.ELA-LITERACY.L.4.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, that are basic to a particular topic (e.g., *wildlife, conservation,* and *endangered* when discussing animal preservation).

Reading Foundation:
CCSS.ELA-LITERACY.RF.4.4 Read with sufficient accuracy and fluency to support comprehension.

Grade 5

Reading Informational Text:
CCSS.ELA-LITERACY.RI.5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
CCSS.ELA-LITERACY.RI.5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
CCSS.ELA-LITERACY.RI.5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.

Writing:
CCSS.ELA-LITERACY.W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
CCSS.ELA-LITERACY.W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
CCSS.ELA-LITERACY.W.5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

Speaking & Listening:
CCSS.ELA-LITERACY.SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

Language:
CCSS.ELA-LITERACY.L.5.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CCSS.ELA-LITERACY.L.5.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
CCSS.ELA-LITERACY.L.5.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.

Reading Foundation:
CCSS.ELA-LITERACY.RF.3.4 Read with sufficient accuracy and fluency to support comprehension.

Next Generation Science Standards/NY State Science Learning Standards K–5

Performance Expectations

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Science and Engineering Practices

Asking questions/defining problems
The innovation prompts have students asking questions and defining problems.

A lot of the writing prompts require students to ask themselves questions.

Constructing explanations/designing solutions, developing and using models
Student inventions are a solution to the innovation prompt. As students create labeled drawings and explanations of their inventions, and possibly prototypes, they are creating models of their products.

The design portion of the activity has the students thinking about, designing, and, if there is time, building a prototype (all of which can be considered various models).

Students share, explain, and give feedback on their ideas and designs.

Obtaining, evaluating, and communicating information
Presenting and discussing their ideas give students a chance to work on these skills.

Disciplinary Core Ideas

ETS1.A: Defining and delimiting engineering problems
ETS1.B: Developing possible solutions
Innovation prompts challenge students to understand a problem and develop possible solutions.

Crosscutting Concepts

Cause and effect, structure and function
As students create and design their inventions they must think about the role of different features.

Systems and system models
Sketches and prototypes (if applicable) give students a chance to model how their invention may work and how people may interact with it.

Scale, Proportion, and Quantity
As students create and design their inventions they must think about the size and weight of their solutions and materials of construction.

Connections to Nature of Science

Science is a human endeavor
The whole idea of the challenge is about solving a problem and thinking about who will use this solution.

Connections to Engineering, Technology, and Applications of Science

Interdependence of science, engineering, and technology
Entrepreneur story and the collaborative nature of invention highlight the interdependence of science, engineering, and technology.

Influence of engineering, technology, and science on society and the natural world
The *Book of Ideas* and the concept of intellectual property are examples of how STEM concepts interact with the whole community.

Instructional Support Documents

The following resources have been recommended to us by a number of teachers who are a part of our CreositySpace community. While many of them are freely available via a quick internet search, we have included them here for your use. Where possible, we have given credit to the resource's creator.

1. Useful phrases for having constructive discussions
2. Cooperative learning strategies (A. Venegas)
3. ELPS scaffolds (N. Balayan, 2019)
4. Multidimensional strategies that support English language development
5. Engineering design process templates

Useful Phrases for Having Constructive Discussions

Asking Clarifying Questions

Can you be more specific?

Can you explain your answer further?

Can you give an example?

Can you please explain your thinking?

Can you repeat what you said?

Could you rephrase that?

Could you say that one more time?

Did I hear you correctly what you said … ?

Did I hear you say … ?

Did I understand you when you said … ?

Is this what you said: _____?

What do you mean by _____?

What's another way you might … ?

What is your evidence?

What resources were used for this project?

Adding to an Idea

I agree with _____because _____.

I agree with _____.

I agree with _____, and I also think _____.

I agree with _____, and would like to add _____.

I agree, and I have an addition: _____.

I believe this is true because _____.

I know that too because _____.

I have something to add; _____.

I think you are right, and I also think _____.

I would like to add to that idea.

This reminds me of _____ because _____.

Yes, that makes sense, but I would also like to add _____.

Respectfully Disagreeing with an Idea

Could you explain, because I have a different idea.

I disagree with that idea because _____.

I disagree with your reasoning because _____.

I disagree with _____ because _____.

I have completely different opinion on that.

I respect your opinion and _____.

I respect your point, and in my opinion _____.

I respectfully disagree because _____.

I see your reasoning and disagree with some of the idea because _____.

That's a good point, and _____.

Cooperative Learning Strategies

There are some popular strategies that can be used with all students to learn content (such as science, math, social studies, language arts, and foreign languages). However, they are particularly beneficial to ELLs for learning English and content at the same time. Most of these strategies are especially effective in teams of four.

1. Round Robin

   Present a category (such as names of mammals) for discussion. Have students take turns going around the group and naming items that fit the category.

2. Roundtable

   Present a category (such as words that begin with b). Have students take turns writing one word at a time.

3. Write-Around

   For creative writing or summarization, give a sentence starter (for example, if you give an elephant a cookie, he's going to ask for…). Ask all students in each team to finish that sentence. Then, they pass their paper to the right, read the one they received, and add a sentence to that one. After a few rounds, four great stories or summaries emerge. Give children time to add a conclusion and/or edit their favorite one to share with the class.

4. Numbered Heads Together

   Ask students to number off in their teams from one to four. Announce a question and a time limit. Students put their heads together to come up with an answer. Call a number and ask all students with that number to stand and answer the question. Recognize correct responses and elaborate through rich discussions.

5. Team Jigsaw

   Assign each student in a team one fourth of a page to read from any text (for example, a social studies text), or one fourth of a topic to investigate or memorize. Each student completes his or her assignment and then teaches the others or helps to put together a team product by contributing a piece of the puzzle.

6. Tea Party

   Students form two concentric circles or two lines facing each other. You ask a question and students discuss the answer with the student facing them. After one minute, the outside circle or one line moves to the right so that students have new partners. Then pose a second question for them to discuss. Continue with five or more questions.

After each cooperative learning activity, you will want to debrief with the children by asking questions such as: What did you learn from this activity? How did you feel working with your teammates? If we do this again, how will you improve working together?

ELPS Scaffolds

Level 1	Level 2	Level 3	Level 4	Level 5
WHOLE CLASS:	**WHOLE CLASS:**	**WHOLE CLASS:**	**WHOLE CLASS:**	**WHOLE CLASS:**
Minilesson: - Visuals (video) - Stop and ask questions - Wait time - Private reasoning - Clarify vocab - Graphic organizer - Collecting feedback - TPR/realia - Modeling (verbally, in writing, ELMO) - Multiple representations - Analyzing sample work	Minilesson: - Visuals (video) - Stop and ask questions - Wait time - Private reasoning - Clarify vocab - Graphic organizer - Collecting feedback - TPR/realia - Modeling (verbally, in writing, ELMO) - Multiple representations - Analyzing sample work	Minilesson: - Visuals (video) - Stop and ask questions - Wait time - Private reasoning - Clarify vocab - Graphic organizer - Collecting feedback - TPR/realia - Modeling (verbally, in writing, ELMO) - Multiple representations - Analyzing sample work	Minilesson: - Visuals (video) - Stop and ask questions - Wait time - Private reasoning - Clarify vocab - Graphic organizer - Collecting feedback - TPR/realia - Modeling (verbally, in writing, ELMO) - Multiple representations - Analyzing sample work	Minilesson: - Visuals (video) - Stop and ask questions - Wait time - Private reasoning - Clarify vocab - Graphic organizer - Collecting feedback - TPR/realia - Modeling (verbally, in writing, ELMO) - Multiple representations - Analyzing sample work
DIFFERENTIATION:	**DIFFERENTIATION:**	**DIFFERENTIATION:**	**DIFFERENTIATION:**	**DIFFERENTIATION:**
Group/pair work: - Intentional grouping - Graphic organizer - Structured talk - Sentence frames - Translations - Pictures - Word bank - Multiple pathways Individual work: - Translations - Sentence frames - Graphic organizer - Vocabulary - Different ways to show what they know - Extended time - Making connections between representations	Group/pair work: - Intentional grouping - Graphic organizer - Structured talk - Sentence frames - Translations - Pictures - Multiple pathways Individual work: - Translations - Sentence frames - Vocabulary - Graphic organizer - Different ways to show what they know - Making connections between representations	Group/pair work: - Intentional grouping - Graphic organizer - Structured talk - Sentence frames - Multiple pathways Individual work: - Graphic organizer - Vocabulary - Making connections between representations	Group/pair work: - Intentional grouping - Graphic organizer - Structured talk - Multiple pathways Individual work: - Graphic organizer - Making connections between representations	Group/pair work: - Intentional grouping - Graphic organizer - Structured talk - Multiple pathways Individual work: - Graphic organizer - Making connections between representations

Multidimensional Strategies That Support English Language Development

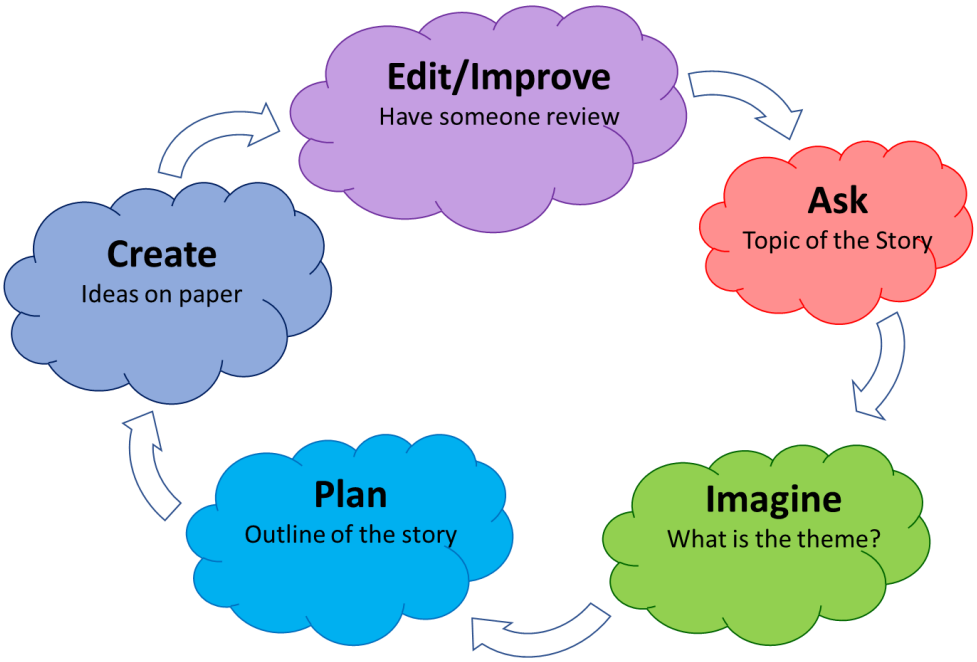
When planning for instruction, use a variety of strategies, techniques, and materials for making grade-level core curriculum accessible for English language learners while at the same time promoting their English language development. The chart below provides examples of sensory, graphic, and interactive supports for English language development within each lesson. Use at least one strategy from each column daily (for example, when showing videos, use the graphic organizer to take notes in addition to providing students with an opportunity to turn and talk with partners).

Sensory Support	Graphic Support	Interactive Support
Real-life objects	Charts	In pairs or partners
Scientific instruments	Graphs	Small groups
Measurement tools	Tables	Whole group
Physical models	Number lines	Using cooperative group structures
Natural materials	Timelines	Using the internet or software programs
Actual substances	Advanced organizers	In student's native language
Organisms or object of investigation	Drawing	With mentors
Posters/illustrations of processes or cycles	Models	Other
Illustrations and diagrams	Graphic organizers (Venn diagram, T-chart, cycles, cause and effect, semantic web)	
Pictures, icons, and symbols	Other	
Videos and films		
Interactive investigations		
Photographs		

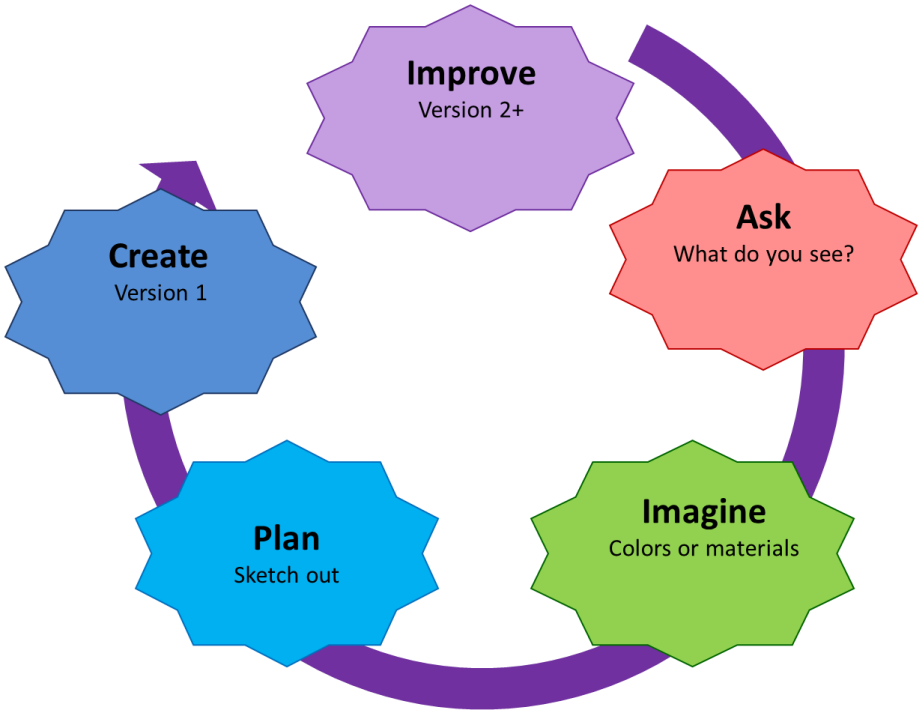
Support is an instructional strategy or tool used to assist students in accessing content necessary for classroom understanding or communication. Support may include teaching techniques, such as modeling, feedback, or questioning. Other types of support involve students using visuals or graphics, interacting with others, or using their senses to help construct meaning of oral or written language. We believe that support is important for all learners to gain access to meaning through multiple modalities, but it is absolutely essential for ELL.

Engineering Design Process

Writing



Art



Need Some Inspiration?

Check out these student inventors!

Natalie (10 years old)

"I love dogs and any kind of animal. This chair has a pet carrier under it. This special seat is going to be sold to airline companies across the world."

Aya (10 years old)

"This is ROBO the help robot. He is basically something to help people and with is parachute. He can be dropped from the sky, and he brings some food and water for people in need."

Ma'ayan (8 years old)

"I made this cat treat dispenser because I don't like touching the cat treats."

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