Muse® Teacher Guide: February 20

PLUS+ GUIDE TO THE INVENTION CHALLENGE
I Can Invent!

WHAT'S YOUR BRIGHT IDEA

This issue of MUSE celebrates the mind and spirit of young inventors across our nation. Students will learn how determination, passion, and the willingness to fail are key components in the quest to advance our society. Prepare to be amazed!

CONVERSATION QUESTION

How do creators achieve their ultimate goal of a successful invention?

TEACHING OBJECTIVES

- **Students will learn how Dr. InBae Yoon pursued his dreams of creating new tools to improve healthcare.**
- **Students will learn how a teenager's boredom and passion led to the invention of an advanced robotic prosthetic.**
- **Students will learn how the determination of two young students led to important inventions.**
- **Students will analyze problem-and-solution relationships.**
- **Students will identify cause-and-effect relationships.**
- **Students will examine the methods by which scientists obtain information.**
- **Students will create an informative brochure that details the advantages of laparoscopic surgery.**
- **Students will write a goal statement for 2019 and include strategies to overcome obstacles that arise.**
- **Students will research how past civilizations used a variety of strategies and materials to purify their water.**

In addition to supplemental materials focused on core STEM skills, this flexible teaching tool offers vocabulary-building activities, questions for discussion, and cross-curricular activities.

SELECTIONS

- **The Curious Kid**
  Expository Nonfiction, ~650L
- **The Limber Inventor**
  Expository Nonfiction, ~1050L
- **For the Win!**
  Expository Nonfiction, ~750L

Special Feature Discussion Guide

I CAN INVENT

What are inventions and how can kids invent things that matter?

Inventions are all around us. They solve problems and make our lives easier. **Use this month's magazine to help students learn about the invention process and meet some young inventors through reading about them and their work.** Then, they can try inventing on their own and/or in groups, at school or at home.

Dear Educator,

Your students are invited to use this month's magazine to spark discussion about invention and then share their own invention ideas in the Dr. InBae Yoon Spark!Lab Invention Challenge, an international contest for young inventors sponsored by the Smithsonian and Cricket Media. Students can enter as individuals or teams by submitting a PowerPoint presentation or video outlining their idea. (Your whole class can even participate as a single team!)

For 2019, the Challenge is asking students to create entries that enhance the lives of older adults, and we are accepting entries from January 17, 2019–April 5, 2019. Winners can receive prizes, a trip to Washington, DC, to meet other inventors, and an educational session on how to patent their invention!

Learn all about this year's challenge on the website, and use this special edition teacher guide to discover how to integrate the magazine into your classroom discussions with Challenge participation!

Happy Inventing!

The Cricket Media Education Team

UNIT OVERVIEW

Essential Question:

What are inventions and how can kids invent things that matter?

Supporting Questions:

- How do inventors get their ideas?
- What are some common inventions and what problems do they solve?
- How do inventors impact our everyday lives and make our world a better place?
- What makes an invention successful?
- What special needs might older people have?
- How might I come up with an invention that helps older people stay independent and be mentally, socially and physically active?

Objectives:

Students will know and be able to:

- describe the steps in the invention process
- engage in the invention process
- participate in a global invention challenge
- explain how inventors use the invention process
- explain the impact of inventions on human society over time
- explore the invention process through articles and by designing and/or inventing an invention
- communicate design ideas using words, drawings and/or models

Resources:

- February 2019 Invention edition of magazine
- Teacher Resources for leading students in Spark!Lab Invent It Challenge submission: https://inventitchallenge2019.epals.com/educator-resources/
- Student Resources for Spark!Lab Invent It Challenge participation: https://inventitchallenge2019.epals.com/student-resources/

Next Generation Science Standards:

- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria).

- Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

See additional standards at the end of the discussion guide.

Vocabulary

- **invent:** the process of coming up with new ideas or designs to solve problems
- **invention:** a new device or process that's designed to solve a problem
- **inventor:** a person who dreams up, designs, and builds new things that make our lives better
- **invention process:** a series of steps that inventors might follow to come up with a solution to a problem
- **patent:** a legal right given to an inventor by the government that allows the inventor to prevent others from making, selling, or using their invention for a period of time
- **prototype:** a model or practice version of a design that can be tested and checked before an actual version is created
- **senior:** an elderly or aging person, usually retired (also called "senior citizen")
- **sketch:** a drawing (Inventors use sketches to show and explain their ideas and inventions. Sketches are needed to apply for a patent.)
- **user:** a person who will use an invention

Use the following activities to gives students opportunities to explore ideas about the topic by participating in both small and large group peer discussions, using the articles they have read and their discussions to support their statements and opinions.

SPARKING COMPREHENSION AND CONVERSATION

Introduce the Magazine and the Invent It Challenge

1. **Engage: Introduce Inventors.** Start by sharing pictures of the inventors in the articles. What do these kids and adults have in common? They have invented things that make life better.

   In this magazine, we're going to learn about inventors and their inventions. And, if the class is interested, we can try inventing ourselves and participate in the Spark!Lab Invent It Challenge. Winners can receive prizes, a trip to Washington, DC, to meet other inventors, and learn how to patent and sell their inventions!

2. **Present the Essential Question: *What are inventions and how can kids invent things that matter?*** Ask students to list inventions they have seen or heard about. Who came up with each invention? How did the person or team come up with the idea? What might have been the process? Post the Essential Question and read it aloud, connecting it to the inventions students mentioned. Remind students that this question does not have one right answer and that they should revisit it with each selection they read.

3. **Activate Prior Knowledge.** As a class, start a 3-column *What, How, Why* Chart. Make the chart on paper or a place on a board where you can keep it throughout the discussion. Ask students to fill in an invention they already know about. Have students continue to complete the class chart as they read selections from the magazine, listing inventions they learn about, who came up with them and how they did it, and finally why the invention is important.

What? What is the invention?	**How?** Who came up with the invention? How did they come up with it?	**Why?** Why is the invention important?

4. **Build Background:** Teach the Invention Process. Tell students that there are key steps that inventors often use. Read each step aloud as you write it on the board and share with them the step-by-step videos found here, which contains an explanation of each step.

   Invention is a process, from creative ideas all the way to successful marketing. Inventors will usually pass through each of the following steps (though not always in the same order!):

   Think It - Identify a problem or need

   Explore It - Conduct Research

   Sketch It - Make sketches

   Create It - Build prototypes

   Try It - Test the invention

   Tweak It - Refine the invention

   Sell It - Market the invention Ask students to think about why each step is important. Tell them to think about these steps as they read and discuss the articles. How is the invention process used by inventors in the articles?

5. **Get Students Thinking About The Challenge.** This year's challenge is about helping older people. Sometimes as we get older, it's harder to do things, such as get up out of a chair, fasten a seat belt, or open a jar. Show the Learn About the Challenge Video. Ask students if they have a grandparent or older person in their lives. Can they think of inventions that make these older people's lives easier?

Use a Read-Aloud to Spark More Discussion


Helping Seniors Communicate

Matias Osuna, 17, knows that talking is an important part of our lives. "Our personality is what we say and how we say it," he says. "Communication is what makes us 'us.'"

He thought about communication when his school's FIRST Lego League team was entering an inventing contest. The challenge was to solve a problem seniors face as they age, or get older. Seniors is the term for people age 60 and up.

That was 2012. Matias was 11 and new to the team. He was eager to learn from the other students. And he was excited to invent something helpful!

Think It = FIND A PROBLEM

Matias's team of 7 kids set out to learn about aging. They visited a senior care home near their school. They learned that a common problem is "dementia." People with dementia can have trouble remembering things. They can forget how to do simple tasks. They might even have trouble putting words together in a sentence. That makes it hard for them to say what they need. And it makes it hard for caregivers to help them.

In Colombia, where Matias lives, and around the world, dementia is a serious problem that affects a lot of people. Matias' team wanted to invent something to help people with dementia and their caregivers.

Explore It = STUDY THE OPTIONS

Matias and his team knew some computer programming. They wondered if they could make a communication app. They learned about an emergency communication system that asks people questions. In that app, the people select an answer from a set of options. The team liked this model. The team also learned that many people in Colombia have tablets. Tablets are easy for seniors to hold and tap. An app for a tablet could be a good solution!

Sketch It = DRAW A PICTURE

The team imagined an app with simple icons. The icons would stand for basic needs. They sketched the icons and the screens the seniors would see. They drew icons for food, bathroom, dressing, and health needs. There was also an emergency "panic button" and an icon for basic words, such as "Hello" and "Goodbye."

Sketching plans for the icons

1. **Preview the Read-Aloud.** Introduce and project the Read-Aloud article, "Helping Seniors Communicate." Tell students this invention was created for the Spark!Lab Invention Challenge.
   - Remind students that they will be discussing this and other articles with each other. Encourage students to jot down details or questions to share with each other.
   - Encourage students to listen for details that build understanding around the Essential Question, as well as the invention process, and any information they might add to the class *What, How, Why* Chart.

2. **Introduce the Reading Skill: Prereading.** Before you begin reading, tell students that this article contains headings, pictures, and captions that give clues about the text. Invite students to skim the headings and look at the pictures. Invite students to skim the headings and look at the pictures. Then, ask the following questions:
   - What do you think this article is about?
   - What does it mean to invent?
   - What problem does Matías want to solve?

3. **Introduce Vocabulary.** Introduce two topic-specific words that students will encounter in this article:
   - prototype: a working model
   - patent: a legal right given to an inventor by the government that allows the inventor to prevent others from making, selling, or using their invention for a period of time

   Before providing each definition, have students look for these words in the article itself. Ask students to infer the meanings based on the context. Help students look for context clues in the text and refine their definitions.

4. **Read and Model.** Complete the following activities as you read the selection. Using Headings, use "Think-Alouds" to model how the headings help you navigate the text. For example, after the introductory paragraph, point out the first heading and link it to the first step in the diagram of the Invention Process. Then present this Think- Aloud:

   The heading of this next section is Think It: Describing the Problem. This is the first step in the Invention Process. This helps me know as a reader where I am in the invention process and what happens during the first step. After I read this section, I'll see if I can describe the first step in the invention process.

5. **Discuss.** After you read, show students a list of the key steps in the Invention Process. Then discuss each step in the context of Matías' process.
   a. Think It: What problem was Matías and his team trying to solve? (They wanted to find a way to help older people communicate with their caregivers.)
   b. Create It: How did Matías' team create his invention? (They used a computer program called Flash to create the application.)
   c. Try It: What did Matías' team learn from the first round of tests? (The buttons were too small and not all needs could be communicated.)
   d. Tweak It: How did Matías improve the invention? How could you improve on it? (He made the icons bigger, added more options, and changed the basic words to basic questions.)

Explore and Discuss the Articles

1. **Preview the Selections.** Tell students it's now time to read about the process of invention on their own! Direct them to flip through the magazine and preview the articles in this unit. Encourage them to skim each article as they think about which one interests them the most. Explain that while they are encouraged to read all the articles in this magazine, they will be choosing one "focus article" to read closely and discuss with their peers.

2. **Select a Focus Article.** After students have had time to preview the articles, tell them to pick one that they'd like to spend more time on and discuss with their classmates. Have them read a few paragraphs to see if they have any trouble reading it but encourage them to "stretch" their reading skills a little if they like the story.

3. **Read and Take Notes.** Suggest that students track the invention process steps used by the inventor(s) in their focus article. Also remind them to jot down questions they'd like to share with their classmates. When they are finished, encourage students to think about an invention they would like to work on. If they aren't sure, encourage them to read additional articles in the magazine to continue to build their knowledge about inventions and the invention process.

4. **Discuss the Articles.** Have students form small groups based on the article they read. Provide them with the following questions to use as discussion prompts. Tell them that they will be sharing what they learned with the rest of the class, and suggest that one or more students record the answers they come up with. Also, encourage them to add the invention they read about to the class *What, How, Why* Chart.

   Discussion Prompts
   - What problem does each inventor try to solve?
   - What solutions does the inventor consider or try?
   - How well did the first design or prototype work?
   - How did the inventor improve the invention over time?
   - Which steps in the invention process did the inventor follow?
   - Who is likely to use the invention and how might it help them?

Reflect and Discuss

1. **Share Ideas.** Bring the small groups together for a whole-class discussion. Ask students to share what they learned from their individual articles with the rest of the class. Move from group to group, asking volunteers to share the summary of the article, and then important ideas from their discussion.

2. **Synthesize.** After small groups have shared their ideas, discuss the following questions as a class. Encourage students to support their answers with details and evidence from the focus article they read.
   - How do inventions help us in our daily lives?
   - What role might invention play in the future?
   - What would life be like without inventions?

3. **Revisit the Essential Question.** Bring the class together to allow students to share what they've learned. Then, return the conversation to the Essential Question: What are inventions and how can kids invent things that matter?

Allow students to share how their understanding around this question has grown based on their reading and discussions.

Participate in The Spark!Lab Invention Challenge!

Now that students have built their background knowledge about inventors and the invention process, lead your students in engaging in the invention process, using the theme of the Challenge (helping aging people) and help them submit their ideas online to the international competition.

See the Spark!Lab invention website for additional details and resources to support students in creating and submitting their invention ideas.

STANDARDS ALIGNMENT

National Council of Social Studies Standards

- Theme 2: Time, Continuity and Change
- Theme 8: Science, Technology and Society

CCSS Anchor Standards for Reading

Key Ideas and Details

- Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence … to support conclusions drawn from the text.
- Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
- Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
- Interpret words and phrases as they are used in a text. Integration of Knowledge and Ideas
- Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.
- Range of Reading and Level of Text Complexity
- Read and comprehend complex literary and informational texts independently and proficiently.

Anchor Standards for Writing

Text Types and Purposes

- Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately.
- Write narratives to develop real or imagined experiences or events. Production and Distribution of Writing
- Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
- Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Research to Build and Present Knowledge

- Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
- Draw evidence from literary or informational texts to support analysis, reflection, and research.

Range of Writing - Write routinely over extended time frames and shorter time frames for a range of tasks, purposes, and audiences.

Anchor Standards for Speaking and Listening

- **Comprehension and Collaboration** - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners
- **Presentation of Knowledge and Ideas** - Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

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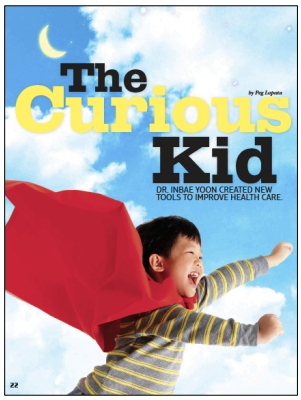
The Curious Kid

pp. 22–23, Expository Nonfiction

Dream big with InBae Yoon and learn how small ideas can lead to great inventions. Students will examine the technology of laparoscopic surgery while being inspired to follow their own passions.

Lexile Score: ~650



RESOURCES

- Solution Seeker

OBJECTIVES

- Students will learn how Dr. InBae Yoon pursued his dreams of creating new tools to improve healthcare.
- Students will analyze problem-and-solution relationships.
- Students will create an informative brochure that details the advantages of laparoscopic surgery.

KEY VOCABULARY

- ***laparoscopy* (p. 23)** a surgical procedure in which small incisions are made in the abdominal wall and instruments are inserted to view the organs or perform a surgery
- ***manipulate* (p. 23)** to handle or control, typically in a skillful manner
- ***open surgery* (p. 23)** traditional type of surgery in which a large incision is made using a scalpel

ENGAGE

Conversation Question: How do creators achieve their ultimate goal of a successful invention?

Ask if anyone in the class has had a surgery and would be comfortable sharing details. Inquire further about relatives and friends. Allow time for discussion and list any pertinent revelations on the board. Guide the conversation so that it acknowledges how modern inventions are constantly making new surgeries possible and shortening recovery times. Complete the vocabulary activity below, and then distribute the article.

INTRODUCE VOCABULARY

Prepare students to read by introducing the key vocabulary terms. Divide the class into groups of three and assign each child in the group one of the vocabulary words. Instruct them to define and record the meaning of the term. They will each be responsible for teaching their word to the others in the group. Upon completion, students should have recorded accurate definitions for all three words.

READ & DISCUSS

Reinforce information presented in this article by using the following prompts to direct discussion.

- Explain what is meant by the first sentence in paragraph two. (“Like many inventors, Yoon thought big.”)
- What is laparoscopic surgery?
- How has InBae Yoon helped patients (human and animal) all around the world?

CONCEPT/SKILL FOCUS: Problems and Solutions

INSTRUCT: Inform students that they will be rereading the article with a partner and highlighting passages that depict how Yoon solved certain problems that existed in the medical field. Distribute copies of the graphic organizer, *Solution Seeker*, and tell students that they will be responsible for recording the problem/solution relationships from the article. Pairs should discuss their findings as they complete their work.

ASSESS: Review the information that the students listed on their charts. Evaluate the thoroughness and accuracy of their statements. If errors are noted, direct students to return to the text to make corrections.

EXTEND

Language Arts Have students create a brochure that would inform patients about the benefits of laparoscopic surgery. They can use information from the article as well as other resources to educate new patients. Students should use graphics/drawings to enhance their brochure. Attempt to display the finished work. (Nurse’s office, local vet, etc.)

Solution Seeker

Use information from the article, "The Curious Kid," to explain the problems of open surgery that Dr. InBae Yoon was able to resolve by using laparoscopic technology.

Open Surgery Problems	Laparoscopic Solutions
Large cuts from surgery take a long time to heal.	"Keyhole" surgery only requires tiny cuts that heal more quickly.

How can being curious help an inventor to reach their goals?

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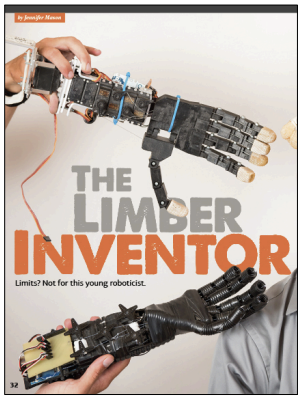
The Limber Inventor

pp. 32–37, Expository Nonfiction

Young readers will be fascinated to learn about the inventor, as well the invention, in this article that details the journey of Easton LaChappelle. Discover why his robotic prosthetics are an exciting advancement for people who are missing limbs, and why his devices have gained the attention of the POTUS and NASA.

Lexile Score: ~1050



RESOURCES

- A Robotic High Five

OBJECTIVES

- Students will learn how a teenager's boredom and passion led to the invention of an advanced robotic prosthetic.
- Students will identify cause-and-effect relationships.
- Students will write a goal statement for 2019 and include strategies to overcome obstacles that arise.

KEY VOCABULARY

- ***amputate* (p. 34)** to surgically cut off all or part of a limb or digit
- ***cacophony* (p. 36)** a harsh, chaotic mixture of sounds
- ***neurons* (p. 36)** nerve cells that receive and send electrical signals throughout the body
- ***prosthetic* (p. 34)** a manufactured replacement body part

ENGAGE

Conversation Question: How do creators achieve their ultimate goal of a successful invention?

Create a K-W-L (know, want to know, learned) chart on the board titled **PROSTHETICS**, and record student responses. Upon finishing the reading and the provided activity, refer back to the chart and amend the last column.

INTRODUCE VOCABULARY

Invite pairs of students to find definitions for the key vocabulary terms. Then post the definitions provided so that students may check their work. Have the pairs choose six additional words from the article and procure definitions. They will then create a crossword puzzle using all ten words. Share puzzles with another class for use as a prereading activity for this article.

READ & DISCUSS

Reinforce the main concepts in this article by requiring the students to write complete answers to the questions below. Review and discuss the responses to ensure that the children have clarity before proceeding to the following supplemental activities.

- Explain how Easton LaChappelle's robotic arm functions.
- Why does Easton say he became an inventor?
- What are some of the reasons that someone could be missing a limb?
- How would dramatically reducing the cost, while also advancing the technology of prosthetics, be life changing for people with disabilities?

CONCEPT/SKILL FOCUS: Cause and Effect

INSTRUCT: Lead the students in a discussion that guides them to recognize the many cause-and-effect relationships (a relationship in which one event makes another event happen) that are presented in this article. Introduce the graphic organizer, *A Robotic High Five*, and advise students that they will be searching through the article for such relationships. Allow students to share ideas and assist each other in locating suitable passages in the text.

ASSESS: Circulate and converse with students as they are working. Collect and review the worksheets to evaluate individual understanding of cause-and-effect relationships. Consider arranging peer remediation groups if necessary.

EXTEND

Language Arts On page 36 Easton discusses how he never let the limits of his location, resources, or knowledge hinder his quest. Instruct the students to write a goal statement for 2019 and to include strategies that will help them overcome any obstacles that may arise.

A Robotic High Five

Use information from the article, "The Limber Inventor," to record the cause-and-effect relationships presented.

Page #	Cause/Behavior	Effect/Result
p. 34	As a student inventor, Easton decides to build a better and cheaper prosthetic.	Easton wins many awards and helps people all around the world.

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For the Win!

pp. 42–45, Expository Nonfiction

Students will explore the creative minds of two young inventors and examine their award-winning creations. Tackling problems such as drought and water purity, young readers will be inspired by these adolescent scientists.

Lexile Score: ~750

RESOURCES

- Determined Designers

OBJECTIVES

- Students will learn how the determination of two young students led to important inventions.
- Students will examine the methods by which inventors obtain information.
- Students will research how past civilizations used a variety of strategies and materials to purify their water.

KEY VOCABULARY

- ***drought* (p. 44)** a prolonged period of abnormally low rainfall, usually resulting in a shortage of water
- ***mimic* (p. 44)** to imitate; copy
- ***prototype* (p. 44)** a preliminary model of something from which other forms are developed
- ***purify* (p. 45)** to remove contaminants from

ENGAGE

Conversation Question: How do creators achieve their ultimate goal of a successful invention?

Use the internet to show the class some short clips of student inventors. Appeal to their sense of wonder by allowing them to learn about children in their age bracket who have contributed to the world through their creations.

INTRODUCE VOCABULARY

List the four vocabulary terms on the board without the definitions. Challenge the students to discuss the words and to decide on two different categories that the words could belong to. (Example: Water Words/Invention Words . . . answers can vary.) Next, post the given definitions on the board along with the title, “For the Win,” and have students predict the content of the article. They may add additional words to the categories as they arise during the reading.

READ & DISCUSS

Pose the following questions to the students to facilitate meaningful discussion following the reading of the article.

- What is the Spark!Lab Dr. InBae Yoon Invent It Challenge?
- Explain the two inventions: Super Soil Straws, AquaSol.
- What common personality traits do these two young inventors (Kavi and Hamsini) have in common?

CONCEPT/SKILL FOCUS: Obtaining Information

INSTRUCT: Review with the students that this article focuses on two young inventors and the determination that was necessary to achieve a particular goal. (Page 42 refers to this as the “process behind the prize.”) Introduce the graphic organizer, *Determined Designers*, and have the class reread the article independently and underline sentences that depict the different ways in which the inventors had to acquire information in order to advance their inventions. They may work in small groups to complete the graphic organizer.

ASSESS: Circulate and have mini-conversations with the students as they are completing their work. Collect and review their organizers for accuracy, and evaluate their answer to the final question.

EXTEND

Social Studies Throughout history, as well as in underdeveloped countries today, humans have been focused on ascertaining and maintaining a clean water supply. Research how past civilizations used a variety of strategies and materials to provide their people with this necessary elixir of life. Encourage students to make a simple poster and to share their findings with the class.

Determined Designers

Use information from the article to record how these two young inventors obtained information to advance their creations.

Invention	How Information Was Obtained
Super Soil Straws by Kavi	**1.** **2.** **3.**
AquaSol by Hamsini	**1.** **2.** **3.**

The article states that the biggest tip for doing well in an invention contest has nothing to do with the invention itself—it's all about the process. Explain this sentence.

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