

Explore! Invention

Original Program Air Date: January 19, 2017

Grade Levels: 3-6

Program Description:

Thomas Alva Edison and the light bulb. Alexander Graham Bell and the telephone. Mary Anderson and windshield wipers. Marion Donovan and disposable diapers. Lonnie Johnson and the Super Soaker Water Gun. Each of these people and each of their inventions have changed the way we live our lives, how we work and how we play.

How do you create a new invention? What is the process like? Do you have an idea for an invention that you think could change the world? Then join us to Explore! Invention. Through the course of this energetic and interactive cross-curricular program, students get a chance to answer our big picture question for themselves and listen to the answers of others as they engage in activities related to the process of invention and learn from our program guests.

To investigate the program's theme and big picture question through a cross-curricular approach, each episode of *Explore!* utilizes Who, What, Where, When, Why and How questions:

Who does that? gives students a chance to meet someone who works in the field or does an activity related to the program's theme.

What do you want to know? guides our segments when we go to questions from participating groups.

Where is that? focuses on a geographic exploration related to the program's theme.

When did that happen? takes us back in time to people, places, events related to the program's theme.

How does that work? lets students discover the workings of a machine or concept related to the program's theme.

Why you ask? delves into more detail/explanation/background on a topic related to the program's theme.

For this episode, we explore those questions in a number of ways. Students meet and learn from Dr. Samuel Achilefu, professor at Washington University in St. Louis and inventor of 'cancer goggles' that are changing the way surgeons are able to operate on cancer patients. They also meet and learn from St. Louis area middle school students who were honored at the White House Science Fair for their creation of an environmentally friendly process for Styrofoam recycling that resulted in the invention of a new, environmentally friendly adhesive. We travel to innovation hubs to see how they create a climate for invention, and we take a trip through time as we look at major inventions and inventors in history.

Program Objectives:

Students will:

1. Engage in critical and creative thinking.
2. Build on their current understanding of, and develop new insights into, the process of invention by engaging in interactive activities and discussion.
3. Interact with inventors and innovators.

4. Develop an answer for themselves to the question: "How do you create a new invention?"

Program Format:

Time codes are provided in blue to help you find a specific segment in the archived program.

I. Welcome and Introduction—An overview of the program’s theme and importance of the topic is presented as student groups are welcomed to the program. (00:00 to 02:36)

A. Big Picture Question for the Program

How do you create a new invention?

B. Overview Information

We provide general information about the invention process and events in the program.

C. The Word Is...

As we discuss cool things about invention, we define a number of the program’s vocabulary words including:

Invention

Innovation

Incubation

D. When Did That Happen?—We begin our cross-curricular exploration by highlighting interesting invention events in history. (02:37 to 05:26)

II. Interactive Segment—In this portion of the program students interact with the program host and guests to learn more about how the process of invention and specific inventions the guests have created. Our guests are Dr. Samuel Achilefu of Washington University in St. Louis, and the St. Louis student inventor group that calls itself “The Blockheads.” (05:27 to 08:23)

A. Meet Our Guests

- 1. Dr. Samuel Achilefu**—Professor of Radiology, Biomedical Engineering, Biochemistry and Molecular Biophysics--Washington University School of Medicine
- 2. The Blockheads**—Coaches: Michelle Yopez and Ryan Gralike; Students: Sindhu Bala, Sydney Gralike, Julianna Jones, Reagan Mattison, Caroline Sluss, Christina Yopez

Student Questions for this Segment:

What inventors inspired you?

B. Where Is That?—This video segment continues our cross-curricular exploration of invention by traveling geographically and through time to important hubs of innovation. (08:24 to 11:36)

C. Interaction with Dr. Achilefu—Dr. Achilefu discusses his invention of the cancer goggles, share the goggles and how they are used, and answers student questions. Video of the cancer goggles being used in the operating room is included. (11:37 to 19:22)

Student Questions for this Segment:

What made you think of the idea for the “Cancer Goggles?”

Are you currently working on perfecting this invention or are you moving on to other inventions?

In the future are you working on other inventions related to cancer?

Has this been your only invention?

D. Invented by Accident—This video segment highlights the “accidental” versus “intentional” process of invention by looking at some major inventions that began with an accidental discovery and then changed the world. (19:23 to 22:42)

E. Interaction with the Blockheads—The student inventors joining us share the invention they took to the White House Science Fair, answer student questions, and give a demonstration highlighting part of their invention and innovation process. (22:43 to 29:22)

Student Questions for This Segment:

How did you come up with the idea of your invention?

What chemicals did you use to test with the Styrofoam?

How did you come up with adding orange peels as part of the ingredients?

III. Summary and Closing—We summarize major concepts learned today, say thank you and goodbye. (29:23 to 30:02)

Featured National Standards:

The following **Common Core Standards for English/Language Arts and Literacy in History/Social Studies, Science and Technical Subjects** are referenced in this program:

Grades 3-6 College and Career Readiness Anchor Standards for Reading

7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

Grades 3-6 College and Career Readiness Anchor Standards for Writing

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

Grades 3-6 College and Career Readiness Anchor Standards for Speaking and Listening

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others’ ideas and expressing their own clearly and persuasively.
2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
3. Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric.

4. 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.
5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

Grades 3-6 College and Career Readiness Anchor Standards for Language

6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

Featured National Standards: (Science)

Science as Inquiry - Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

1. Abilities necessary to do scientific inquiry
2. Understandings about scientific inquiry

Science and Technology - An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

1. Abilities of technological design

Featured State Standards:

Please refer to the National Standards included above.

Program-Related Activity Suggestions: The pre-program activities below are designed to get your students thinking about the topics we will explore in the program and to develop advance “burning questions” and “activity responses” for us to consider for inclusion in the live program.

1. Learn More About Our Guests—If you have students who are interested in learning more about our program guests and their inventions, please share the resources below with them and also have them view the additional video segments with each guest that they’ll find on our website at <http://www.hectv.org/watch/hectv-live/explore-invention/>.

Videos from the HEC-TV Website

“New Cancer Goggles Help Doctors See Cancer”

<http://www.hectv.org/watch/innovations/new-cancer-goggles-help-doctors-see-cancer-july-2014/15339/>

Web resources to learn about Dr. Achilefu

<https://source.wustl.edu/2016/02/washington-people-samuel-achilefu/>

http://www.stltoday.com/news/local/metro/nigerian-born-wash-u-scientist-wins-annual-st-louis-award/article_db835312-9a05-588a-a7b5-7fdf28653805.html

<http://news.stlpublicradio.org/post/inventor-cancer-goggles-receives-st-louis-award#stream/0>

Web resources to learn about the student inventors

<http://stlouisreview.com/article/2016-05-05/student-inventor>

<http://blockheadinnovations.com/about-blockheadgirls/>

<https://www.greatbigstory.com/stories/proof-that-anyone-can-save-the-world>

2. Think About the Process of Invention—The purpose of this activity is to get students thinking about the creative process of invention, how it occurs, factors that can help create a better climate for invention, and characteristics/traits inventors have that help them succeed. The activity may be done in either of two ways: 1) have all students engage in all elements of the activity; or 2) divide students into small groups to complete elements 1 and 2 and then come back together to complete elements 3 and 4.

Element 1: Think About Being an Inventor

Have students do the following:

1. View the video entitled “New Cancer Goggles Help Doctors See Cancer” on the HEC-TV website at <http://www.hectv.org/watch/innovations/new-cancer-goggles-help-doctors-see-cancer-july-2014/15339/>.
2. View the video entitled Invention 16 “When Did that Happen? Invention” on the Educate.Today website.
3. Think about inventors they have known or have studied in school and/or share resources of your own with students about famous inventors

As students view the videos and read about/remember what they have learned about other inventors, have them list qualities or characteristics of the inventors that seem apparent as they learn their story. For example, do the inventors seem intelligent, careful, thoughtful, resilient, curious, diligent, clever, or...? After completing their list of qualities/characteristics, have them select the quality they believe would be most important for a successful inventor to have. Have them write an explanation for why this quality would be the most important that they can share with the class. They can use Student Tool 13 Process of Invention to write their ideas. The worksheet is available on the last page of this document and also on Educate.Today.

Element 2: Think About How Inventions Occur

Have students do the following:

1. Ponder the phrase, “Necessity is the mother of invention.” What do they think is meant by that adage and why might it be an important part of the invention process? Have them write their ideas down so they can share them with classmates later.
2. View the video entitled “St. Louis is a Hub for Innovations” available on the HEC-TV website at <http://www.hectv.org/watch/innovations/st-louis-is-a-hub-for-innovations-startup-dreams-to-medical-marvels/20423/>. The segment that students should watch is about the Cortex Innovation District in St. Louis. It runs from the 01:05 mark of the video to the 06:18 mark.
3. View the video entitled Invention 17 “Invented by Accident” on the Educate.Today.

As students view the videos, have them think about/listen for/notice examples of circumstances or conditions that seem to make successful invention possible. Have them list the ideas that come into their mind and add them to what they wrote about the phrase, “Necessity is the mother

of invention.” After looking over what they have written, have students select one condition that they believe most contributes to successful inventing. Have them write an explanation for why this quality would be the most important that they can share with the class. They can use Student Tool 13 Process of Invention to write their ideas. The worksheet is available on the last page of this document and also on Educate.Today.

Element 3: Students Share Their Thinking

After students have completed elements 1 and 2 (either as entire class or in small groups), have students share their single most important quality and their supporting reasoning from element 1 and/or their single most important condition and their supporting reasoning from element 2 with each other in small groups or whole class discussion.

3. More Invention Related Lessons: Building on the content and activities explored in the program, consider the following web resources for extension/enrichment activities for your students to engage in individually, in small groups, or as an entire class.

PBS Kids: Invention—Making the World a Better Place

http://www-tc.pbskids.org/designsquad/pdf/parentseducators/DS_Invent_Guide_Full.pdf

Education World: Teaching Through Invention

http://www.educationworld.com/a_lesson/lesson240.shtml

Scholastic: Inventions that Changed the World

<http://teacher.scholastic.com/lessonrepro/lessonplans/theme/inventions.htm>

Museum of Science: Be Inventive

<http://legacy.mos.org/sln/Leonardo/BeInventive.html>

Just Think It.com: The Invention Convention in the Classroom

<http://www.just-think-inc.com/documents/LessonGuide2012.pdf>

Teacher Vision website

<https://www.teachervision.com/inventions/teacher-resources/6636.html>

Pro Teacher!: Teachers Share Activities on Inventors and Inventions

http://www.proteacher.org/c/386_Inventors_and_Inventions.html

Vocabulary:

The following terms and their definitions are highlighted in the program and/or in the program’s preparatory materials:

Incubation

Innovation

Invention

