[i] ashland independent film festival

INVENTING TOMORROW Study Guide

Every year 1,700 winners of local, regional, state, and national competitions are invited to participate in a week-long celebration of science, technology, engineering, and math known as the Intel International Science and Engineering Fair (ISEF), the world's largest pre-college science competition. **INVENTING TOMORROW** follows a few of those 2017 contestants (all of them sixteen or seventeen years-old) from around the globe, as they pursue their research and inventions, and travel to the competition.

NUHA ANFARESI is from Bangka, Indonesia. She created a prototype of a filter to be used by the illegal tin-miners in her region, whose mining waste is polluting the fish, coral, plankton, and the human population in and around her home.

JARED GOODWIN is a third-generation native from the Big Island of Hawaii. He researched the cancer-causing presence of arsenic in Hilo's soil, which was originally released by a production plant, but the 1960 tsunami spread the arsenic further inland into the soil.

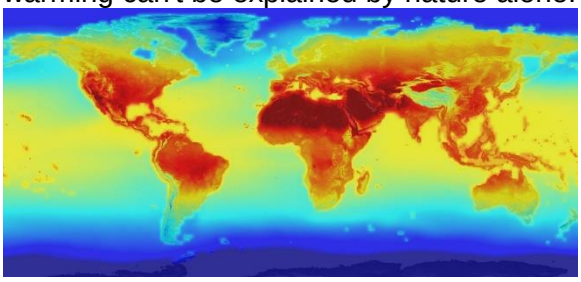
SAHITHI PINGALI is from Bangalore, India. Sahithi was concerned about raw sewage and phosphates in the lakes of Bangalore and beyond, but data collection was an enormous task. She created an approach of crowd-sourcing the research to improve data collection.

JESUS MARTINEZ and his co-inventors **JOSE ELIZADE** and **FERNANDO SANCHEZ** are concerned about the growing problem of air pollution in their home city of Monterrey, Mexico. They created a photocatalytic paint that would decrease the presence of nitrogen dioxide and sulfur dioxide in the air, when the paint is used on buildings throughout the city.

Intel International Science and Engineering Fair (ISEF) is often called "the science fair of science fairs," where students compete as "Olympians of science." Awards are based on students' abilities to tackle challenging scientific questions, use authentic research practices, and create solutions for the problems of tomorrow. In 2018, students from eighty-one different countries competed for the highest awards. More information on ISEF: https://www.intel.com/content/www/us/en/education/competitions/international-science-and-engineering-fair.html

What is Climate Change?

All of the research done by the four students in INVENTING TOMORROW addresses problems of pollution, whether water pollution, soil pollution, or air pollution, which is a major contributor to climate change. Some causes of climate change are natural, including changes in Earth's orbit and in the amount of energy coming from the sun. Ocean changes and volcanic eruptions are also natural causes of climate change. However, the vast majority of scientists think that recent warming can't be explained by nature alone. Most scientists say it's very likely that most of the warming since the mid-1900s is due to the burning of coal, oil, and gas. These gases are called greenhouse gases. Scientists use climate models to predict how Earth's climate will change. Climate models are computer programs with mathematical equations that predict that Earth's average temperature will keep rising over the next 100 years. While there may be a year or years where Earth's average temperature does not rise, the overall trend is expected to be up, and is expected to rise even if the amount of greenhouse gases in the atmosphere decreases.



https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-climate-change-58.html

Scientific Advancement Begins with Me

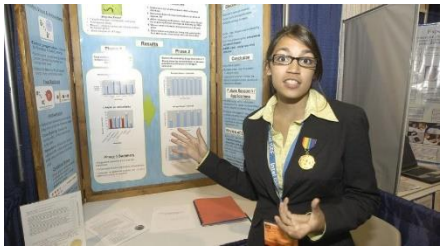
All of these teenage scientists are assessing and addressing problems with their own environment, and each sees it as her/ his job – at least in part – to fix it. They are using the scientific process to create change in their own backyards, to then carry the solutions out into the world. An interdisciplinary and applied approach to science, technology, engineering and mathematics (STEM) is key to innovation in a world of environmental crisis, climate change, and denial of science. We are currently facing many challenges in the world of STEM that, if solved, could positively impact the economy, the overall job market, and availability of skilled workers.

https://www.diplomaticourier.com/closing-the-skills-gap-in-stem/

"[Science] is more than a school subject, or the periodic table, or the properties of waves. It is an approach to the world, a critical way to understand and explore and engage with the world, and then have the capacity to change that world..."

— President Barack Obama, March 23, 2015

Our Country's Youngest Congressperson is an ISEF Alum



Since January 3, 2019, Alexandria Ocasio-Cortez (also known as AOC) has been the U.S. Representative for New York's 14th congressional district, which includes the eastern part of The Bronx and portions of north-central Queens in New York City. When elected, AOC became the youngest woman ever elected to Congress. In 2007, at the age of seventeen, Alexandria Ocasio-Cortez placed second in the International Science and Engineering Fair in the Microbiology category, with her project on the effect of antioxidants on roundworms. Skills that helped Ocasio-Cortez to succeed at ISEF are many of the same qualities that help an elected public servant succeed: communication and public speaking skills, along with persistence and a logical approach to problem solving. There are many other examples of respected politicians who began their careers as scientists:
https://student.societyforscience.org/blog/doing-science/science-stepping-stone-politics

Learn More from Ted Talks by Recent ISEF Winners

https://www.societyforscience.org/content/ssp-blog/deep-dive-10-ted-talks-society-alumni

DISCUSSION QUESTIONS:

1. Sahithi said that she originally approached the problem of water pollution as an activist, but then found it necessary to tackle the problem through the world of science. Why do you think Sahithi chose the scientific path?

2. Each of these young scientists was pushed somehow out of their cultural comfort zone, either while doing their research, or while competing at ISEF in Los Angeles. Can you think of examples?

3. Nuha sought advice from the Indonesian Institute of Sciences; Jared asked help from a Geology Professor at the University of Hawaii; Jesus, Jose, and Fernando worked in the lab of the Autonomous University at Nuevo Leon. Explain the importance of mentorship in the field of sciences. Describe how each young scientist was influenced by a mentor.

4. Jared's mentor at University of Hawaii supported the importance of "documenting what you don't know," as much as documenting the proven progress of his research. Why?

5. Each of these young scientists faced disappointment at some point in the film. Can you give an example of one of these moments, and what that character did to "shake it off?"