SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Design a North Star Finder

Technology and the Skilled Trades

Grades 9 and 10

Lesson Plan – Ideate

Learning Goals

- Gain an understanding of fundamental technological concepts underlying technological education through hands-on, project-based learning while developing technical skills.
- Develop creative and flexible approaches to problem solving that will help them address challenges in various areas in everyday life.

Overall Expectations

A1. Initiating and Planning demonstrate an understanding of fundamental technological concepts and related skills by initiating and planning projects.
A2. Designing and Performing develop projects that involve creating products and/or services, using a variety of resources and techniques, and record the development of their projects.

Specific Expectations

A1.2 apply an understanding of fundamental technological concepts, design considerations, and science, technology, engineering, and mathematics (STEM) concepts as appropriate in developing projects involving the creation of products and/or services.
A1.3 investigate and describe design considerations, including accessibility requirements, that are relevant to developing projects involving products and/or services for a specific user or community.
A1.4 communicate design ideas for various purposes and audiences, using appropriate industry terminology.
A1.5 establish and justify evaluation criteria for products and/or services being developed, including both qualitative and quantitative measures, making connections to relevant fundamental technological concepts.
A2.2 identify factors that could impact the development of their projects and apply appropriate strategies to increase the probability of a positive outcome.

Description

This lesson follows the Empathize and Define lesson plan. Having investigated the problem of designing a North Star Finder and coming to a greater understanding of their audience, students will use that information to come up with many ideas for a solution and narrow their options down to a few that may work.

Materials

- Internet access
- Chart paper
- Sticky notes
- Markers
- Micro:bit

Introduction

There are many strategies for ideation. This lesson will introduce them to a variety of ways to approach a problem and come up with solutions.
In the last lesson, students investigated stars as a method of navigation and tried to understand the value of a star finder as well as potential audiences for that device. They also researched what is already out there and how different cultures might use a star finder. Finally, they linked the use of a star finder to the United Nations Sustainable Development Goals and the 94 Calls to Action after having researched and learned about Indigenous astronomy and its importance to Indigenous culture and learning.
In this lesson, students will apply what they learned to the creation of ideas. Students will investigate how they might begin to approach the task of designing a star finder.
This project will use a Micro:bit as the main technological component for a star finder. A Micro:bit is a microcontroller which includes several sensors, including:

1. Microphone – the Micro:bit can detect sound
2. Speaker – the Micro:bit can produce simple noises using a piezo speaker
3. Accelerometer – the Micro:bit can tell if it is being moved, rotated, if it is upside down, and if it is tilted, and by how much
4. Compass – the Micro:bit can find, to some degree of accuracy, a compass heading
5. Light – the Micro:bit can detect light
6. Temperature – the Micro:bit can detect the temperature of its surroundings
7. Touch – the Micro:bit has buttons, and can also detect if something is touching the logo

Additionally, the Micro:bit has pins, which can be connected to a circuit with clips. This means other kinds of sensors can be purchased and connected to the Micro:bit.
The Micro:bit is coded using the website https://makecode.microbit.org/. You can use block code, Python, or JavaScript to code a Micro:bit. For beginners, block code is a friendly way to introduce coding.

Action

Students should already be in their groups from the first lesson on Empathy. Have students return to the same groups.

Part 1: Quantity

Activity A: "How Might We" Questions

In the first part of our ideation phase, we want to come up with different angles from which we might approach our problem. This helps us avoid getting locked into one rigid approach in our future brainstorming exercises.
Our project is a device which will help us find the North Star (Polaris or Giiwedin-anang).
A few examples of "How Might We" questions include:

- How might we help people in the city with stargazing despite light pollution when it comes to finding Polaris?
- How might we help children with access to easy-to-use tools when it comes to stargazing?
- How might we help people navigate using the stars if it's bright out, or it's daytime?

1. Write the phrase "How might we help _____ with _____ when it comes to _____?" somewhere students can see it.
2. Have students plug in different audiences, needs, and circumstances from their empathy activities in the last lesson. Have each group generate three "How Might We" questions.
3. Give students 10 minutes or so to do a traditional brainstorm to answer their own questions.
4. The students should come up with a lot of different ideas and these ideas should not be limited.

Activity B: Make it Worse

This is a fun exercise in creativity. Our problem is finding Polaris or Giiwedin-anang so we can navigate.

1. Give students 10–15 minutes to come up with as many ways as possible to come up with ideas that won't work. For example, a star finder that relies on detecting light.
2. Have students explain in detail why each idea won't work. A star finder that relies on detecting light won't be able to differentiate one star from another and will be impacted by light pollution.
3. Have students trade their ideas with another group.
4. Have students reverse engineer solutions from the ideas that won't work.
5. This should result in some additional ideas that might work.

Part 2: Quality

Now that we have many ideas, it's important to narrow down the choices and pick out the good ones.

Activity A: Thematic Analysis / Affinity Mapping

1. Hand out sticky notes and chart paper.
2. Talk to your students about coding their ideas.
3. They need to pick out some keywords that might help them group their ideas into different categories or clusters. Some ideas might fall into more than one group, so they can use the extra sticky notes to put them in numerous groupings.
4. Optional: After they have coded the ideas and separated them into different categories, students will identify themes. There is no limit to the number of themes, and they will come up with their own themes based off the ideas they created.
5. They will also look at how to prioritize the themes/categories.

6. Alternative: You can do Affinity Mapping using a software tool like Miro, Canva, Padlet, or a Vibe board. Look for an Affinity Mapping template.

Activity B: Details

1. Have each group choose their top four ideas. They don't have to be from different themes, but it is a good idea to have as much variety as possible.
2. List the risks and benefits of each idea. They can do a quick SWOT analysis – Strengths, Weaknesses, Opportunities, Threats.
3. Divide the chart paper into four sections and use it as a space to elaborate on each of the ideas. As students flesh an idea out, they may realize it doesn't work as well as they thought. They may change their choices but should end this activity with exactly four ideas that they will move forward with.

Activity C: Presentation

1. Have the group prepare a Dragon's Den style presentation of each of their four ideas for a star finder.
2. Have each group present their ideas to the class.
3. After each presentation, have the remaining students ask questions and try to either poke holes in the ideas, or make suggestions to improve them.
4. At the end of all presentations, have students return to their individual groups.
5. *Alternative*: Do a gallery walk with the four ideas on a large chart paper. Each group will go around and critique the other groups' ideas. They will select which ones are the best ideas. Remind students that critiquing is not just saying what is wrong or bad; sometimes you just need clarification, and you should give suggestions for improvement.

Activity D: Tools

1. Introduce students to the Micro:bit. Discuss the sensors it is equipped with, and its functions.
2. Discuss which of these sensors might be useful in locating the North Star.
3. Have students go to makecode.microbit.org and start a new project.
4. Give students 15–20 minutes to explore the blocks in MakeCode (https://makecode.microbit.org/), and to imagine ways in which the sensors and functions of a Micro:bit could be used to create a star finder.
5. Give students 15–20 minutes to incorporate the functionality of the Micro:bit into one or more of their three ideas.

Consolidation/Extension

Students can be asked to write an individual reflection on which ideation activities worked better or worse for them and why. This can be used as an evaluation tool, as well as the presentation, the worksheet, and the chart paper activity.

Additional Resources

If you are an All-Access Pass member, check out our introduction to Micro:bit asynchronous lesson to learn more about the basic functions of a Micro:bit.