HOW CAN WE HELP? USING TECHNOLOGY TO IMPROVE OUR LIVES (GRADE 6)

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After learning about the basic fundamentals of electricity, students will begin to explore how they interact with technology that is around them and how they might become producers rather than continuing to be consumers. Subtopics would be: Physical Computing (https://www.cs.utah.edu/~elb/Papers/PhysicalComputingTalk.pdf), Computer Science (Understanding Coding) (https://www.computerscience.org/resources/computer-programming-languages/). Students may explore the BBC Micro:bit (http://microbit.org/) and other similar programmable boards (microcontrollers (https://en.wikipedia.org/wiki/Microcontroller)).

Grade Level: Grade 6

Strand(s) and Unit(s): Understanding Matter and Energy –Electricity and Electrical Devices Unit

Inquiry Focus

Using the knowledge and understanding of electricity acquired in class, how might we* be able to positively contribute to our community by developing a new device or technology that the class has designed and coded? The design thinking (https://www.interaction-design.org/literature/topics/design-thinking) model should be used during the unit. Students will have the opportunity to explore, design and build.

"How (http://www.designkit.org/methods/3)*Note: You can prompt the students to create their own might We…" (http://www.designkit.org/methods/3) questions that relate to the inquiry.

Timeline

This unit will take approximately 10 to 12 periods (50 minutes in length) to complete. The first few periods will be involved in brainstorming and ideation. The remaining periods will be devoted to building, improving and testing students' inventions or systems.

Big Ideas

Understanding what people in the community may need to improve their quality of life or meet a need.

Overall Expectations

1. Evaluate the impact of the use of electricity on both the way we live and the environment;

2. Investigate the characteristics of static and current electricity, and construct simple circuits;

3. Demonstrate an understanding of the principles of electrical energy and its transformation into and from other forms of energy.

Specific Expectations

This specific expectation links to using Microcontrollers and using the design thinking model.

2.5 Use technological problem-solving skills (see page 16) to design, build, and test a device that transforms electrical energy into another form of energy in order to perform a function (e.g., a device that makes a sound, that moves, that lights up).

Key Concepts

What sort of problems do you experience on a day-to-day basis that can be solved if there was a new piece of technology that would help?

What bothers you every day?

Is there somebody in our community that would benefit from a new piece of technology? How would you help them?

Is there anything that you use on a regular basis that you think needs to be changed or improved using electrical devices and technology?

Prior Skill Sets

Skill level will be based on what the teacher is comfortable implementing in the class and what the students have been exposed to prior to the unit. Some students will have prior knowledge of coding and robotics which will come in handy. If a teacher is unfamiliar with microcontrollers, there are a number of resources available in the document below to assist with increasing the teacher's knowledge base. There are plenty of communities online who can assist if there is a design or idea that the students come up with that the teacher is unable to provide support. No idea should be rejected due to lack of understanding on the part of the teacher.

Prior Knowledge

Students should know how a circuit works and how energy is converted from one type to another. This is particularly important for students to understand when it comes to designing a solution using microcontrollers.

Materials and Equipment

Most of the equipment and materials can be found in kits varying in price and specification to the board. Usually, the parts can be used with most microcontrollers. Below is a basic list of parts that could help students develop their solutions. There are lots of other parts that can be purchased. See the reference section for sources to purchase the equipment from (some are board approved across Ontario).

BBC Micro:bit

Arduino Uno

Battery clip with 2 x AA or AAA (depending on what kit you purchase)

Alligator clips

Jumper wires

Breadboard

Motors

Servos

LEDs 5mm

Resistors (variety)

Piezo speaker

Ultrasonic sensor

Safety

When it comes to using anything that may have an electrical charge or electricity flowing through it, basic rules must be set.

Teacher instructions: begin by explaining to the students do's and don'ts with electrical devices. As a class create a list and then look at the resources provided by microbit.

https://microbit.org/guide/safety-guide-page/ (https://microbit.org/guide/safety-guide-page/)

-This is a document that can be printed and shared with your students.

https://microbit.org/guide/safety-advice/ (https://microbit.org/guide/safety-advice/)

Instructional Planning and Delivery

Introduction

Using the design thinking model

Brainstorming Reference

https://blog.hubspot.com/marketing/creative-exercises-better-than-brainstorming (https://blog.hubspot.com/marketing/creative-exercises-better-than-brainstorming)

Developing Empathy (1 period - 50 minutes)

Part 1

Where does technology help in our daily lives? (10 minutes)

"What are the "first things you do" when you wake up?

"How does Technology help you daily?"

- Prompt the students with an example of your morning wake up:
    -
        - "When I get up, I ask "Alexa, what is the weather forecast for the day?"
- Students will talk about their routines at the beginning.
    - Look fors:
        -
            - One of the students may mention the use of an alarm clock or electric toothbrush
            - May reference what their parents do in the morning to get the day started.
            - They might have and Echo Dot (Alexa) or a different smarthome system.

"Why do we depend on technology so much?"

- Allow students to think about the values technology provides and how it can both help and hinder our daily lives.

Hand out the sheet [BLM 1] and instruct students to record all of the technology they work with or interact based on where in their day it connects.

Success Criteria: (TBD by both the students and teacher)

Example

I have:

Listed a wide variety of technology that helps us daily

Identified the drawbacks to using certain technology (e.g. cell phone games are a distraction).

Etc.

Developing Empathy towards Defining (1 period - 50 minutes)

Part 2

Identifying what we need

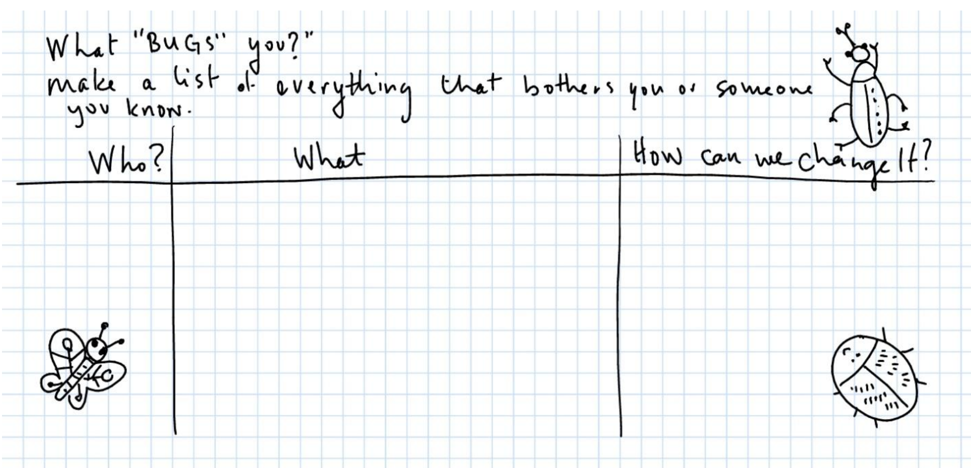
Students will be given an opportunity to explore some of the problems that they are experiencing daily with respect to technology or the lack of technology. They would isolate a "bug" that annoys them and have them explore the possibility of solving it.

Online Resources for examples of practical solutions

Practical and Mechanical solutions (https://www.boredpanda.com/creative-solutions-everyday-problems/?utm_source=google&utm_medium=organic&utm_campaign=organic)

Prompt: "What "bugs" you?"

- A "bug" is defined as something that stands out as an aggravator that needs to be solved. It can be absolutely anything. There is no wrong answer.
- Students will work in partners or groups to create a list/chart of all the "bugs" that can bother them, a friend, a family member (young and old) and/or a system or thing. (See image below for an example of the chart.)
- After, students need to compare the lists and identify similarities.



Ideation (1 - 2 periods)

SHOW: Slide deck - about microcontrollers https://docs.google.com/presentation/d/1zLQpk6i4DHZVfO7Cto_IE1iNlopum5IDO7QdsVwLgKk/edit?usp=sharing (https://docs.google.com/presentation/d/1zLQpk6i4DHZVfO7Cto_IE1iNlopum5IDO7QdsVwLgKk/edit?usp=sharing)

HANDOUT: Ideation https://docs.google.com/drawings/d/1aLJ46G6-GOxqmNA1yYmEDSaTrVssBWjm6wAAvmBqZqM/edit?usp=sharing (https://docs.google.com/drawings/d/1aLJ46G6-GOxqmNA1yYmEDSaTrVssBWjm6wAAvmBqZqM/edit?usp=sharing)

Students will choose their top three problems and as a group try to find a possible solution for one problem.

Narrative (To be read out loud to the students):

Your class is going to be divided into a number of small groups. You'll be responsible to develop a plan based on the ideas that were selected from the ideation lesson. The goal of each group is to be a think tank and maker team. After one idea is selected the group's objective is to identify the need and develop a solution. Each member of the group will have to develop their skills to solve the problem. Can you code? Can you build? Can you design?

Verbal cues can be:

How can we...?
Is there an alternative to...?
How much does...?
Could we create...?
What if...?

Begin with Video

https://tvo.org/video/documentaries/big-life-fix/ep-1-big-life-fix (https://tvo.org/video/documentaries/big-life-fix/ep-1-big-life-fix)

Ep. 1 - Big Life Fix

The team of inventors must come up with solutions for three different problems. They attempt to help a terminally ill photographer who can no longer use his hands to operate a camera. They try to bring cutting-edge communication to a remote Welsh village that has no internet access and an unreliable telephone connection. And they work to give some control back to a young designer who has Parkinson's disease and who has been unable to use a pen since developing tremors in her hands two years ago.

Activity: The students (and their groups) will need to keep documentation of their work throughout the process. They should be encouraged to write a journal to keep a record of their process from idea/problem to solution and implementation (building/making the solution - physical/digital).

Prototyping (up to 10 periods if needed)

HANDOUT: https://docs.google.com/drawings/d/1uXVqPtboCwadruaMxI0MbLa7ciXWbm_9xZNMJQNF5kA/edit?usp=sharing (https://docs.google.com/drawings/d/1uXVqPtboCwadruaMxI0MbLa7ciXWbm_9xZNMJQNF5kA/edit?usp=sharing)

This part of the design thinking model will require teachers to be as flexible as possible. Students will have a wide range of ideas and needs for their projects. Allow time for research. The International Baccalaureate uses the Design Cycle to help students through the process of developing their ideas.

Evaluation: Use descriptive feedback to nurture students' ideas. Encourage students to delve deeper into their solutions.

Resources:

Microcontrollers:

https://microbit.org/ (https://microbit.org/)

https://www.arduino.cc/ (https://www.arduino.cc/)

https://calliope.cc/en (https://calliope.cc/en)

Purchasing equipment

https://www.creatroninc.com/ (https://www.creatroninc.com/)

https://sayal.com/STORE/ (https://sayal.com/STORE/)

http://www.canadarobotix.com/ (http://www.canadarobotix.com/)

https://www.fairchancelearning.com/ (https://www.fairchancelearning.com/)

Programming environments:

https://scratch.mit.edu/ (https://scratch.mit.edu/)

https://makecode.microbit.org/ (https://makecode.microbit.org/)

https://lab.open-roberta.org/ (https://lab.open-roberta.org/)

https://www.tinkercad.com/#/ (http://www.tinkercad.com)

Implementation/Consolidation:

After the students have worked through the design process, they will either have something that works or doesn't. If a project is more theoretical, students need to present their findings/concepts. For those who have created something that works, they would have to test and present.

The final event for this unit can have a number of different outcomes. Depending on time and available space, the event can be arranged similarly to a science/maker fair with display boards and presentations. It can also be presented to the class group by group (traditional).

Assessment Opportunities

(for, as, of learning, rubrics (strands), peer evaluation sheets, other)

Success Criteria can be developed by the students with the teacher and a customized rubric should be developed.

For Learning: Ask the students to brainstorm and identify topics related to this unit of study (review of content).

As Learning: While students are designing, use conferencing and descriptive feedback to handle questions or issues that may arise during the process (ideation and prototyping). It would also benefit both the student and the teacher if a self-reflection is kept. A Design process journal kept would assist in documentation. Click here for Google Search (https://www.google.ca/search?q=myp+process+journal&safe=strict&source=lnms&tbm=isch&sa=X&ved=0ahUKEwj73JjI7OfdAhUE-6wKHb5HDQsQ_AUIDigB&biw=1440&bih=755#imgrc=_)

Process Journals can be presented and shared with peers.

Example of a rubric

Rubric

	Level 1	Level 2	Level 3	Level 4
Empathy	The team had difficulty identifying a problem and required assistance	The team was able to identify a problem a general problem	The team was able to identify a problem that affects a specific group or individuals	The team was able to identify and a problem that affects a specific group or individuals who they directly contacted

Define	One solution was chosen	A couple possible solutions were explored before one was chosen	A number of possible solutions were explored before one was chosen	A number of possible solutions were explored, documented and discussed before one was chosen
Ideate	A limited number of designs were recorded	A couple of designs were created to meet the need	A few designs were created to meet the need	Many designs were created to meet the need and evaluated to see which could work.
Prototype	A prototype was not finished but there was an attempt.	A prototype was created but it may not work or function but with more time and resources could be improved.	A prototype was created that either worked or could possibly work if there were more time and resources	A prototype was created that either worked or could possibly work if there were more time and resources
Test	It could not be tested	It was tested but did not solve the problem	It was tested and was somewhat successful in solving the chosen problem	It was tested and the results were positive. The prototype worked.

Future Opportunities/Extensions

There are lots of opportunities for students would like to continue learning about microcontrollers. There are large communities available online that can provide assistance When developing a more complex design using Arduino or BBC micro:bits.

Not only are microcontrollers available for students to use but there are microprocessors such as the Raspberry Pi that can be programmed to perform tasks.

Students seeking enrichment or those who are more advanced; projects can be extended by using a 3D printer for customized parts that can enhance the designs or increase their complexity.

(mailto subject out this

(https:// ... catalyst/how-can-we-help-using-technology-to-improve-our-lives-grade-6)

WATCH THE VIDEO

02:50 min

(//www.youtube.com/embed/aJ0s6I0gOnU?width=800&height=450&iframe=true)

RESOURCES

- stao ideate.pdf (https://connex.stao.ca/sites/default/files/stao_ideate.pdf)
- stao blm 2 bugs page 1.jpg (https://connex.stao.ca/sites/default/files/stao_blm_2_bugs_-_page_1.jpg?width=1448px&height=696px&iframe=true)
- microcontroller slidedeck gr.6 electricity inquiry.pdf (https://connex.stao.ca/sites/default/files/microcontroller_slidedeck_gr.6_electricity_inquiry.pdf)

ELEMENT

- Inquiry (/expert-elements/inquiry)

(/classroom-catalysts) RETURN TO CATALYSTS (/classroom-catalysts)