**Fund Me!**

**Overview:**

The students will be researching the costs and benefits of space exploration in order to determine whether the Canadian Space Agency should receive increased funding for their programs or if another program needs it more urgently. In order to prepare the students for this inquiry, the teacher needs to lay the groundwork on the necessary tools and devices for space exploration, and knowledge about space phenomena. This inquiry will create an awareness of the benefits and costs of space exploration.

**Grade Level:** 6

**Strand and Topic: Understanding Earth and Space Systems:** Space

**Inquiry Focus:**

*What does it mean for society to learn about/explore space?*

axis / tilt / rotation / revolution / planets / moons / comets / asteroids

Note that the time required depends on students’ background knowledge, skills set, and level of interest. Additional time may be required for completion of student work.

**Big Ideas**:

* Earth is a part of a large interrelated system.
* Technological and scientific advances that enable humans to study space affect our lives.

**Overall Expectations:**

**Science and Technology**

1. assess the impact of space exploration on society and the environment
2. investigate characteristics of the systems of which the earth is a part and the relationship between the earth, the sun, and the moon
3. demonstrate an understanding of components of the systems of which the earth is a part, and explain the phenomena that result from the movement of different bodies in space

**Language: Oral Communication**

1. listen in order to understand and respond appropriately in a variety of situations for a variety of purposes
2. use speaking skills and strategies appropriately to communicate with different audiences for a variety of purposes

**Language: Reading**

1. read and demonstrate an understanding of a variety of literary, graphic, and informational texts, using a range of strategies to construct meaning

**Language: Writing**

1. generate, gather, and organize ideas and information to write for an intended purpose and audience

**Language: Media Literacy**

1. demonstrate an understanding of a variety of media text

**Social Studies: B.** **Canada’s interactions with the Global community**

* B2. Inquiry: use the social studies inquiry process to investigate some global issues of political, social, economic, and/or environmental importance, their impact on the global community, and responses to the issues

**Mathematics: Data Management and Probability**

* collect and organize discrete or continuous primary data and secondary data and display the data using charts and graphs, including continuous line graphs
* read, describe, and interpret data, and explain relationships between sets of data

**The Arts: Drama**

* B1. Creating and Presenting: apply the creative process (see pages 19–22) to process drama and the development of drama works, using the elements and conventions of drama to communicate feelings, ideas, and multiple perspectives
* B2. Reflecting, Responding, and Analysing: apply the critical analysis process (see pages 23–28) to communicate feelings, ideas, and understandings in response to a variety of drama works and experiences

**Specific Expectations:**

**Science and Technology**

* 1.1 assess the contributions of Canadians (e.g., astronauts Marc Garneau and Roberta Bondar; astronomers Richard Bond, David Levy, and Helen Hogg; Spar Aerospace Limited’s development of the Canadarm; the University of British Columbia’s development of the “Humble” space telescope) to the exploration and scientific understanding of space
* 1.2 evaluate the social and environmental costs and benefits of space exploration, taking different points of view into account (e.g., the point of view of health care workers and workers in other agencies that compete with space programs for public money; astronauts and their families; the general public; scientists)
* 2.1 follow established safety procedures for handling tools and materials and observing the sun
* 2.2 use technological problem-solving skills (see page 16) to design, build, and test devices (e.g., a sundial, a model of the earth’s rotation around the sun) for investigating the motions of different bodies in the solar system
* 2.3 use scientific inquiry/research skills (see page 15) to investigate scientific and technological advances that allow humans to adapt to life in space
* 2.4 use appropriate science and technology vocabulary, including axis, tilt, rotation, revolution, planets, moons, comets, and asteroids, in oral and written communication
* 2.5 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes
* 3.1 identify components of the solar system, including the sun, the earth, and other planets, natural satellites, comets, asteroids, and meteoroids, and describe their physical characteristics in qualitative terms
* 3.4 identify the technological tools and devices needed for space exploration
* 3.5 describe the effects of the relative positions and motions of the earth, moon, and sun

**Language: Oral Communication**

* 1.2 demonstrate an understanding of appropriate listening behaviour by adapting active listening strategies to suit a variety of situations, including work in groups
* 1.6 extend understanding of oral texts by connecting, comparing, and contrasting the ideas and information in them to their own knowledge, experience, and insights; to other texts, including print and visual texts; and to the world around them
* 2.2 demonstrate an increasingly sophisticated understanding of appropriate speaking behaviour in a variety of situations, including paired sharing, dialogue, and small- and large-group discussions
* 2.3 communicate orally in a clear, coherent manner, using appropriate organizing strategies and formats to link and sequence ideas and information
* 2.5 identify a range of vocal effects, including tone, pace, pitch, volume, and a variety of sound effects, and use them appropriately and with sensitivity towards cultural differences to help communicate their meaning
* 2.6 identify a variety of non-verbal cues, including facial expression, gestures, and eye contact, and use them in oral communications, appropriately and with sensitivity towards cultural differences, to help convey their meaning
* 2.7 use a variety of appropriate visual aids, (e.g., video images, maps, posters, charts, costumes) to support or enhance oral presentations

**Language: Reading**

* 1.1 read a wide variety of texts from diverse cultures, including literary texts (e.g., short stories, poetry, myths, legends, fantasies, novels, plays), graphic texts (e.g., graphic novels, advertisements, atlases, graphic organizers, charts and tables), and informational texts
* 1.2identify a variety of purposes for reading and choose reading materials appropriate for those purposes

**Language Arts: Writing**

* 1.2 generate ideas about a potential topic and identify those most appropriate for the purpose
* 1.4 sort and classify information for their writing in a variety of ways that allow them to view information from different perspectives and make connections between ideas

**Language Arts: Media Literacy**

* 1.1 explain how a variety of media texts address their intended purpose and audience
* 1.3 evaluate the effectiveness of the presentation and treatment of ideas, information, themes, opinions, issues, and/or experiences in media texts

**Social Studies: B. Canada’s interactions with the Global community**

* B2.2 gather and organize information on global issues of political, social, economic, and/or environmental importance, including their impact and responses to them, using a variety of resources and various technologies
* B2.5 evaluate evidence and draw conclusions about global issues of political, social, economic, and/or environmental importance, their impact on the global community, and responses to the issues
* B2.6 communicate the results of their inquiries, using appropriate vocabulary

**Mathematics: Data Management and Probability**

* collect data by conducting a survey (e.g., use an Internet survey tool) or an experiment to do with themselves, their environment, issues in their school or community, or content from another subject, and record observations or measurements
* read, interpret, and draw conclusions from primary data (e.g., survey results, measurements, observations) and from secondary data (e.g., sports data in the newspaper, data from the Internet about movies), presented in charts, tables, and graphs (including continuous line graphs)

**The Arts: Drama**

* B1.1 engage actively in drama exploration and role play, with a focus on identifying and examining a range of issues, themes, and ideas from a variety of fiction and non-fiction sources and diverse communities, times, and places
* B1.2 demonstrate an understanding of the element of role by selectively using other elements (e.g., time and place; relationship; tension) to build belief in a role and establish its dramatic context
* B1.4 communicate feelings, thoughts, and ideas to a specific audience, using audio, visual, and/or technological aids to strengthen the impact on the viewer
* B2.1 express personal responses and preferences and make connections to themes and issues presented in their own and others’ drama works
* B2.2 identify a favourite scene and give reasons for their preference, using correct drama terminology to describe how the elements of drama contribute to its effectiveness

**Key Concepts**:

The earth is a part of a large interrelated system. Its rotation around its axis results in day and night, while its revolution around the sun covers a period of one year (along with seasonal changes depending on the distance from the earth’s equator). The moon travels around the earth, and as it travels, only one side faces the sun. Different sections of the moon reflect the sun’s light as the moon travels, creating the different moon phases.

Space exploration has brought many benefits to society. High-quality radio and television signals are now relayed around the globe by satellite. Biological experiments in space, such as the growing of insulin crystals, are contributing to our ability to fight disease. The technology used for space shuttle fuel pumps is now being used to make better artificial hearts. Geographical data obtained by satellites have improved the quality of maps and made navigation safer. But space exploration is also very expensive, involves risks to the lives of astronauts and others, produces pollution, and creates space junk that may eventually fall back to earth.

**Prior Skill Sets:**

The students should be familiar with the skills for investigating and researching from previous grades and units. Similarly, the students should be familiar with the safety procedures for handling tools and equipment, as well as have some knowledge of designing, building, and testing devices.

**Prior Knowledge:**

**Grade 1**: Daily and Seasonal Changes

* 3.1 identify the sun as earth’s principal source of heat and light
* 3.3 describe changes in the amount of heat and light from the sun that occur throughout the day and the seasons

**Grade 3**: Forces Causing Movement

* 3.2 identify different kinds of forces (e.g., gravity – the force that pulls objects towards the earth; electrostatic force – the push or pull that happens with charged objects; magnetic force – the force of a magnet that attracts objects containing iron or nickel)

**Grade 4**: Light and Sound

* 3.1 identify a variety of natural light sources (e.g., the sun, a firefly) and artificial light sources
* 3.2 distinguish between objects that emit their own light (e.g., stars, candles, light bulbs) and those that reflect light from other sources (e.g., the moon, safety reflectors, minerals)

**Grade 5**: Social Studies B. The Role of Government and Responsible Citizenship

* B1.1 assess the effectiveness of actions taken by one or more levels of government to address an issue of national, provincial/territorial, and/or local significance
* B1.2 create a plan of action to address a social issue of local, provincial/territorial, and/or national significance
* B1.3 create a plan of action to address an environmental issue of local, provincial/ territorial, and/or national significance (e.g., managing waste disposal, regulating industrial practices that damage the environment, ensuring safe drinking water, expanding availability of energy from renewable sources, reducing vehicle emissions), specifying the actions to be taken by the appropriate level (or levels) of government as well as by citizens, including themselves
* B3.3 describe the shared responsibility of various levels of government for providing some services and for dealing with selected social and environmental issues
* B3.4 describe different processes that governments can use to solicit input from the public (e.g., elections, town hall meetings, public hearings, band council meetings, commissions of inquiry, supreme court challenges, processes for granting easements, referendums), and explain why it is important for all levels of government to provide opportunities for public consultation
* B3.5 describe key actions taken by different levels of government to solve some significant national, provincial/territorial, and/or local issues
* B3.6 explain why different groups may have different perspectives on specific social and environmental issues

**Materials and Equipment:**

* computers, internet access
* chart paper
* cardboard/wood
* hand drill
* dowel
* marker
* hourglass/timer
* computer
* projector
* chart paper
* shoebox
* black paint/marker
* flashlight
* stress ball
* scissors/X-Acto knife
* sugar
* marble
* aluminum pie plate, video recorder
* paper plate, scissors, compass, crayons, brads/metal paper connector

**Safety:**

A hands-on approach is important in the teaching and learning of science. Therefore, possible risks may not be entirely eliminated, but procedures and techniques may be modified to create a safe learning environment. Be sure to instruct students on the proper use of tools and materials. The teacher must ensure that students understand potential dangers (tell them each safety consideration and ask them why it is important to observe them).

Safety Considerations:

* Make sure that there is appropriate supervision when working
* Instruct students not to use tools or materials for their unintended purpose, and not to use them without teacher approval
* When working near electrical devices, make sure that hands are dry
* Make sure that there is no equipment with frayed ends
* Refer to STAO Elementary Safety Resource (<http://stao.ca/res2/unifElemSafety/>) for Safety Considerations in Using Electrical Energy (pg. 91-93), as well as Designing, Building, and Constructing (pg. 72-80)

**Instructional Planning and Delivery:**

The vastness of the topic, Space, means students will have a variety of background knowledge, interests, and possible misconceptions. There are different levels of inquiry, and this resource offers guidance on teacher-led and student-led inquiries, depending on the skill of the student. Ongoing assessment is important. If not feasible each day, at least have students write a journal entry after each activity as part of assessment.

The inquiry process is: **Engage -> Explore -> Explain -> Extend -> Evaluate**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type** | **Structured or Directed** | **Guided** | **Coupled** | **Open or Full** |
| **Participant** | Teacher Initiated and Performed | Teacher Initiated, Students Performed | Teacher Initiated | Student Initiated |

**Teacher Directed Student Directed**

**Path to Inquiry**

**Engage (I SEE)**: Activate students’ prior knowledge and interest in the subject

The students’ background knowledge and interest in the topic of Space will play a large role in their comfort level with the topic. The activity in **Engage** is used as a springboard into the inquiry. To stimulate the thinking of students (I WONDER), there is also a stage for Questioning: Brainstorming on the topic. Have a Question matrix (<https://belmontteach.files.wordpress.com/2014/01/question-matrix.jpg>) somewhere visible to the students (Language Arts board if your classroom has one) as a reference when they are trying to formulate their own questions. It is important that the right environment is established for questioning and that the teacher models Questioning in such a way that asks for deeper thinking. The following websites have good advice on how to get students to think deeper:<https://belmontteach.wordpress.com/2014/01/23/better-questioning-thinking-about-thinking/>

<http://sayersjohn.blogspot.co.uk/2013/01/questioning.html>

Be aware that the students will have questions during discussions, as well as questions that will come up when students are doing an activity.

NOTE: If links do not work, copy and paste the link in a new tab/window.

**Activity 1: Introduction to Space**

* Tools: computers, internet access

Think-Puzzle-Explore (Think: What do you think you know about space? Puzzle: What questions do you have about space? Explore: How can we explore the topic?) should help students connect their background knowledge to what they could learn from hands-on, inquiry experiences. Have students fill in T-P on the topic of Space. Allow the students time to think on their own, jot down notes, and to share with a partner. The following website has good advice on establishing a routine with TPE:

<http://blog.discoveryeducation.com/blog/2015/06/15/sos-think-puzzle-explore-tpe/>

In First Nations culture, storytelling is an important developmental and educational tool, and is a central characteristic of their rich oral traditions. Legends, stories, and teachings, which remained intact, were passed down from generation to generation over thousands of years. Storytelling was not only used as an important instructive tool, it was also a means of entertainment during the long winter season.

Read the short story, “*How Summer Came to Canada*” <http://aace-english.com/free-lessons/first-nations-aboriginal-peoples/Summer_Winter_Legend.pdf>

Provide the students with books/websites that tell a story about the native representation of aspects of space (see Resources below this Activity). The students will read it, and retell the story to the class. This may involve props, costumes, and memorization, or be as simple as Reader’s Theatre where there is emphasis on the oral expression rather than on acting and costumes. (<http://schools.spsd.sk.ca/curriculum/instructionalstrategies/category/readers-theatre/>)

As a class, ask the students for feedback about the performances, as well as the stories themselves. Tell them that they will be studying Space, and to think about what they know about it based on what they saw, and based on what they remember from past experience. Have the students write their comments and questions on post-it notes for collection (this could be done online instead of paper post-it, <http://note.ly>). Tell the students that they will collect knowledge by setting up a wikia. Teacher collects the post-it notes and inputs the comments/questions into the I WONDER section of the wikia.

A Wikia website will be used as a tool for students to visualize and keep track of their learning (<http://www.wikia.com/Special:CreateNewWiki>). One idea would be to have each group have their own wiki page on the wikia , with the main page containing a) links to each groups’ page and b) the I WONDER section on the main page for questions. Each question should have space for links to different pages, created along with what the students learned during inquiry. An example of a classroom wikia can be found here:<http://classroom.wikia.com/wiki/Wikia_in_the_Classroom>

Have the students setup their group’s wiki page, create links to the main page, as well as type in their questions on the designated Question page. After, have the students reflect in their journals about what they learned about Space from the stories they heard, and compare it with what they knew previously (which they wrote in the Think portion of their TPE chart).

Resources:

*Thirteen Moons on Turtle’s Back* by Joseph Bruchac

On constellations: Seeing the Ininewuk (Cree) and Ojibway Sky: <http://jane.whiteoaks.com/2009/10/13/first-nations-astronomy-seeing-the-ininewuk-cree-and-ojibway-sky/>

How the Hare Rescued the Sun: <http://www.kidsgen.com/stories/jungle_world/how_the_hare_rescued_the_sun.htm>

Wesakechak and the Origin of the Moon: <http://lancecardinal.blogspot.ca/2011/03/wesakechak-and-origin-of-moon.html>

**Questioning (I WONDER)**

Space is a vast topic, and the students will probably have different entry points in terms of knowledge and interest. Therefore, misconceptions can also become an experiential activity and should be noted for possible exploration later. Questioning can be done collectively with the whole class so that the teacher can keep track of the questions, answer ones that should be answered immediately for safety, and help the students classify those that can be safely carried out as an inquiry. Knowledge from personal and cultural experiences may also come up.

There are users in the wikia community that operate under anonymity and might become temptation for vandalism from outside the class. The teacher can prevent this by changing editing permissions to be restricted to the teacher as the main administrator. However, this would mean the teacher needs to create the accounts for each group since the students are under 13 years of age. The group accounts will have editing permission, and anonymous editors are not allowed to edit. Be sure to send a note home to parents explaining the purpose and benefits of the activity, and the steps the teacher has taken to ensure a safe online learning community.

NOTE: Make sure that you send a note home to parents explaining the purpose and benefits of the activity, and the steps the teacher has taken to ensure a safe online learning community. This letter is also a consent form if the school or the board does not have existing policies on the usage of online platforms. A link to a sample consent form can be found in the **Evaluate** section.

Below are possible questions that the inquiry activities will be answering. Have the questions in mind, and try to steer student comments/questions in that direction. This is similar to co-creating Learning Goals, Success Criteria, and Rubrics with the students. Of course, this will not always happen in reality and other questions will come up that cannot be placed under these inquiry questions. Any remaining questions should be collated and investigated as an **Extension** (see related section).

|  |  |
| --- | --- |
| Teacher-led | Student-led |
| What are the implications of spending money on space programs?  How has space exploration helped the advancement of society?  How might an increase in funds help your department benefit the public?  What contributions have the CSA made to space exploration?  What risks do people going to space expose themselves to?  What needs does your department have that are not currently met, and why aren’t they met? | How does the moon change faces?  How do lunar/solar eclipses occur?  What happens when a meteor hits land?  Why is Pluto no longer a planet?  Why do planets have names from Roman mythology?  How are stars and constellations important?  What is necessary to launch people to space?  How might we be able to observe space phenomena from earth? |

**Explore / Inquiry activity: (I DO)**

The idea is to gradually release responsibility; the ideal situation would be to have an Open inquiry where the teacher presents a topic (not the inquiry question), as well as the materials, and students will design their own experiences. In order to build student skills and confidence, the teacher can demonstrate the process through an inquiry on creating a sundial. Examples will be provided by the teacher, and then the students will have hands-on experiences through designing/constructing a sundial. In the next activity, the students will learn about the design process: research, designing, building, testing, and redesigning for their Science fair, all of which should allow the students to become more skillful. The Knowledge Building that the students will do as a community throughout the unit should prepare them for the final task (<http://learnteachlead.ca/projects/knowledge-building/>).

**Activity 2: Design: Sundials**

Tools: cardboard/wood, hand drill, dowel, marker, timer, ruler, hourglass, paper plate, ruler, pen

Read *The Raven Steals the Light*.

Invitation to inquiry: Show the students an hourglass. Tell them that raven stole all the means of telling time on earth. If there were no wall clocks, wristwatches, cellphones, etc. in the room, how would you tell time? Show the students the materials they will work with. How might they be used to create a contraption to tell time?

With their groups, have students think of ways people tell time which do not involve clocks. After sufficient time has passed, invite the students to share or even write their questions themselves on the designated space on their wikia.

Review Safety Considerations in the **Safety** section before proceeding.

Students create their design and sample procedure in their journals, then show the teacher for approval. The following website, <http://www.wikihow.com/Make-a-Sundial>, or using cheap materials (paper plate and straw) <https://www.nwf.org/kids/family-fun/crafts/sundial.aspx> should help them construct a sundial.

Example procedure:

1. Find a place with as much exposure to the sun as possible.
2. Use a hand drill to drill a hole in the centre of the wood/cardboard and insert the dowel in the hole.
3. Look at the time on your wristwatch or school clock (ONLY for the first mark), and use a marker to mark the top of the flat cardboard/wood surface where the shadow of the stick falls at the top of the hour in which you are beginning the recordings.
4. Set the timer to ring at every hour after that; when the alarm rings, mark the shadow again.
5. Thirteen hours should be marked on the sundial, and the pattern of the markers should have the appearance of a semi-circle when completed. It should end with the same number it begins with. For example, if your sundial begins at 7am, it should end at 7pm. Depending on the time of day you begin, it may take a couple of days for your sundial to be complete. If you begin late in the day, stop when the sun goes down and begin the next day when the sun rises, marking each hour until you reach the first mark of the day before.

Once their sundial is complete, have the students test their contraptions for accuracy. Let them think about how accuracy would be affected if they moved their sundial to a different area, or even a different country.

Students communicate what they learned by updating the information in the wikia with notes and/or pictures of their design, and what they learned under the corresponding question.

It is a good idea to provide direct instruction at the end. Gather the class around the smartboard/projector and point out the important concepts about the sundial and the process that allowed the students to learn about it. This solidifies the knowledge gained from the inquiry experience, ensuring that all students can benefit from the constructed knowledge that the wikia contains.

**Activity 3: Space Fair**

Tools:

* computer, projector, chart paper
* shoebox, black paint/marker, flashlight, dowel, stress ball, scissors/Xacto knife
* sugar, marble, aluminum pie plate, video recorder
* paper plate, scissors, compass, crayons, brads/metal paper connector
* straws, pencils, paper, tape, scissors

The students will watch a video product created to teach about the solar system, singing to the tune of “Shake it Off“ by Taylor Swift. Video: “Spin it off - Solar Systems song” <https://www.youtube.com/watch?v=E91IqJI8dsU>. Now have the students watch another video product created to teach about the solar system, <https://www.youtube.com/watch?v=ZHAqT4hXnMw>

Have the students provide feedback to the videos.

* What did you learn from the presentations?
* What information is present/missing from the product?
* How would you improve the product?
* Would you present the knowledge about the solar system in a different way?

Invitation to inquiry: The students will become experts on a method for space exploration or a phenomenon in space. Tell the students that they will be choosing a topic, researching it, creating a game/model/experiment about the method/phenomena they chose, as well presenting the information orally/visually to the younger grades in a Space Fair.

Hand out chart paper, and have the students bring out the TPE chart that they made in Activity 1. Have them Think-Pair-Share on how to explore the space topic. After sufficient time has passed, invite the students to fill in the designated question area in the wiki. After hearing the other groups’ ideas, the students can then add more comments, questions, or possible ways to explore a topic. (Guided: Teacher presents the list of materials and possible topics in the Resources below, providing advice on the procedure, if needed.) Have the students update the I WONDER section in the class wikia with their comments/questions.

Inquiry questions:

* How does the moon change faces?
* How do lunar/solar eclipses occur?
* What happens when a meteor hits land?
* Why is Pluto no longer a planet?
* Why do planets have names from Roman mythology?
* How are stars and constellations important?
* What is necessary to launch people to space?
* How might we be able to observe space phenomena from earth?

Option: Open Inquiry: The students might also be interested in a different phenomenon or technology or invention that was for/came from space exploration. The students write the materials down plus what they plan to design and present. They show the list to the teacher who, safety, cost, and availability permitting, will get the materials for the students.

Review the Safety Considerations in the **Safety** section before proceeding.

After looking at all of the possible topics, have the students choose the topic they will present in the Science Fair. They research, create designs, then show those design to the teacher for approval and so that the teacher can help gather the materials.

Have the students create a page on what they are going to present, and continually update their wikia pages with their progress, notes, designs, etc.

Inquiry Resolution: Before the Space Fair, each group will present to the class, in order to test their products, and receive feedback about their concepts and presentation skills. An example form of feedback would be Two Stars and a Wish. The presenters could also create a quiz (paper or through Socrative; see **Evaluate**) to check whether their classmates understood, or if the group needs to revise something in their presentation to make it clear.

Gather the class and point out the important concepts presented by each group and the process that allowed the students to learn about it. This solidifies the knowledge gained from the inquiry experience. Afterward, have the students reflect on the process of researching, planning, designing their presentations, what they learned, and any problems they encountered.

Resources:

An activity to create a small model of the solar system using manipulatives (instead of constructing a model, give the students the distance of the planets to the sun, and have the students scale it using different non-standard measurement tools, like cubes or cards, and mark those distances): <http://www.nasa.gov/sites/default/files/546148main_ESS8_ScaleModelsOfTheSolarSystem_C3_Final.pdf>

Study the phases of the moon: Moon phase box: [http://www.teachertube.com/video/how-to-make-a-moon-box-55496#](http://www.teachertube.com/video/how-to-make-a-moon-box-55496)

Study the effects of the relative positions of the earth, moon, and sun: <http://www.enchantedlearning.com/crafts/astronomy/sunearthmoon/>

An experiment with meteorite impact (record with a video camera the impact of marble on a bowl of flour/sugar or water, open the movie in iMovie or Windows Movie Maker, and watch the impact in slow motion; try different balls like golf ball/ping pong ball as meteorites): <http://www.sciencebuddies.org/science-fair-projects/project_ideas/Astro_p010.shtml#procedure>

Test how far rockets can go by building their own:

<http://er.jsc.nasa.gov/seh/Paper_Rockets.pdf>

Build a Telescope (the video also has information about optics): <https://www.youtube.com/watch?v=msIAdyljrwI>

**Activity 4: Fund Me!**

Tools: computers, internet access

Invitation to inquiry: Pose Scenario: Guy Laliberte was the CEO of Cirque du Soleil. For eight days, he went on a flight to space to raise awareness on water issues facing humans on earth (water is a scarce resource). His space flight cost 35 million dollars and he will be donating a hundred million dollars to promote education, community involvement, and public awareness of water issues over a span of 25 years. The Canadian Space Agency has approached him, in the hopes of getting a donation to help the program with space exploration. How might you convince Laliberte to support space exploration? How might Laliberte explain why he would not want to donate to the CSA?

Videos: <https://www.youtube.com/watch?v=dNegdHPrcUc>, <https://www.youtube.com/watch?v=81c_4pOcjCw> (until 2:43, the rest is in French)

Text: <http://www.space.com/7375-circus-billionaire-space-trip-worth-penny.html>

As a class, have the students go back to their work space and think of the scenario, and any questions or comments that they could ask.

Inquiry questions:

* How has space exploration helped the advancement of society?
* What contributions have the CSA made to space exploration?
* What risks do people going to space expose themselves to?
* What would it mean if space exploration was stopped?
* As with Laliberte’s support for the water issues, what other social issues could use Laliberte support, other than space exploration?

In their groups, students fill out their TPE charts about how they could investigate the questions they chose from the scenario. Encourage them to look at official websites for space exploration (CSA, NASA) and any non-governmental organizations (other than One Drop which Laliberte supports) that could also benefit from receiving increased funds. They could also contact the VROC through videoconferencing for experts in the respective field (scientists, astronauts, researchers, etc.) <http://www.vroc.ca/vroc/en/>. The level of support provided could be varied (teacher provides specific articles, provides websites to search, or leaves the research open to the students).

Variation: A student that needs a lot of support could be provided with text-to-speech assistive technology or they could investigate the methods that Laliberte used to adapt to a life in space, update the wikia with the information, then present to the class.

<http://www.forbes.com/sites/stevenbertoni/2011/06/09/why-cirque-du-soleil-billionaire-guy-laliberte-traveled-to-space/>

Students will update the class wiki with information, any evidence, or support that they have. The information needs to include where they obtained the information, and the Inquiry Question that their update will be answering. The information could be statistics, a picture with a short description, or a summary of an article/story.

Afterwards, the teacher will then have the class gather around the projector/SMARTboard in order to discuss the knowledge that have been collected through the wikia. Students reflect in their journals about what they learned, and include their own opinion.

Put signs in the four corners of the room: All for CSA, Mostly for CSA, Some for CSA, and None for CSA. Based on their opinions, have the students move into those corners. Within their groups in those corners, have the students discuss why they believe that Laliberte should do as their sign says (ex.: discuss why Laliberte should donate some money to CSA and most money to something else).

Then, the discussion between groups will be done using a Talking Circle instead of a debate: there needs to be a talking stick that would be passed around from each group, designating who will be talking. This promotes respect because everyone then has the responsibility to listen. Each group will have five minutes to say their opening statement. Then, each group will have five minutes to talk about what the other groups said. Lastly, each group will have five minutes to summarize their points again, taking into consideration what they heard from other groups.

Props and costumes are recommended (explain to the students that visual aids and products as evidence make their points more convincing, and that costumes will help them get into the role).

Inquiry Resolution: If you were Laliberte, what would your answer be to the CSA?

Students will create an entry in their journal reflecting whether they changed their minds or if they still have the same position, and why (include two reasons that they heard from the other groups).

Option: Open Inquiry: The parties of the federal government are debating whether the CSA should receive the donation from a billionaire, or if another department needs the money more urgently. CSA, Education, Health, Canadian Wildlife Fund, and RCMP each need a budget increase in order to continue their high standards. Therefore, astronauts, doctors, teachers, public workers, scientists, and the police will need to discuss within themselves why their department needs money. The decision will be made only after the program has submitted a claim with supporting evidence as to why their program needs funding. (Questions: How might an increase in funds help your department benefit the public? What needs does your department have that are not currently met, and why aren’t they met?) First, the students will research a certain department, then update the class wikia with the information they found. The teacher will then have the class gather around the projector/SMARTboard in order to discuss the knowledge that has been collected through the wikia. Afterwards, the students can choose (or the teachers could assign randomly) to be part of a department that is in the running to receive the donated money, and will be explaining why that department needs more funding.

Variation: In grade 5, the students studied the role of government as well as the importance of public consultation. Instead of only doing a class discussion, this could be taken to the entire group of grade 5 students, or even to the whole school. After listening to the discussion between the opposing parties, the grade 5 students could be given a survey on whom they think should be provided the funding, and why (at least 2 reasons).

**Explain**: Communication

The students have different opportunities to be able to communicate their learning about space. The main method is the wikia website which should be used to keep track of the inquiry process. The students should update the website with the knowledge they learned from their inquiry experience. Catering to some accommodation and different learning styles, students may write about, draw, or post pictures of the process in their journals. Additionally, the students have an opportunity to present their findings to the younger members of the school population, as well as other classmates who belong to a different group and would, therefore, have a different opinion. The students will receive feedback on their knowledge and ability to communicate from everyone who participated in their respective circles.

**Student Support Resources:**

Books:

*Thirteen Moons on Turtle’s Back*, by Joseph Bruchac, Puffin books, 1997

*The Raven Steals the Light*, by Bill Reid and Robert Bringhurst, Vancouver: Douglas & McIntyre, 1988

Websites:

Enchanted Learning. Sun Earth, Moon Model. Retrieved from: <http://www.enchantedlearning.com/crafts/astronomy/sunearthmoon/>

Conquer, B (2015, January). In Spin it off - Solar system song. Retrieved from: <https://www.youtube.com/watch?v=E91IqJI8dsU>

Emdu. (2009). In How to make a moon box. Retrieved from: [http://www.teachertube.com/video/how-to-make-a-moon-box-55496#](http://www.teachertube.com/video/how-to-make-a-moon-box-55496)

How to Make a Sundial. Retrieved from: <http://www.wikihow.com/Make-a-Sundial>

Make a Sundial from a Plate. Retrieved from: <https://www.nwf.org/kids/family-fun/crafts/sundial.aspx>

Nasa. (2012, May). In Scale Models of the Solar System. Retrieved from: <http://www.nasa.gov/sites/default/files/546148main_ESS8_ScaleModelsOfTheSolarSystem_C3_Final.pdf>

Rockets. Retrieved from: <http://er.jsc.nasa.gov/seh/Paper_Rockets.pdf>

Science Buddies Staff. (2014, October 3). In Craters and Meteorites. Retrieved from: <http://www.sciencebuddies.org/science-fair-projects/project_ideas/Astro_p010.shtml>

StoryBots. (2013). Outer Space “We are the Planets,” Solar System Song. Retrieved from: <https://www.youtube.com/watch?v=ZHAqT4hXnMw>

(2009, October). Seeing the Ininewuk (Cree) and Ojibway Sky. Retrieved from: <http://jane.whiteoaks.com/2009/10/13/first-nations-astronomy-seeing-the-ininewuk-cree-and-ojibway-sky/>

How the Hare Rescued the Sun. Retrieved from: <http://www.kidsgen.com/stories/jungle_world/how_the_hare_rescued_the_sun.htm>

Wesakechak and the Origin of the Moon. Retrieved from: <http://lancecardinal.blogspot.ca/2011/03/wesakechak-and-origin-of-moon.html>

How Summer came to Canada. Retrieved from: <http://aace-english.com/free-lessons/first-nations-aboriginal-peoples/Summer_Winter_Legend.pdf>

epicfantasy. (2009). How to Make a Small Easy Telescope. Retrieved from: <https://www.youtube.com/watch?v=msIAdyljrwI>

issmania. (2009). Guy Laliberte from the ISS. Retrieved from: (1) <https://www.youtube.com/watch?v=dNegdHPrcUc>, (2) <https://www.youtube.com/watch?v=81c_4pOcjCw>

Moskowitz, C. (2009). Space Billionaire Says Space Trip Worth Every Penny. Retrieved from: <http://www.space.com/7375-circus-billionaire-space-trip-worth-penny.html>

Bertoni, S. (2011). Why Cirque du Soleil Billionaire Guy Laliberte Traveled to Space. Retrieved from: <http://www.forbes.com/sites/stevenbertoni/2011/06/09/why-cirque-du-soleil-billionaire-guy-laliberte-traveled-to-space/>

Virtual Researcher on Call. Retrieved from: <http://www.vroc.ca/vroc/en/>

**Related Background Resources and/or Links:**

Astronomy for Kids. Retrieved from: <http://www.kidsastronomy.com/>

Bowdoin, S. (2015, June). SOS: Think Puzzle Explore. Retrieved from: <http://blog.discoveryeducation.com/blog/2015/06/15/sos-think-puzzle-explore-tpe/>

Byers, J. (2013, May). Readers’ Theatre. Retrieved from: <http://schools.spsd.sk.ca/curriculum/instructionalstrategies/category/readers-theatre/>

Create New Wiki. Retrieved from: <http://www.wikia.com/Special:CreateNewWiki>

ESA - Space for Kids. Retrieved from: <http://www.esa.int/esaKIDSen/index.html>

Gr.6 Space Integration, Our Solar System. Retrieved from: <http://www.spiritsd.ca/learningresources/FNM%20Resources/6-9/GR6%20Space%20Integration,%20Our%20Solar%20System%20%282%29.pdf>

Knowledge Building - Inquiry Based Learning. Retrieved from: <http://learnteachlead.ca/projects/knowledge-building/>

O’Brien, Tim. (2012). In The Earth and Beyond. Retrieved from: <http://www.childrensuniversity.manchester.ac.uk/interactives/science/earthandbeyond/>

Space for Kids. Retrieved from: <http://www.sciencekids.co.nz/space.html>

Your Rubric is a Hot Mess; Here’s How to Fix It

<http://www.brilliant-insane.com/2014/10/single-point-rubric.html>

**Indigenous Connection:**

This unit incorporates storytelling. Humans have been beholden to what is happening in space, such that a rich oral tradition came from it. Storytelling, another important developmental and educational tool, is a central characteristic of the rich oral traditions of First Nations communities. Legends, stories, and teachings, which remained intact, were passed down from generation to generation over thousands of years. Storytelling was not only used as an important instructive tool, it was also a means of entertainment during the long winter season.

An elder from an FNMI community could be invited to provide a richer, authentic experience with storytelling. Contact your local FNMI community or ask the administration if they have contact to a FNMI community leader.

In the culminating task, the discussion between groups will also be done using a Talking Circle: in this unit, the class will use a talking stick. This would be passed around from each group, designating who will be talking. This promotes respect because everyone then has the responsibility to listen. If someone wishes to speak, they raise their hand and wait until the talking stick is passed to them. In FNMI culture, a person has a right to pass in the Talking Circle.

Please refer to the STAO website for additional suggestions and resources for incorporating indigenous perspectives into activities: (LINK TO BE ADDED LATER)

**Extend / Redesign**: Application of the knowledge and skills gained in the unit in a different context

Activity: revisit the Question section on the wikia and ask the students which questions have been answered, and what has yet to be answered.

Look at the collection of students’ questions; organize remaining questions into researchable topics possibly related to the Space unit (collect related questions together, identify broader categories which the collected questions fall under)

Teacher Tip: Do not shy away from not knowing the answer to the students’ questions. Use it as the platform for an open inquiry.

Students decide on the important questions to answer, then work collaboratively to develop an answer to the question (research), and communicate their learning.

Students learn about their chosen topics using the textbook/articles provided by the teacher/or found on their own.

Sample question: Why is Pluto no longer a planet? (create a new mnemonic)

Encourage the use of visual aids or constructed products (model or a game).

Other opportunities/activities:

World cafe: Each group chooses a few articles about space. Students print out, or put up a link on the wikia page to the article for advanced reading. Each group becomes a discussion circle leader, and will lead their own group in discussing the article their group chose on space (discussion leader brings snacks, and provides summary and questions/prompts about the article to start the discussion).

Invite an astronaut or scientist to be a guest lecturer or to join the class in a guest lecture. The students could even show their products from the Space Fair and ask for advice and feedback.

Astronomy vs Astrology

* What’s the difference?
* Are they both accurate?
* Should the results of a reading in astrology be believed?

Roman Mythology (examine the relationship with planet characteristics vs Roman gods’ characteristics)

For additional ideas on the topic of Space, refer to the STAO resource, <http://stao.ca/cms/gr-6-astronomy>

**Evaluate (I REMEMBER)**: Assessment

Whether the following assessment would be included in the student’s overall mark is left to each teacher's discretion. It is suggested that the following should definitely be monitored as evidence of the student’s learning skills.

Things to look for in assessment: (has shown signs of being able to… -> can...)

* uses new vocabulary appropriately
* uses new knowledge to improve on their design during the technological-design process
* identifies the solar system and describes the relationships between relative bodies in the system
* identifies the needs of humans in space, and as well as tools and devices needed to explore space

**Assessment For Learning:**The TPE chart is a good tool to assess students’ prior knowledge and also to help determine what to do next instructionally in terms of strategies and differentiation/accommodation. The teacher must also be aware of student comments/questions/answers as possible tools of formative assessment.

* TPE chart with students’ comments, questions
* Observations, discussions (questions and answers)
* Focused Listing: Provide a topic and students list the associated vocabulary, concepts, even describe pictures, as quickly as possible. Teacher can use these lists to facilitate discussion or as quick assessment of prior knowledge.
* The teacher could test the students’ prior knowledge (based on the expectations in the Prior Knowledge section), they can use Socrative ([www.socrative.com](http://www.socrative.com)) or Kahoot ([www.getkahoot.com](http://www.getkahoot.com)) both of which provide instant feedback to the teacher after each question has been answered; therefore, the teacher can clarify any confusion and then move on to the unit’s activities.
* Exit card can be used to monitor the student’s progress towards a Learning Goal: (Today I learned… Today I learned more about… Today I improved at… / Some of the steps I took to get there… / Some evidence that I am meeting the learning goal is… / I need to learn more about…).

**Assessment As Learning:**The goal is for students to become self-reflecting learners. Students have their own journals in order to be able to reflect on what they learned after each activity. When working collaboratively, students have a chance to learn from each other. Additionally, having visible learning goals, or a visible tracking checklist of the concepts/skills, will help students determine by themselves whether they have understood a concept or are able to perform a skill.

Journals after every activity ensure that the students are reflecting on what they learned:

* What did I do in class today?
* What did I learn?
* What did I find interesting?
* What questions do I have about what I learned?
* What was the point of today’s lesson?
* What connections did I make to previous ideas of lessons?

In place of quizzes, journals must be checked periodically; the teacher must be diligent so that the students are also diligent.

Visible tracking checklist (Learning goals/concepts are on a chart, and students put a check mark once they understand the concept.)Student conferences may help those students who are not confident (or too confident) in placing marks on the checklist.

Besides the wikia, other options would be creating a collaborative website using sites like Tackk (<https://tackk.com>) and Weebly (<https://education.weebly.com>), both of which allow the teacher to create a virtual classroom, student accounts, etc. The websites are free, and allow for collaboration and the creation of blogs. Like wikia, the websites are legal for those over 13 years of age, and so the teacher must send home a letter to inform the parents of the online policies as well as to obtain consent if this is not something that the school or board already required of the parents (Tackk provides an example of a Parent Letter:<https://df4fak26u0jfx.cloudfront.net/Tackk_Parent_Letter.pdf>).

Two Stars and a Wish could be filled out by the students about their own product/presentation, or for another group’s/student’s product/presentation.

Metacognition:

* Based on the presentations, how would you teach someone about the eclipse (illustrate, create a model, dramatize, etc.)?
* How would you want someone to teach you about telling time using the sun (would you prefer the demonstration, or making your own)?
* Why did you choose that method of presentation?
* Would you change your own method of delivery?

When the success criteria and rubric are co-created, hand out a copy of the rubric to the students. The students can then use the rubric to self-assess (I predict my mark will be \_\_\_\_ because \_\_\_\_ ) and submit the rubric at the end of the activity.

**Assessment Of Learning:**The single point rubric, instead of the traditional levelled rubric, allows the teacher to provide feedback to the students. The middle column contains the criteria that show how students will meet the grade-level expectations. The column on the left is a space for the teacher to write about what the student needs to work on. The column on the right is a space for the teacher to write about what the student did that exceeds expectations (e.g., creativity to additional information).

<http://www.brilliant-insane.com/2014/10/single-point-rubric.html>

Sample Rubric (Activity 4: Fund Me)

|  |  |  |
| --- | --- | --- |
| Concerns (Areas that Need Work) | Criteria (Standards for this Performance) | Evidence that you Exceeded Standards |
| *Sample comments: You need to make it clearer how your evidence is related to the scenario* | 1) Provides evidence of cost/benefit of space exploration | *Sample comments: I really like how you used visual aids; you made a connection to NASA that was not mentioned in the class wiki showing initiative, additional research* |
| *Sample: Need more practice with tenses; vocabulary used out of context* | 2) Appropriate science and technology vocabulary used, grammar conventions met, oral skills are appropriate for their level | *Sample: No errors, corrected self when speaking* |
| *Sample: A little disorganized; you should make it clear whose case you are supporting* | 3) Correctly/Accurately represented their chosen point of view | *Sample: Use of specific group names (Kids can Free the Children), saying if “I” was a volunteer with the organization* |

For the student:

A) Piece of feedback I am going to focus on this time and two specific things to do to act on this specific piece of feedback

B) Piece of feedback that I was: surprised by, or didn’t expect, or disagreed with: