

**CODE/MOE/UOIT Makerspaces Project**

**Lesson Plan: Grade 6 Science & Social Studies: Designing a Mars Rover, Part I**

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| **BIG IDEAS:**  **Building communities in space reflect the same needs as communities on Earth but have specialized situations and requirements unique to their location in space. This has wide ranging implications for resource extraction, biodiversity, conservation of energy and resources, social and biological interactions, and the effect of humans on the new environment. How do we learn from the challenges of our past to ensure a more positive future for the human race in the 21st century and beyond?**  **Science and Technology Overall Curriculum Expectations: Grade 6**  **Understanding Life Systems**  1.assess human impacts on biodiversity, and identify ways of preserving biodiversity;  3. demonstrate an understanding of biodiversity, its contributions to the stability of natural systems, and its benefits to humans.  **Understanding Structures and Mechanisms**   1. investigate ways in which flying devices make use of properties of air; 2. explain ways in which properties of air can be applied to the principles of flight and flying devices.   **Understanding Earth and Space systems**  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.  **Social Studies: Grade 6**   1. **Canada’s interactions with the Global Community**   **1, 3; explain the importance of international cooperation in addressing global issues (International Space Station); describe significant aspects of involvement in some parts of the world (applying this context to space colonization) including the impact of this involvement** | |
| **Learning Goals:**  “We are learning to and about:”  The proposed plans for a lunar and Mars colony in space (2024) and the reality of space colonization in our immediate future.  The various social, biological, ethical, and cultural implications of colonizing in space and what is required to survey and map the terrain before construction can begin.  How to predict weather and other hazards that might impact the construction or daily life of buildings, plants, or animals/humans on the surface of the space colonies?  The effects of space travel on the human body, and what unique medical implications there are for humans born and living in space who might return to Earth to live or vacation.  How NASA, CSA, ESA and other space agencies as well as other groups around the world are preparing for space colonization.  Research existing methods, materials, and innovations currently used on earth or in space, and improve upon their design model to function on Trappist-1 planets based on the area of interest for each student’s inquiry (Mission Speciality). | **Success Criteria:**  “We will be successful when…”  We can talk about the various factors that led to colonization in North America (Turtle Island) and the ways that the interactions between First Nations and settlers impacted on the cultures of both peoples in a positive or negative way.  We can tell you about the ways that NASA and other space agencies begin to prepare for major exploration (e.g. lunar landing) or construction in space (e.g. ISS or Hubble Telescope) and the challenges they faced planning, preparing, transporting and carrying out the missions.  We understand the unique weather, landforms, and soil composition of the Moon and/or Mars and can talk about how they will affect the abilities of rovers and other vehicles conducting scientific field work on the surface.  We can research and share ideas about how the human body reacts to space travel and to gravity. We can apply that knowledge to predicting problems for those selected to participate in manned scientific explorations of the terrain of the Moon, Mars or the Trappist-1 planets.  We can compare the different groups around the world involved in actively planning or preparing for space colonization. Through email we contact these agencies to ask questions we have had through the inquiry process regarding mapping and field work on other space terrains.  We can locate, sort, analyze, and synthesize information regarding existing rovers used in scientific exploration of planets, moons and asteroids in space. Taking this knowledge we can innovate current designs to create new rovers that will conduct fieldwork and mapping on the Trappist-1 planets. |
| **Lesson Overview:**  **Design a model of a rover to conduct scientific research on the Trappist-1 planets (mapping terrain, soil composition, weather and environmental hazards, plant and animal life)** | |
| **Materials and Technology:**   * **Spheros** * **Littlebits** * **found materials** * **computers/ipads or other mobile technology for research and design and control of Spheros** * **Tinkercad (**[**www.tinkercad.com**](http://www.tinkercad.com)**)** * **Google Classroom to house research links, news items, and discussion** * **design boards and dry erase markers** * **hot glue guns, modelling clay, dowels, and other items used for design of prototype** | |
| **Student Accommodations/Modifications:**   * **Scribing** * **Speech to text (Dragon Dictation), text to speech technology (WordQ)** * **Direct assistance with model when required** | **Lesson will be differentiated by:**   * **Content, specifically: Provide the specific digital resources needed to research chosen inquiry areas** * **Process, specifically: peer and teacher support with use of Tinkercad, Littlebits, and Google Classroom** * **Product, specifically: Assistance with construction of model and elements of final display of research** * **Environment, specifically: quiet work space; different forms of technology to suit student preference (desktop, laptop, iPad, netbook, iPod), multiple areas for construction and consultation with partners** |
| **MINDS ON: Getting Started** | |
| During this phase, the teacher may:  • activate students’ prior knowledge;  • engage students by posing thought-provoking questions;  • gather diagnostic and/or formative assessment data through observation and questioning;  • discuss and clarify the task(s). | During this phase, students may:  • participate in discussions;  • propose strategies;  • question the teacher and their classmates;  • make connections to and reflect on prior learning. |
| Describe how you will introduce the learning activity to your students. What key questions will you ask? How will you gather diagnostic or formative data about the students’ current levels of understanding? How will students be grouped? How will materials be distributed?  Initially, each student will share a reflection about the idea of space colonization and their opinion about whether we, as a human race, are ready for space colonization and what things concern or excite us about the possibilities of living and working in space.  We examine the imagination of others regarding space exploration and colonization through digital media (The Martian, pilot episode of Space 1999, excerpts from Babylon 5, excerpts from Star Trek and Star Trek Next Generation).  We view the initial announcement and press conference held by NASA in January regarding the discovery of the Trappist-1 planets. | |
| **ACTION: Working on it** | |
| During this phase, the teacher may:  • ask probing questions;  • clarify misconceptions, as needed, by redirecting students through questioning;  • answer students’ questions (but avoid providing a solution to the problem);  • observe and assess;  • encourage students to represent their thinking concretely and/or pictorially;  • encourage students to clarify ideas and to pose questions to other students. | During this phase, students may:  • represent their thinking (using numbers, pictures, words, manipulatives, actions, etc.);  • participate actively in whole group, small group, or independent settings;  • explain their thinking to the teacher and their classmates;  • explore and develop strategies and concepts. |
| Describe the task(s) in which your students will be engaged. What misconceptions or difficulties do you think they might experience? How will they demonstrate their understanding of the concept? How will you gather your assessment data (e.g., checklist, anecdotal records)? What extension activities will you provide?  We form groups based on student area of science interest (biology, geology, meteorology, botany, herbology, topography). Students research various rovers already in use or had been used for scientific study of the Moon and Mars to gather ideas about the specific purpose and needs of the rover to perform its duties. Misconceptions: that what works on Earth will work in space; that machinery will work in the same way in all environments regardless of temperature, terrain, distance from sun, and other anomalies specific to space environments.  Members of the mission team provide feedback, suggestions and support to each other during the the research periods. Revamping of initial designs takes place based on research results and students understanding of current technologies available that didn’t exist at the time of the other rovers missions. Misconceptions: that the science is too difficult to understand at this age level; that students cannot envision the technology or innovations required to design an effective scientific rover. Assessment gathered via assignments posted to Google Classroom with initial designs (written, oral or photographic)  Students create a scaled prototype of their rover design and accompanying report about its purpose, materials required to build and what is needed to interact with the rover during its mission and interpret the data it provides. Misconceptions: size of physical rover and the relationship between prototype and actual rover. Assessment gathered from completed prototype and written/video explanation of its purpose, construction, and needs. | |
| **CONSOLIDATION: Reflecting and Connecting** | |
| During this phase, the teacher may:  • bring students back together to share and analyse strategies;  • encourage students to explain a variety of learning strategies;  • ask students to defend their procedures and justify their answers;  • clarify misunderstandings;  • relate strategies and solutions to similar types of problems in order to help students generalize concepts;  • summarize the discussion and emphasize key points or concepts. | During this phase, students may:  • share their findings;  • use a variety of concrete, pictorial, and numerical representations to demonstrate their understandings;  • justify and explain their thinking;  • reflect on their learning. |
| How will you select the individual students or groups of students who are to share their work with the class (i.e., to demonstrate a variety of strategies, to show different types of representations, to illustrate a key concept)? What key questions will you ask during the debriefing?  We will work together to create an exhibit of the results of our Colonization in Space unit. All rover teams will share their thoughts about each item and can offer suggestions for the design or the method of presentation at the Makerfaire exhibit. Key Questions: What were the challenges with using Spheros for the driving mechanism for your design? Based on these challenges, how could Littlebits be useful where the Spheros were not? How would your prototype change if you utilized components from Littlebits instead?  Students will assist each other with the Tinkercad program and the creation of the artifacts to be printed on the 3D printer as well as with the physical backdrop for their display. Students may either display their research in written form or record a video detailing their research and the significance of their artifact (no longer than 4 minutes in length) to be played on an ipad with their artifact at the Makerfaire. Key Questions: what different modes are considered in the creation of the presentation (graphic, audio, video, written, colour, interactivity)? Which ones relate to and enhance your presentation of your particular rover design? | |