

**CODE/MOE/UOIT Makerspaces Project**

**Lesson Plan: Grade 5 Science & Social Studies: Space Colonies**

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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 5**  **Understanding Life Systems**   1. analyse the impact of human activities and technological innovations on human health;   **Understanding Structures and Mechanisms**  1. analyse social and environmental impacts of forces acting on structures and mechanisms;  2. investigate forces that act on structures and mechanisms;  3. identify forces that act on and within structures and mechanisms, and describe the effects of these forces on structures and mechanisms.  **Understanding Earth and Space Systems**  **1.** analyse the immediate and long-term effects of energy and resource use on society and the environment, and evaluate options for conserving energy and resources;  **2.** investigate energy transformation and conservation;  **3.** demonstrate an understanding of the various forms and sources of energy and the ways in which energy can be transformed and conserved.  **Social Studies**  **Gr. 5**  **A 1.3 Explain ways in which interactions between and among First Nations and Europeans in New France are connected to issues in present day Canada (specifically treaty agreements and trade)** | |
| **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.  How colonization on Earth has impacted cultures (FNMI and others) and community in Canada in positive and negative ways.  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 in a specific location (Moon, Mars or 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 form a clear opinion with evidence to support that opinion about whether we are ready as a human race to colonize in space.  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 construction or daily life on the surface of those places.  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 living in space or born in space if they return to the different gravities of Earth or on other 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 space colonization.  We can locate, sort, analyze, and synthesize information regarding space colonization. Taking this knowledge we can combine our individual interests in the subject into a team vision of a Lunar or Mars colony that showcases our own innovations to be shared with others. |
| **Lesson Overview:**  **Design a model of an item that is important to the construction of a space colony or something that would be used at a space colony.** | |
| **Materials and Technology:**   * **found materials** * **computers/iPads or other mobile technology for research and design and to record weekly mission vlogs regarding research progress** * **team mission logbook to hold information about research and minutes from weekly mission briefings** * **Tinkercad (**[**www.tinkercad.com**](http://www.tinkercad.com)**)** * **Google Classroom** | |
| **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** * **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)** |
| **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) | |
| **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 interest (Lunar Colony, Mars Colony, Trappist-1 exploration team). Each student chooses a specific area of interest regarding one aspect of creating or building a colony (housing, materials, medical, life support, transportation etc.). Misconceptions: that living in space is impossible for people to do in our near future; that the human body cannot adjust to living in space on a permanent basis.  We work individually on the research for three periods then meet one period a week in our Mission teams to share a brief report on the progress and set research goals for the following week. In addition students will record a mission vlog each week providing a more detailed summary of their research. Members of the mission team provide feedback, suggestions and support to each other during the mission briefing and throughout the research periods. Misconceptions: that the science is too difficult to understand at this age level; that students cannot envision the technology or innovations required to make space colonization a reality.  Each week the students will record a mission vlog (video log) detailing their research in more detail than in the oral report in the Mission briefing. They will identify additional inquiry questions and challenges they are facing in the research. This will allow for more directed and timely support to be provided to the students by the teacher to help them further their inquiry in a focussed and effective way. Students will therefore summarize their research in written form as well as orally providing more than one way to synthesize what they know. | |
| **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. Mission teams meet together to discuss each student’s idea for their individual display items and be asked to present what artifact they intend to design in Tinkercad to showcase their research and how it promotes the colony as a whole cohesive unit. All members of the mission team 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 your experiences using Tinkercad to create your artifact that summarizes your research? What are the differences between designing in 2 dimensions verses designing in 3D?  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 mission specialty and the artifact you are featuring in the display? | |