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Methods Of Integrated Stem Education - EDCI 55800

Mission Control Day 2 Unit

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The Mission Control program is a 5-day program designed for students to work in teams to complete a mission from the point of view of an astronaut, Mission Control, and the backroom support. For this assignment, I am designating activities conducted in one day as the lessons within this unit, so some information within the lessons is set up for a future unit.

The Mission Control program is a 5-Day program where high school students from around the world come to learn about Mission Control and their “Plan, Train, Fly” motto. They will also experience what it takes to plan and perform an Extra Vehicular Activity (EVA) from the perspectives of the astronauts, Mission Control, and their back room support. Students will begin the week by learning about the various roles they will be performing later in the week, learn about Mission Control, and complete team building activities. Day 2 is where this unit fits in, where students will learn about the water ice on the Moon and what instruments were used to make those discoveries. They will then perform their own mission to gather video information about their simulated lunar surface which they will be exploring on Day 3 and 4. Day 2 will also start with a tour to the historic Mission Control facility at Johnson Space Center in Houston, Texas, where they will see what Mission Control looked like the day astronauts first landed on the Moon, complete with a 20 minute video of the Moon landing as well as what was on the screens in Mission Control that day. Day 3 starts with a guest speaker, someone who works for NASA, ideally someone with Mission Control experience. Then students will review and practice how they work together in the three different teams for the EVA, how they communicate, and solve problems. Later that day they will conduct the first of three EVAs followed by a debrief. During that EVA, I will be throwing at least 1 alarm for them to troubleshoot through. Day 4, students will switch roles and conduct another two EVAs, followed by a debrief of the EVAs. Day 5 starts with a tour of the current ISS Mission Control at Johnson Space Center followed by a presentation from an Astronaut, usually retired, and then concludes with a graduation ceremony.

In the Mission Control Day 2 Unit, students will utilize technology to remotely explore and gather information about a simulated lunar surface to determine where to research resources and set up a habitat. With this unit, students will be using cameras on rovers and drones to survey an area for land forms with simulated resources for experiments to be done in a different unit as well as elevation information to determine the best location for a life-sized habitat for doing experiments. This information gathering would be done remotely, meaning students would have to utilize computers to view the drone video footage in real time while simultaneously recording video from the rovers for evaluation and discussion later. The story is that they are exploring the Moon, and they need to determine where to put the habitat with an airlock and where to collect samples from. This will be inside a classroom with rock samples and craters with simulated materials. Formative assessment will be done through teacher observation and informal discussion as well as through peer review as the students will work together to provide answers to these questions amongst themselves and then discuss as a class their findings.

One way this lesson will motivate students is by putting them into a simulation. The objectives are woven within a story, a clear purpose for doing this surveying, with room for different solutions to the same problem. In one study by Johnson and Johnson, they found that “having the students design and implement the activities prompted them to be more engaged during the lesson and caused them to be more productive and invested in the nuanced academic components of the assignments” (2016, p. 116). Aside from the introductory background information, the students will be actively working on their plans, trying them out, and learning what went well and what needs to be adjusted before the actual run of their project, investigating the simulated lunar surface. A running theme for the overall program this unit is a part of is “Plan, Train, Fly”. Berland and Steingut “…suggest that educators must create space and time for students to investigate why their designs succeeded and failed and give students a reason to reflect on their successive attempts” (2016, p. 2755).

While the students are working, the teacher will be checking in on students, offering feedback and ideas, making sure students understand what tools and concepts are available to them to help with the project. “Students may not seek to clarify or expand their understandings if they do not recognize the utility of that effort” (Berland & Steingut, 2016, p. 2745). The science content is easier to see given the lunar geology information given, but math may be more difficult to notice. There will be a daily journal for students to fill out, and for this day, there will be sections to reflect how they used math and science skills within this engineering and technology challenge. This will help students understand “the ways in which the math and science content is useful, or valuable” (Johnson & Johnson, 2016, p. 2753) when it comes to using math, science, engineering, and technology together.

Since this lesson will be taught to a variety of students of various backgrounds and first languages, this activity was designed so that students are able to work together in a manner that works best for the team. It is important to consider the “…individual nuances of how students develop preferences for learning, organize information, and express themselves within school settings. We highlight this process by demonstrating how student designed and led lessons can increase students’ overall engagement in academic contexts” (Johnson & Johnson, 2016, p. 107). Some cultures may be very direct and linear in their thinking while other cultures may take a more circuitous approach. It may not always be apparent how the students prefer to communicate, and since the students are only in the program for a week, it’s a short learning curve to learn what the students need.

Since language could also be a cause for concern, this lesson is designed to allow students to process information in whatever language they feel most comfortable in. “When students do not speak English as their first language, even more consideration needs to be taken while designing linguistically appropriate lessons” (Berland & Steingut, 2016, p. 108). The journals will not be collected, they are for personal reflection, so they can write in whatever language they choose, although the printed guiding questions will be in English.

Key learning outcomes: Geology, Spatial Reasoning, geography, teamwork, problem-solving, geometry

Lesson	Objectives	Standards
1 – Why are we going back to the Moon, Geology of the Moon	- Identify and describe basic geological features of the Moon - Explain the reasons for NASA returning to the Moon	HS-ESS1-3 Earth's Place in the Universe
2 – Observing the Moon – Satellites and Rovers, Designing and Building a Reconnaissance Mission	- create and execute a plan for attaching a camera to a rover - record video from a flown drone and driven rover	STEL-1N - Explain how the world around them guides technological development and engineering design HS-PS4.C: Information Technologies and Instrumentation HS-ETS1-2 Engineering Design STEL-7AA - Illustrate principles, elements and factors of design
3 – Gathering Intelligence and Analyzing Data	- collect data using cameras from rovers and drones - analyze data from video footage	STEL-2Z - Use management processes in planning, organizing, and controlling work NCTM - Use visualization, spatial reasoning, and geometric modeling to solve problems
4 – Discussing your Findings	- identify rocks based on video footage - synthesize data from video footage with other teams - create a plan for surveying a simulated Lunar surface	NCTM - Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships STEL-7W - Determine the best approach by evaluating the purpose of the design

References:

Berland, L. K., & Steingut, R. (2016). Explaining variation in student efforts towards using math and science knowledge in engineering contexts. *International Journal of Science Education, 38*(18), p. 2742-2761.

Johnson, E. J., & Johnson, A. B. (2016). Enhancing academic investment through home-school connections and building on ELL students' scholastic funds of knowledge. *Journal of Language and Literacy Education, 12*(1), p. 104-121.