Introduction to Human Space Exploration

Course Overview:

"Intro to Human Space Exploration" is a student-centric, interdisciplinary course with a strong emphasis on modern teaching and learning strategies including project-based learning, cooperative learning, student-lead instruction and discussion, individualized instruction, and enrichment activities. The various projects throughout the course encourage the use of technology and allow students to become engaged in the learning experience, as they are given a sense of ownership over the content.

Additionally, parental and community involvement is highly encouraged and is made possible through several of the recommended projects.

"Intro to Human Space Exploration" has been designed to foster creativity, to ignite a passion for exploration, both in space and on Earth, and to encourage continuing education and careers in science and engineering. Additionally, when properly administered, this course should promote team work, encourage goal setting, rejuvenate problem-solving skills, promote diversity awareness, and remind students of the importance of having a dream and working hard to achieve that dream.

Finally, this course will help students to see that math and science are not just theoretical, but that they serve a practical purpose in every-day life.

Course Objectives:

After completing this course, students will be able to:

- Identify common features of the solar system, including planets, satellites, and stars
- Recognize and explain basic facts and concepts related to atmospheric layers, rocketry and propulsion, orbital mechanics, microgravity, and other concepts essential to space flight, and the resources, design principles, and tools needed for successful space flight
- Summarize the history of human space exploration, with a particular emphasis on major milestones and meaningful events (key space missions) and key people who played important parts in those missions
- Compare and contrast life on Earth with life in space
- Connect various space events and technologies to current events and products/ technologies made possible because of them, as well as describing the numerous social, economic, scientific, and humanitarian benefits gained from human space exploration thus far, and potentially gained through continued human space exploration
- Connect space-related activities, projects, and milestones to the necessity of working as a team to accomplish such goals, then connect that concept to other areas of life
- Demonstrate through various group projects, community events, and volunteer activities, a social consciousness and a vision for the future, as well as a respect for our planet, for others, for ourselves, and for our entire universe

Topics Included in this Course:

1. Why Explore Space
2. Introducing the Solar System
3. General Space Flight Concepts
4. The Race Begins
5. Mercury and Gemini
6. Apollo
7. Apollo Applications
8. The Space Shuttle and Related Ventures
9. Space Disasters and Space Safety
10. Our Future in Space

Project and Activity Overviews:

Shadow a Hero:

A catalyst for individualizing instruction. Also, a way to engage students by allowing small groups to teach mini-lessons to the rest of the class. In this activity, groups (each consisting of of two students) are given, by their own choice or random selection, the opportunity to study notable space pioneers. Numerous people will be listed in the detailed instructions for this project, but the list is not exhaustive, and students and teachers may wish to suggest their own space “heroes”. One group might be interested in the first human to set foot on the moon, the first American in space, the first female commander, the first African American astronaut, etc.

Students will use the internet and recommended reading material to learn about the lives of said people and the important part they played in human space exploration. Then, each group will present what they’ve learned to the class, either through multimedia presentation or through a short skit written by the group. The exact timing of a given presentation should coincide with a lesson on a relevant topic. For example, it would be most appropriate for a student or group of students studying Neil Armstrong to give their presentation during a lesson on the Apollo program. Some students may be called upon during multiple lessons if the content is relevant.

KWL Table:

This is a table created by each student, or collectively by the whole class, at the start of the course to help teachers and students understand present levels of knowledge and to individualize instruction. KWL represents three columns of the table: what the students already know (**K**), what the students want to know (**W**), and what new information the students have learned as the course progresses (**L**). Students complete **K** and **W** at the beginning of the course. Once a particular area of space exploration is discussed, students complete the third column of the table to represent what they have now learned, **L**.

Spinoffs:

In this project, students work in groups - selecting a favorite product, technology, or activity to research on how it may have been enhanced by the space program. They then deliver multimedia and hands-on presentations to share what they’ve learned, as well as to have fun experiencing each other’s products or activities when appropriate.

Solar System:

Individual students or small groups use every-day items to construct a model of the solar system, including the sun, the Earth, the moon, the other planets, etc.

Wind Tunnel Project:

This project allows students to construct paper airplanes with designs of their choosing and then fly them in a wind tunnel to see the effects of the wind at different speeds on their aircraft. The students work together to bring the necessary components for the wind tunnel.

Layers of the Atmosphere:

In this project, the entire class creates a bulletin board to display the five principle layers of Earth's atmosphere. Then, each student chooses his/her favorite flying machine - such as a commercial jet, fighter jet, the Space Shuttle, or any other flying vehicle, and researches that vehicle to determine in which layer of the atmosphere it normally flies. Students bring in pictures or homemade models of their flying vehicle to display on the bulletin board.

Interactive Apps:

Students use a variety of iPad apps, such as Solar Walk, The Space Shuttle Simulator, and others to take 3-D tours of the solar system, fly the shuttle, land on the moon, and more.

MicroGravity:

In this project students practice putting different size nuts on to bolts. Then, a plastic tub is filled with enough water that the students' hands are submerged without resting against the bottom of the tub. Students now put the nuts on to the bolts while working with their hands under water and compare and contrast the feeling of working in water vs. out of water. This is the closest we can come to simulating a microgravity environment in the classroom.

Light Food:

Students toss marshmallows into the air and attempt to catch them in their mouths without using their hands to simulate eating in a microgravity environment. Teachers may also wish to present real space food for the students to sample.

Real Rocket:

Students work together to assemble and paint a provided model rocket, then launch it outdoors. Students play various roles, such as announcer, launch director, range safety officer, recovery team, etc to simulate genuine launch conditions.

Movie Reviews:

Students will watch, in class or on their own time, one of several space-related movies or TV shows as specified in the course, and must demonstrate their knowledge of the content through a variety of related assessments.

Mission Control Teamwork Console Project:

A project for the entire class which uses a combination of technology and other resources to allow students to participate in a flight simulation including liftoff, moon landing, and reentry. Small groups of students will act as different controllers responsible for different systems etc.

Space Travel Guide:

Students work in groups of three to four to create space travel brochures based on real missions that have already taken place, such as moon landings, Skylab, or shuttle missions to the ISS. Students will use all their knowledge to inform potential travelers about the features of their space craft, food on the menu, what to pack, various emergency procedures, and more. Students should gather real photos and videos, maps, and more to make the guides interactive. Apps like Apple GarageBand and iMovie, Keynote, Microsoft Powerpoint, or Mackiev's Hyperstudio may be used.

Large-group Future Space Colony Project:

Imagination is key in this project for the entire class, in which students plan a colony on the moon, Mars, or another planet/satellite of their choice. In an often unheard of combination of feasibility studies and visionary work, small groups are responsible for various aspects of the colony such as government, culture, environmental concerns, health and medicine, business, entertainment, etc. Students must research how things are done on Earth, then figure out how or if they can be done in the new colony. The culmination of this project will be a combination of reports, multimedia presentations, role-play, and more.

Community Events/Family Nights:

An invitation will be extended to the community for an evening of interactive presentations and other activities focusing on students demonstrating what they have learned in the course and the importance of continued space exploration.

Field Trips:

Enrichment trips to such places as the National Air and Space Museum, Kennedy Space Center, Johnson Space Center, a Challenger Learning Center, or other similar facilities.