

NASA TECHNOLOGY AND TOOLS THAT SUPPORT TEACHING

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NASA sponsors a variety of on-line programs and activities that are learning environments for science and technology education. These classroom technologies are part of NASA's commitment to involve the education community in its scientific endeavors and inspire America's students

toward academic excellence. A NASA program called the Learning Technologies Project (LTP) hosts over 50 online projects that deliver education materials to students around the globe. The LTP combines NASA research, the perspective of NASA employees and advanced Internet technologies to provide unique technology-based learning environments.

Technologies such as streaming media, interactive gaming, 3-D simulations and remote manipulation of scientific instruments are woven into curricular studies to promote academic achievement in K-12 math and science. This paper highlights some of the notable projects within the LTP program; the ROVER Ranch, NASA Qwhiz, Quest, the Learning Technologies Channel, FoilSim, Telescopes in Education and the WHY? Files.

The ROVER Ranch is an interactive, Web-based robotics workshop for assembling the hardware and instructions for a simulated robot to perform a mission in a virtual 3-D environment. An example mission environment is the photoreconnaissance of the International Space Station (ISS). The ROVER Ranch presents the learner with fundamental information about the mission goals, facts about the orbital environment and robotics. Based on this information, the user builds and programs a virtual robot to accomplish its task. Users design the robot by selecting parts for various functions such as propulsion, electric power, navigation and inspection. Once the robot is built, it's programmed and placed in a 3-D virtual environment. Options available in the simulation depend on the planning and design of the robot. The idea is to involve users in a simplified design and programming task that exercises skills in mathematics and science as tools that can be explored interactively. ROVER Ranch gives participants an opportunity to learn and apply basic math and science concepts and to observe the behavior of a system they design. The ISS mission and prototype robot are based on the Sprint AERCam, a small spherical free-flying camera platform used for outside inspection of spacecraft which has been put in an ISS VRML model. The ROVER Ranch emphasizes the concepts related to robotics and the environment of the mission. <http://prime.jsc.nasa.gov/ROV>

The NASA Qwhiz! is a multi-player Web game that students can use to study class materials, learn technology skills and create learning games for others. Students match wits with other students around the country in real-time competition or play the computer on a single player question/answer game board. Teachers use the Qwhiz for study drills, to evaluate student learning and fulfill instructional technology teaching requirements. The website contains the Qwhiz game library, the QwhizMaker and the QwhizMiner. A Qwhiz consists of columns of question categories and the object of the game is to answer as many questions correctly in the shortest amount of time. Game sessions can get pretty lively! The QwhizMaker is a set of Web forms used to make game boards and the QwhizMiner is a search tool to retrieve Internet data to put into a Qwhiz game. <http://prime.jsc.nasa.gov/Qwhiz>

NASA Quest is an Internet project that combines the experts of NASA and Internet-based communication tools to highlight scientist's technical work as they go about performing NASA's mission. At present there are five subject teams; Space Team Online, Aerospace Team, Solar System, Deep Space and Women of NASA. Each team has a set of NASA volunteers that contribute biographies and journal entries over the course of the project. Activities include webcasts, chats and question/answer sessions with NASA experts, audio and video programs, lesson plans, collaborative activities for students, background information, photos and a place for teachers to meet and collaborate online. These projects are open to anyone, free of charge and participants can come and go as they like. <http://quest.arc.nasa.gov>

The Learning Technologies Channel (LTC) is a branch of the Quest site that provides chats, forums and webcasts to the educational community. A QuestChat is an opportunity for students and the general public to meet and ask questions of NASA experts using the Internet. From a desktop computer, people can type comments and questions into a "chat room" and receive live responses from NASA personnel. The QuestChats are run on the Quest website so all a user needs to participate is a graphical web browser and an Internet connection. A forum is an opportunity to interact with NASA experts at more flexible and convenient times. LTC video webcasts feature special events such as shuttle launches and landings, planetary probe activities or other important NASA events. The video webcasts also feature

specially scheduled education events such as NASA Connect, the Stanford Solar Series, and US. Department of Education Meetings. The LTC webcasts feature concurrent moderated Chat Rooms for interaction with scientists participating in the programs. LTC events are delivered to the Web via streaming media using Real Media technology which is freely available. <http://quest.arc.nasa.gov/ltc>

FoilSim is interactive simulation software that demonstrates the airflow around various shapes of airfoils. The Airfoil View Panel is a simulated view of a wing being tested in a wind tunnel with air moving past it from left to right. Students change the position and shape of the wing by moving slider controls that vary the parameters of airspeed, altitude, angle of attack, thickness and curvature of the airfoil, and size of the wing area. The software displays plots of pressure or airspeed above and below the airfoil surface. A probe monitors air conditions (speed and pressure) at a particular point on or close to the surface of the airfoil. The software calculates the lift of the airfoils, allowing students to learn the factors that influence lift. <http://www.grc.nasa.gov/WWW/K-12/FoilSim/index.html>

Telescopes in Education (TIE) provides the opportunity to use a remotely controlled telescope and charge-coupled device (CCD) camera in a real-time, hands-on, interactive environment to students around the world.

TIE uses a science-grade 24-inch reflecting telescope located at the Mount Wilson Observatory, high above the Los Angeles basin in the San Gabriel Mountains of Southern California. The telescope is used by K-12 students to observe galaxies, nebulae, variable stars, eclipsing binaries, and other objects. The telescope and CCD can be operated remotely by educators and students from the convenience of their classroom computers via modem and special astronomy software. Images are downloaded to a remote user in five minutes or less (depending on the user's modem) and can be stored on the user's computer for image processing and study. <http://tie.jpl.nasa.gov/tie/index.html>

The NASA WHY? Files is a series of instructional programs consisting of broadcast, print, and on-line elements. Emphasizing standards-based instruction, problem-based learning, and science as inquiry, the series seeks to motivate students in grades 3-5 to become critical thinkers and active problem solvers. Each program supports the national mathematics, science, and technology standards and includes a 60-minute video broadcast, a companion educator's guide, web-based activities and materials, and information about NASA programs, projects, facilities and researchers. Recent sessions have focused on sound, electricity and aerodynamics. The NASA WHY? Files is broadcast on the Learning Technologies Channel. <http://whyfiles.larc.nasa.gov/>

These and many other NASA education resources are available for use in schools and are for the most part free. Resources are available in the disciplines of aeronautics, aquatics, astronomy, astrophysics, career planning, environmental science, history, mathematics, science, engineering, space science, volcanology and weather mapping. All of NASA's online information such as up-to-the-minute mission information and images, archived information, lesson plans and teacher tested activities is available to create classroom content. These support materials can enhance established curriculum or create new collaborative projects. To participate in any of these projects visit the NASA Education home page, Spacelink or the Learning Technologies Project. Join us online as we share the power and excitement of the work at NASA with our children.

<http://education.nasa.gov>

<http://www.spacelink.nasa.gov>

<http://learn.jvv.nasa.gov>