

Title

K-12 STEM Using NASA Resources (Science, Technology, Engineering, and Mathematics)

Target Audience

This course is designed for pre-service and K-12 educators.

Prerequisites

There are no prerequisites for this course.

Course Description

This course provides methods and strategies to integrate technology and engineering with mathematics and science through inquiry or problem based learning (PBL) activities that are engaging and aligned with the Virginia Standards of Learning (SOL) for mathematics, science, and technology. Exploring STEM lessons already created by NASA, learners will focus on utilizing NASA's resources and integrating a variety of 21st century learning tools in their instruction to support STEM education. The design of an inquiry or problem-based STEM lesson plan that focuses on one of NASA's Mission Directorates (Aeronautics, Science, Exploration, or Space Operations) and effectively integrates 21st century learning tools will be the culminating project.

Facilitator

TBA

Credit

45 recertification points

Standards

This course will help the teacher to meet Virginia Standards of Learning in Science and Mathematics, K-12. - <http://www.doe.virginia.gov/VDOE/Superintendent/Sols/home.shtml>

This course will help the teacher to meet International Technology Education Association Standards, which covers both Engineering and Technology - http://www.iteaconnect.org/TAA/Publications/TAA_Publications.html

This course will help the teacher to meet the International Society for Technology in Education Standards for Students - NETS - <http://www.iste.org/AM/Template.cfm?Section=NETS>

Learning Outcomes:

After completion of this course, learners will:

- Understand 21st century learners and how the role of technology can support their learning.
- Identify learning styles and differentiate instruction to meet the needs of all learners.
- Identify the four NASA Mission Directorates and locate resources to support instruction.
- Develop an inquiry or problem-based lesson aligned with the Virginia Standards of Learning (SOL) to support science, technology, engineering, and mathematics (STEM) education,
- Implement web-based resources, software applications, and 21st century learning tools to support instruction.

Process

In each one week session, learners will explore 21st century learning tools, application software, or web-based resources from reliable sources to support STEM education. Learners will also complete an assignment based on readings, participate in the discussion board, and reflect on what they have learned.

Session 1: Who are our students and are we preparing them for the 21st Century?

Explore the following web resources and Web 2.0 Tools:

Social bookmark sites

- <http://www.portaportal.com>
- <http://del.icio.us/>
- <http://www.ikeepbookmarks.com/>

Articles and Video clips about 21st Century Education

- 21st Century Schools describes their vision of what 21st century education might look like - http://www.21stcenturyschools.com/What_is_21st_Century_Education.htm
- Digital Natives - Digital Immigrants - Part I - by Marc Prensky - <http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf>
- Digital Natives - Digital Immigrants - Part II - Do They Really Think Differently? - <http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part2.pdf>
- Adopt and Adapt - Marc Prensky - <http://www.edutopia.org/node/1423/print>
- View this [video clip about our 21st century learners](http://www.youtube.com/watch?v=NLIGopyXT_g) - http://www.youtube.com/watch?v=NLIGopyXT_g

Learning and Teaching Inventory:

- <http://www.engr.nesu.edu/learningstyles/ilsweb.html>

Instructional Technology Aid:

VoiceThread:

- <http://voicethread.com/#home> - where you can create a voicethread.
- <http://ed.voicethread.com/#home> - The educational version.
- <http://www.edutopia.org/voicethread-interactive-multimedia-albums>- An article on their popularity.
- http://www.youtube.com/watch?v=6a_KF7TYKVC - A YouTube video about Social Networking

Product

- Create a web-based bookmark account to collect and store all resources during the course.
- Create and submit a VoiceThread describing your experiences using technology and how you prepare your students for the 21st Century.
- Reflect on the process of creating a VoiceThread and how it could be used in the classroom.

Idea Sharing:

- Introduce themselves in the Virtual Café
- Who are our students and what are you doing to prepare them for the 21st Century?

Online Journal:

What are your expectations for this course? What knowledge and skills do you hope to learn? How will this professional development experience shape your future instruction?.

Session 2: What is STEM teaching and how does it fit with Inquiry/Problem-Based Learning?

Explore the following web resources and Web 2.0 Tools:

Articles about STEM education

- <http://www.hsalliance.org/stem/FAQ.asp>
- <http://www.nga.org/Files/pdf/0702INNOVATIONSTEM.PDF>
- <http://www.stemedcaucus.org/>
- <http://umassk12.net/stem/>

- <http://umassk12.net/earth/>

Articles about Inquiry/Problem-Based Learning

- <http://www.udel.edu/pbl/>
- <http://www.cotf.edu/ete/teacher/teacherout.html>
- http://www.samford.edu/ctls/problem_based_learning/
- <http://www.thirteen.org/edonline/concept2class/inquiry/>
- <http://www.exploratorium.edu/ifi/resources/classroom/com/>
- <http://www.inquiry.uiuc.edu/inquiry/definition.php>

STEM Standards

- Virginia Standards of Learning for Science and Mathematics K-12 - <http://www.doe.virginia.gov/VDOE/Superintendent/Sols/home.shtml>
- ITEA Standards - http://www.iteaconnect.org/TAA/Publications/TAA_Publications.html
- ISTE NETS - <http://www.iste.org/AM/Template.cfm?Section=NETS>

Instructional Technology Aid:

- PowerPoint
- Turns images into animation - <http://animoto.com/>
- PhotoStory 3
- iMovie

Product 2

Tower Power – Learners or their students will create a tower using index cards and tape, taking pictures of each stage. They will use these pictures and one of four tools to create an animation showing their design process. Part 2 of the assignment is to write a reflection of how they could use this in a STEM lesson.

Idea Sharing

Working in small groups, learners will discuss the broad definition of technology. Each group will be given two pictures of old and new technologies. They will describe the materials, their purpose, why they changed, and how the change improved quality of life. They will also hypothesize on what might be a futuristic version of this technology.

Online Journal

Exploring Virginia Standards of Learning for mathematics and science, ITEA standards for technology and engineering, and NETS, learners will reflect on how to integrate them into a STEM lesson.

Session 3: How does NASA use STEM to prepare students to become 21st Century consumers and explorers?

Explore the following web resources and Web 2.0 Tools:

NASA's involvement with STEM

- http://education.nasa.gov/divisions/higher/overview/F_One_Giant_Step_STEM_Education.html
- http://www.nasa.gov/about/highlights/what_does_nasa_do.html
- <http://fellowships.hq.nasa.gov/gsrp/enterprises>
- NASA Search Engine - <http://www.nasa.gov/audience/foreducators/index.html>
- Smart Skies - <http://www.smarskies.nasa.gov/>
- Future Flight Design - <http://futureflight.arc.nasa.gov/welcome.html>
- Fold it and Fly it - http://www.nasaexplores.com/show_58_student_st.php?id=02123190203
- My NASA Data - <http://mynasadata.larc.nasa.gov/>
- Space Settlement video library - <http://www.nas.nasa.gov/About/Education/SpaceSettlement/Video/>
- NASA's Photo Journals - <http://photojournal.jpl.nasa.gov/index.html>
- Light,optic.lessons - <http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Optics.Guide.html>
- Moon plant growth activity - http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Packing_Up_for_the_Moon.html
- NASA Quest - <http://quest.arc.nasa.gov/>
- Echo the Bat and Amelia the Pigeon - <http://science.hq.nasa.gov/kids/imagers/>
- PCs In Space - <http://pcsinspace.hst.nasa.gov/index.html>
- NASA Explorer Schools - <http://aesp.nasa.okstate.edu/efolio/>
- Packing Up for the Moon - http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Packing_Up_for_the_Moon.html
- Think Small in a Big Way - <http://stardust.jpl.nasa.gov/classroom/activities/1-stardst-ch01.pdf>

Instructional Technology Aid:

- <http://www.inspiration.com/>
- Tutorial - <http://www.inspiration.com/productinfo/inspiration/index.cfm>

Product 3:

Website Evaluation - Review at least five of the NASA sites (Or find additional ones in the search engine.) Complete the information on the Evaluation sheet. From those five sites, choose one to evaluate in more depth.

Idea Sharing:

Learners will pick one or more of what they found at the NASA website to share with their fellow learners in the Discussion Board, including the search parameters and how it might be used in the classroom.

Online Journal

Using Inspiration, Kidspiration, or an Open Source program, create a web showing the NASA's four Mission Directorates. Be specific with standards of learning. Reflect on how you might use this with your students.

Session 4: How do Other Organizations Support NASA's Efforts?

Explore the following web resources and Web 2.0 Tools:

Engineering

- Discover Engineering - <http://www.discoverengineering.org/>
- How do I Use Engineering in My Classroom? - http://www.engineeringk12.org/educators/How_Do_I_Use_Engineering_In_My_Classroom/Individual_Lesson_Plans/default.php
- Hands on activities about the different kinds of engineering - <http://www.swe.org/iac/lp/index.html>
- Bridge Building Lesson - <http://www.ed.uri.edu/SMART96/Middle/BRIDGES/bridge.html#Day%201>
- Bridge building Webquest - <http://volweb.utk.edu/Schools/bedford/harrisms/stubridge.htm>

Flight

- The K-8 Aeronautics Internet Textbook - <http://wings.avkids.com/>
- Flying Paper Clips - <http://www.lessonplanspage.com/ScienceExCanAPaperClipFloatInAirMO68.htm>
- Gander Academy's Resources on Flight Lessons - <http://www.stemnet.nf.ca/CITE/flightteachers.htm>
- Discovery School - Understanding Flight - <http://school.discoveryeducation.com/lessonplans/programs/understanding-flight/>
- North Carolina's Museum - http://ncartmuseum.org/Flight/flight_plans/lessons.html

Space

- Think Small in a Big Way - <http://teachspacescience.org/graphics/pdf/10000272.pdf>
- Amazing Space - <http://amazing-space.stsci.edu/>
- Lessons, games, and fun about space - <http://science.pppst.com/space.html>
- Surfnetkids.com - <http://www.surfnetkids.com/spacekids.htm>
- math activities about space - <http://www.k111.k12.il.us/King/math.html>

- About.com - space lessons - <http://space.about.com/cs/spaceeducation/a/educate.htm>
- Space Explorers - <http://peoria.k12.il.us/shwhite/SpaceExplorSB.html>
- Windows to the Universe - <http://www.windows.ucar.edu/>
- Solar System Image Archives - http://www.windows.ucar.edu/cgi-bin/tour.cgi?link=/our_solar_system/system_il.html&sw=false&sn=0&edu=elem&cdp=/windows3.html&cd=false&frp=/windows3.html&fr=f&tour
- The Nine Planets - <http://www.seds.org/nineplanets/nineplanets/nineplanets.html>
- The Galaxy Page - <http://dmoz.org/Science/Astronomy/>
- Your weight on other worlds - <http://www.exploratorium.edu/ronh/weight/index.html>
- Challenger Learning Center - <http://www.challenger.org/>

Global Warming

- Global Warming site - <http://epa.gov/climatechange/index.html>
- Global Warming quiz/animation- http://epa.gov/climatechange/kids/global_warming_version2.html
- Solar Energy Lessons - <http://www.fsec.ucf.edu/en/education/k-12/curricula/sm2/index.htm>

GIS/GPS

- GIS lesson plans - <http://edcommunity.esri.com/software/aejee/>
- A Hotlist of GPS lesson plans - <http://www.gis2gps.com/GPS/lessonplans/gpsplans.htm>
- The Science Spot - <http://sciencespot.net/Pages/classgpslsln.html>
- A Hotlist of GIS lessons and resources - <http://www.gis2gps.com/GIS/gis.html>
- Google Earth Lessons - <http://www.gelessons.com/>

Instructional Technology Aid:

AT&T's Knowledge Network has created a website that helps teachers harness the power of the Internet and make it easy to create projects for students. Called [Filamentality](#), it combines the "filaments of the web" with your "mentality" allowing you to create a variety of formats that meet your personal or learner needs. They describe and provide tutorials for you on [Five Activity Formats](#), each one more difficult than the other. Best of all, they will host what you create right on their site for FREE. However, if you post on their site, you are not able to include any images. There are lots of good examples here for you to look at.

Product 4

Pick one of [NASA's Mission Directorates](#) and create either a Multimedia Scrapbook, a Treasure Hunt, or a Subject Sampler sharing materials and resources that would help a teacher teach that subject.

Idea Sharing:

Share one lesson or resource that you found in your search with your fellow learners in the Discussion Board, describing the resource and how you might use it in the classroom.

Online Journal:

Reflect on one on the Five Activity Formats on the Filamentality website and how you might use it in the classroom.

Session 5: How can literature and UDL enhance the STEM experience?

Explore the following web resources and Web 2.0 Tools:

Universal Design for Learning (UDL)

- CAST – The National Center for Accessing the General Curriculum - <http://udl.cast.org/ncac/WhatisUDL372.cfm>
- Teaching Every Student in the Digital Age - <http://www.cast.org/teachingeverystudent/ideas/tes/>
- Curriculum Access in the Digital Age - New technology-based strategies offer hope that students of all abilities will have the opportunity to thrive in school - <http://edletter.org/past/issues/2002-jf/digitalage.shtml>

Literature and Engineering Model Programs

- Children’s Engineering Through Reading - <http://www.eweek.org/site/Library/reading.shtml>
- Engineering is Elementary - <http://www.mos.org/eie/>
- Virginia Department of Education’s Teacher Resource Guide for Engineering Activities for K-5.- http://www.doe.virginia.gov/VDOE/Instruction/CTE/te/K5/Engineering/Childrens_Engineering.pdf
- NASA’s Imagers – <http://science.hq.nasa.gov/kids/imagers/>

Instructional Technology Aid:

BookBuilder is a website that allows you to utilize UDL principles as you create, read, and share engaging digital books that build reading skills for students. Your universally designed books will engage and support diverse learners according to their individual needs, interests, and skills. Go to this website - <http://bookbuilder.cast.org/> - to learn more about UDL and

how to use BookBuilder to create your own reading activities or to read what others have created and shared.

Idea Sharing:

After examining the Engineering is Elementary site and the 13 storybooks, describe one to the group and how it might be used in a STEM lesson.

Product 5:

Pick a book or story to describe how it might be used in an integrated STEM lesson. Included in the description will be references to specific standards addressed by the lesson.

Online Journal

Reflect on UDL and how it meets the needs of diverse learners.

Session 6: Putting it All Together

Final Product

Develop an inquiry or problem-based lesson aligned with the Virginia Standards of Learning (SOL) to support science, technology, engineering, and mathematics (STEM) education.

Idea Sharing

Share the lesson plan and comment on peers' lesson plans.

Online Journal

Reflect on how this course compares with the goals and expectations from Session 1.