STEAM – Unit 1 (AEROSPACE ENGINEERING)

Content Area: **ENGINEERING (Gifted and Talented Grade 3/4)**
Course(s):
Time Period: **Ongoing**
Length: **Ongoing**
Status: **Published**

Big Idea

Gifted and talented students should be exposed to the career possibilities in intellectually challenging, high demand areas such as aerospace engineering. The aerospace industry has an insatiable demand for engineers. (EGFI, 2018) Aerospace engineers design and build jet fighters, spaceships, rockets, planes, satellites --- essentially any craft that soars through or above the atmosphere. (EGFI, 2018) Aerospace engineers also write computer code and programs to control rovers and satellites all over the solar system. Over the next decade, aerospace engineers will be challenged to do amazing things such as design personal air taxis, build privately funded spacecraft, successfully send passenger rockets to Mars, and plan the first human colony on Mars.

To fully explore the subject of aerospace engineering, students will research and report on the history of aerospace engineering and space exploration. Mimicking aerospace engineers, students will design models of airplanes, rockets, satellites, rovers, space stations, and Mars colonies. Students will practice the scientific method by posing a question, identifying variables, conducting tests, collecting data, graphing data, and interpreting data. Students will follow the engineering design process by identifying a need or problem, designing a solution, building a prototype, testing it, identifying problems, and fixing them.

If finances allow, students would benefit from an outside field trip to an aerospace museum, flight museum, or interactive camp...such as be an astronaut for a day. If possible, students will also have the opportunity to participate in simulation activities such as domestic flight and space shuttle lift off. Students will keep a journal/portfolio of their research, experiences, experiments, data analysis, and conclusions. Students will use technology to record, analyze, and present their research at the end of the semester.

Enduring Understanding

SWBAT understand the career possibilities in aerospace engineering. SWBAT to identify the scientific method. SWBAT to understand the engineering design process. SWBAT identify the importance of using models and iteration in design. SWBAT empathize with stakeholders to improve design outcomes. SWBAT make connections between scientific concepts (such as chemistry, physics, and circuitry) and effective aerospace engineering practices. SWBAT make connections between experiments conducted in the laboratory and real world experiences.

Skills

- Research aerospace engineering.
- Use presentation technology to write a presentation about findings.
- Practice the scientific method.
- Use spreadsheet technology to graph data and and analyze results.
- Practice the engineering design process. Use tools to build a prototype.
- Use technology to present information about historical figures in the aerospace industry and/or information about the characteristics of a planet in our solar system.

Standards

NATIONAL ASSOCIATION FOR GIFTED CHILDREN. www.nagc.org.

Standard 3: Curriculum Planning and Instruction Description: Educators apply the theory and research-based models of curriculum and instruction related to students with gifts and talents and respond to their needs by planning, selecting, adapting, and creating culturally relevant curriculum and by using a repertoire of evidence-based instructional strategies to ensure specific student outcomes. Student Outcomes Evidence-Based Practices

3.1. Curriculum Planning. Students with gifts and talents demonstrate growth commensurate with aptitude during the school year.

- 3.1.1. Educators use local, state, and national standards to align and expand curriculum and instructional plans.
- 3.1.2. Educators design and use a comprehensive and continuous scope and sequence to develop differentiated plans for PK-12 students with gifts and talents.
- 3.1.3. Educators adapt, modify, or replace the core or standard curriculum to meet the needs of students with gifts and talents and those with special needs such as twice-exceptional, highly gifted, and English language learners.
- 3.1.4. Educators design differentiated curricula that incorporate advanced, conceptually challenging, in-depth, distinctive, and complex content for students with gifts and talents.
- 3.1.5. Educators use a balanced assessment system, including preassessment and formative assessment, to identify students' needs, develop differentiated education plans, and adjust plans based on continual progress monitoring.
- 3.1.6. Educators use pre-assessments and pace instruction based on the learning rates of students with gifts and talents and accelerate and compact learning as appropriate.
- 3.1.7. Educators use information and technologies, including assistive technologies, to individualize for students with gifts and talents, including those who are twice-exceptional.

3.2. Talent Development. Students with gifts and talents become more competent in multiple talent areas and across dimensions of learning.

- 3.2.1. Educators design curricula in cognitive, affective, aesthetic, social, and leadership domains that are challenging and effective for students with gifts and talents.
- 3.2.2. Educators use metacognitive models to meet the needs of students with gifts and talents.

3.3. Talent Development. Students with gifts and talents develop their abilities in their domain of talent and/or area of interest.

- 3.3.1. Educators select, adapt, and use a repertoire of instructional strategies and materials that differentiate for students with gifts and talents and that respond to diversity.
- 3.3.2. Educators use school and community resources that support differentiation.
- 3.3.3. Educators provide opportunities for students with gifts and talents to explore, develop, or research their areas of interest and/or talent.

3.4. Instructional Strategies. Students with gifts and talents become independent investigators.

- 3.4.1. Educators use critical-thinking strategies to meet the needs of students with gifts and talents.
- 3.4.2. Educators use creative-thinking strategies to meet the needs of students with gifts and talents.
- 3.4.3. Educators use problem-solving model strategies to meet the needs of students with gifts and talents. 5 National Association for Gifted Children 1331 H Street, NW, Suite 1001 Washington, DC 20005 202.785.4268 www.nagc.org 9-21-10 3.4.4. Educators use inquiry models to meet the needs of students with gifts and talents.

3.5. Culturally Relevant Curriculum. Students with gifts and talents develop knowledge and skills for living and being productive in a multicultural, diverse, and global society.

- 3.5.1. Educators develop and use challenging, culturally responsive curriculum to engage all students with gifts and talents.
- 3.5.2. Educators integrate career exploration experiences into learning opportunities for students with gifts and talents, e.g. biography study or speakers.
- 3.5.3. Educators use curriculum for deep explorations of cultures, languages, and social issues related to diversity.

3.6. Resources. Students with gifts and talents benefit from gifted education programming that provides a variety of high quality resources and materials.

- 3.6.1. Teachers and administrators demonstrate familiarity with sources for high quality resources and materials that are appropriate for learners with gifts and talents.

Assessments

- Teacher observation
- Successful completion of project

- Successful completion of portfolio
- Successful presentation of project to the class

Resources/Instructional Materials

VIDEOS

- Sci Show Kids Space, Let's Explore Space, Let's Go to Space, What's the Farthest We've Gone in Outer Space, What are Stars? What do astronauts do? Take a tour of the space station.
- Brainpop Jr. Space Video Clips
- Brainpop Space Video Clips
- Brainpop Flight Video Clips
- Sci Show Kids Paper Airplanes
- NASA EDUCATION AT GLENN
- NASA videos
- Design Squad PBS Kids

TECHNOLOGY

- Microsoft Flight Simulator Kits (2)
- Portable Planetarium STARLAB ETTC STOCKTON
- Chromebooks, IPADS

BOOKS/ONLINE DATABASES

- Astronauts
- Wright Brothers
- Space Discovery Guides Book Set
- World Book Online
- World Almanac for Kids/Students - Exploring Space http://wak.infobaselearning.com/exploring-space/
- EbscoHost's Explora

FIELD TRIPS

- Buehler Challenger & Science Center's programs, Paramus, NJ
- Cape May Aviation Museum

LESSON WEBSITES

- Teachengineering.org (space series)
- NASA
- CIVIL AIR PATROL - ACE and AEX PROGRAM (AEROSPACE STEM CURRICULUM)
- EGFI
- Future Engineers
- Engineering is Elementary
- Science buddies
- Foss
- Smithsonian
- Design Squad PBS
- Discovery Education - Energy
- Mystery Science Curriculum
- South Carolina Science Curriculum
- Steve Spangler
- Science Bob
- Exploratorium Science Snacks
- Imagination Station Toledo.org
- http://globaldayofdesign.com/
- http://worlds-of-learning.com/

- Pbs learning media nj
- Siemens Lesson Plans
- Lesson Planet

TENTATIVE LESSONS

- HISTORY AND SCIENCE OF FLIGHT AND THE STUDY OF AERONAUTICAL ENGINEERING
    - Read *Wright Brothers* book.
    - Watch SciShow Kids Paper Airplanes video.
    - Read *Kids' Paper Airplanes* by Ken Blackburn.
    - Watch Brainpop Flight video.
    - ACE PAPER BAG MASK AND BERNOULLI: Students construct a device that demonstrates Bernoulli's principle and understand the effect of air flowing over a curved surface---such as a wind. Bernoulli's principle: the pressure in a fluid decreases as the speed of the fluid increases. An example of the Bernoulli's principle can be seen in the paper bag mask activity. When the child blows through the hole in the paper bag mask and over the curved surface of the "tongue", unequal air pressure will LIFT the tongue.
    - NASA GLENN RESEARCH PAPER AIRPLANE LAB. https://www.grc.nasa.gov/www/k-12/airplane/glidpaper.html Students learn the different airplane parts, including wing, flap, aileron, fuselage, cockpit, propeller, spinner, engine, tail, rudder, elevator. Then they each build 2 different (provided) paper airplane (really, glider) designs with instructions, which they test in three trials, measuring flight distance and time. Then they design and build (fold, cut) a second paper airplane design of their own creation, which they also test for flight distance and time. They graph the collected class data. Analysis of these experiments with "model" airplanes and their results help them see and figure out what makes airplanes fly and what can be changed to influence the flying characteristics and performance of airplanes.
    - Teachengineering.org TAKE OFF WITH PAPER AIRPLANES. Students are introduced to the art of designing airplanes through paper airplane constructions. The goal is for students to learn important aircraft design considerations and how engineers must iterate their designs to achieve success. They learn about the basic parts that can be found on most airplanes, and their functions. They also learn how engineers make small-scale models to test ideas and improve early designs. This prepares students for the associated activity in which they first make and test several provided paper airplane designs, after which they design and test their own paper airplane designs.
    - SCIENCE BUDDIES: HOW FAR WILL IT FLY: BUILD AND TEST PAPER AIRPLANES WITH DIFFERENT DRAG. Just one sheet of paper can lead to a whole lot of fun. How? Paper planes! All you have to know is how to fold and you can have a simple plane in a matter of minutes! But what design should you use to build the best plane? In this aerodynamics science project, you will change the basic design of a paper plane and see how this affects its flight. Specifically, you will increase how much drag the plane experiences and see if this changes how far the paper plane flies. There is a lot of cool science in this project, such as how the different forces allow a plane to fly, so get ready to start folding!
    - BETTER LESSON HOT AIR BALLOON CHALLENGE. The principle of hot air rising will be harnessed to create a tissue paper hot air balloon. The molecules within hot air are moving faster than the molecules within cold air. These after moving hot air particles have more kinetic energy and are thus spaced further apart. This causes hot air to be less dense than cold air. A column of hot air will rise above a column of cold air. These same principle can be observed with hot and cold water in the ocean.

      By trapping the hot air in a balloon the students will be able to harness this principle and create a craft that can rise in the air. The teacher will have to decide if the students should follow a set plans to build a hot air balloon (1 week) or allow the students to free build a hot air balloon of their own design (2 weeks). If you have the time to allow for free building, it will probably be necessary to allow your students time to build a second prototype once their first balloon design fails or needs to be improved.

I would also recommend requiring your students to submit a 'design application' outlining how they intend to construct their balloon.

- NASA EDUCATION AT GLENN SHOEBOX GLIDER CHALLENGE. The students you work with today are tomorrow's scientists, technicians, engineers, and mathematicians. Creativity, curiosity, analytical thinking, and the ability to successfully utilize the engineering design process are qualities and skills necessary for NASA's future workforce. Engineering design challenges (EDCs), like the one in this guide, create authentic learning experiences that allow students to develop valuable skills through rigorous and engaging science, technology, engineering, and mathematics (STEM) content. This EDC connects current research being conducted at Glenn Research Center (GRC) with aeronautics research from NASA's history. GRC engineers are studying ways of improving aircraft efficiency and design as well as using specialized aircraft to conduct scientific research from the air. They supported the education team to ensure accuracy and relevance while developing this content.
- CIVIL AIR PATROL FLIGHT SIMULATOR STEM KIT. The kit includes Microsoft Flight Simulator as a Training Aid book and accompanying flight simulation CD, yoke and rudder pedals. We have updated the software component of the kit to include Microsoft Flight Simulator X STEAM Edition, a downloadable product code (no disc required). Teachers should note this is a gaming website, which may be blocked from some schools' usage. Please check with your local IT department for usability with each system's permissions. The flight simulator book has many activities to help learners use flight planning aeronautical charts and other lessons to extend the experiential portion of the flight simulator program. The hands-on approach is designed to spark an interest in flying, especially for CAP cadets, ages 12 and above, who are given opportunities for orientation flights and flight training in CAP. Due to the experience of CAP adult mentorship, a variety of aviation careers will be explored through this project.
- ENGINEERGIRL WRITING CONTEST - Students follow the requirements for the yearly Engineergirl writing contest. If the contest no longer exists, students can choose to write a space related story, play, news show, or commercial.
- ANIMATION USING SCRATCH - Students use the block programming language of Scratch to create an animation. The cartoon animation should depict a scene from the writing assignment.

- AEROSPACE OVERVIEW (3rd and 4th)
  - Read *Astronauts* book by Kate Hayden.
  - Students pick a book from *Space Discovery Guides Book Set* for research.
  - Pick a historical figure, planet, or other aerospace topic that you find interesting. Research the topic, collect facts, write a short research paper using online databases through the library.
  - Brainpop Jr. Space Video Clips
  - Brainpop Space Video Clips
- EXPLORING THE SOLAR SYSTEM (3rd and 4th)
  - TEACHENGINEERING. ORG DESTINATION OUTER SPACE. Students acquire a basic understanding of the science and engineering of space travel as well as a brief history of space exploration. They learn about the scientists and engineers who made space travel possible and briefly examine some famous space missions. Finally, they learn the basics of rocket science (Newton's third law of motion), the main components of rockets and the U.S. space shuttle, and how engineers are involved in creating and launching spacecraft.
  - ETTC STAR LAB to view constellations, solar system, and night sky (sponsored by Atlantic County AVA Media Center). The Atlantic County AVA Media Center has purchased a STARLAB Portable Planetarium System for circulation to member districts. The STARLAB Planetarium is an inflatable dome system that can accommodate approximately 25 students and their teacher. It requires an area that is at least 17 feet in diameter with a ceiling height of 10.5 feet. It can be fully assembled in less than 1/2 hour. The AVA will require that districts borrowing the system have at least 1 staff member who is trained in its set-up and use. A number of individuals have been trained and they need only to notify us of the date and location of their training to be eligible to utilize the system. STARLAB has obvious usefulness in

teaching astronomy, but the variety of projection cylinders that are available will expand that usefulness into social studies with information on Greek and Native American mythology through constellation cylinders and to earth sciences with cylinders that show ocean currents, plate tectonics and continental drift and global weather.

- HISTORY OF SPACE EXPLORATION (3rd rockets and field trip and 3rd/4th field trip)
  - Straw rockets - analyze and graph data (teachengineering.org strawkets and control). Students investigate the effect that fins have on rocket flight. They construct two paper rockets that they launch themselves by blowing through a straw (see Figure 1). One "straw ket" has wings and the other has fins. Students observe how these two control surfaces affect the flight of their strawkets. Students discover how difficult control of rocket flight can be and what factors can affect it. In the continuing hypothetical story for this unit, what students learn about rocket weight adds to their background understanding in their effort to help Tess launch a communication satellite.
  - Rockets (curricular unit engineering.org). Students learn how and why engineers design satellites to benefit life on Earth, as well as explore motion, rockets and rocket motion. Through six lessons and 10 associated hands-on activities, students discover that the motion of all objects—everything from the flight of a rocket to the movement of a canoe—is governed by Newton's three laws of motion. This unit introduces students to the challenges of getting into space for the purpose of exploration. The ideas of thrust, weight and control are explored, helping students to fully understand what goes into the design of rockets and the value of understanding these scientific concepts. After learning how and why the experts make specific engineering choices, students also learn about the iterative engineering design process as they design and construct their own model rockets. Then students explore triangulation, a concept that is fundamental to the navigation of satellites and global positioning systems designed by engineers; by investigating these technologies, they learn how people can determine their positions and the locations of others.
    - Day 1: Keep in Touch: Communications and Satellites lesson
      Day 2: I'm Not in Range: Acting Out Cellular Phone Service activity
      Day 3: Newton Gets Me Moving lesson
      Day 4: Newton Rocket Car activity
      Day 5: Using Thrust, Weight & Control: Rocket Me into Space lesson
      Day 6: Strawkets and Thrust activity
      Day 7: Strawkets and Weight activity
      Day 8: Strawkets and Control activity
      Day 9: Blast Off: Generating Rocket Thrust with Propellants lesson
      Day 10: Fuel Mystery Dis-Solved! activity
      Day 11: Aqua-Thrusters! activity
      Day 12: Pop Rockets activity
      Day 13: Learn to Build a Rocket in 5 Days or Your Money Back lesson
      Day 14: Rockets on a Shoestring Budget activity
      Day 15: Where Am I: Navigation and Satellites lesson
      Day 16: Find It! activity
  - TEACHENGINEERING.ORG POP ROCKETS. Students design and build paper rockets around film canisters, which serve as engines. An antacid tablet and water are put into each canister, reacting to form carbon dioxide gas, and acting as the pop rocket's propellant. With the lid snapped on, the continuous creation of gas causes pressure to build up until the lid pops off, sending the rocket into the air. The pop rockets demonstrate Newton's third law of motion: for every action, there is an equal and opposite reaction. An instructions handout, worksheets (English and Spanish) and quiz are provided. Students must also design a way for the rocket to land softly for future reuse.
  - Field trip to Buehler Challenger & Science Center (Astronaut for a day) (if funds available). B.L.A.S.T. is a hands-on, inquiry-based program and is delivered in a 3 ½ hour block starting between for students in 3rd and 4th grade. Each program includes a "briefing" about astronaut jobs, with specifics of an astronaut as a scientist, tools used and scientific methods employed. The students then break into teams for science labs with curriculum-based exploration of motion & speed, electricity & circuitry, and robotics. Part of the "debriefing" will include a "lift-off" in our state of the art simulated

shuttle. The cost for each 3 ½ hour programming is $620 and can accommodate a maximum of 25-28 students. We can accommodate two programs simultaneously. There is a 30 minutes lunch break, with students bringing their own drink & lunch. This program has been designed from the "Aries Project," which was developed by the National Foundation Project in connection with the Harvard Smithsonian Center for Astrophysics.

  - Betterlesson.com Zip line. This Forces and Motions unit focuses on gravity exerted by Earth on objects, while at rest or during motion. With this in mind, students will investigate types of forces and the effects it has on moving objects. They learn how forces can stop an object from moving, increase or decrease the speed of an object moving, change its direction, and put a resting object into motion. Through models, investigations, research, and the engineering and design process, students learn that gravity is a constant force that impacts an object's motion. The unit wraps up with students using the engineering and design process to create a zip line to illustrate the effects of gravitational force. Engage students in a discussion about how it relates to Newton's three laws of motion and how they apply to a zipline.

- RESEARCH THE INTERNATIONAL SPACE STATION AND OTHER SPACE SETTLEMENTS (3rd Rover/4th Space Colony)
  - (3rd/4th) FUTURE ENGINEERS/NASA 3D DESIGN CHALLENGE (sep 21 for last year). Future Engineers is an online education platform that hosts national innovation challenges for K-12 students. Future Engineers' inaugural 3D space challenge series, sponsored by the ASME Foundation with technical assistance from NASA, was created as a joint commitment to the White House Maker Initiative. The series has produced historic achievements including the first student-designed 3D print in space. Future Engineers received a 2016 Small Business Innovation Research grant from the U.S. Department of Education and was named a Breakthrough Award winner by Popular Mechanics in 2015. All challenges are offered free for student/classroom participation and are aligned with STEAM and Maker education
  - TEACHENGINEERING.ORG LIFE IN SPACE THE INTERNATIONAL SPACE STATION. Students are introduced to the International Space Station (ISS) with information about its structure, operation and key experiments. The ISS itself is an experiment in international cooperation to explore the potential for humans to live in space. The space station features state-of-the-art science and engineering laboratories to conduct research in medicine, materials and fundamental science to benefit people on Earth as well as people who will live in space in the future.
  - TEACH ENGINEERING.ORG CURRICULAR UNIT - MISSION TO MARS. The Mission to Mars unit introduces students to Mars, often called the Red Planet. Students discover why everyone is so interested in studying this mysterious planet. Many interesting facts about Mars are revealed, and the history of Martian exploration is reviewed. Students learn about the development of robotics and how robots are beneficial to science, society and the exploration of space. Details on engineers' involvement in space exploration are explained, such as how orbits enable astronauts to move from planet to planet and what type of equipment is used by scientists and engineers to safely explore space. The specific details on and human risks for a possible future "human" mission to Mars (and back to Earth again!) are explored.
    - Day 1: The Amazing Red Planet lesson
Day 2: An Inflated Impression of Mars activity
Day 3: Red Rover Robotics lesson
Day 4: Strong-Arm Tactics activity
Day 5: Come On Over Rover lesson
Day 6-8: Edible Rovers activity or Edible Rovers – High School activity
Day 9: Get Me Off This Planet lesson
Day 10: The Great Gravity Escape activity
Day 11: Six Minutes of Terror lesson
Day 12: Egg-cellent Landing activity
Day 13: Manned Mission to Mars lesson

Day 14: Are We Alone? activity

- TEACHENGINEERING.ORG THE AMAZING RED PLANET. Students are introduced to the planet Mars. They begin by discussing the location and size of Mars relative to Earth, as well many interesting facts about this "red planet." Next, the history of Martian exploration is reviewed and students discover why researchers are so interested in studying this mysterious planet. The lesson concludes with students learning about future plans to visit Mars.
- (3rd) NASA DESIGNING AND LANDING A ROVER. The teams' challenge is to design and build a model of a Lunar Transport Rover that will carry equipment and people on the surface of the Moon. Students will apply the engineering design process. Design and build a rover that can roll down a ramp. Design and build a landing pod for this rover. Simulate a lunar landing from a significant height (3 to 5 meters). Students may use Little Bits materials to build the Rover.
- PARACHUTE DESIGN JET PROPULSION LABORATORY - CALIFORNIA INSTITUTE OF TECHNOLOGY. https://www.jpl.nasa.gov/edu/teach/activity/parachute-design/. Sending large vehicles to Mars might seem pretty far removed from the classroom, but this lesson allows you to bring it right onto students' desks! In Parachute Design students will design and test parachute landing systems to successfully land a probe on target. After testing, students can optimize their parachutes by experimenting with different materials and shapes for their parachute designs. Students will then retest their designs to see if the changes they made resulted in improved performance. The goal is to land a payload as slowly and softly as possible.
- (3rd) NASA EDUCATION AT GLENN - GAINING TRACTION ON MARS. The students you work with today are the scientists, technicians, engineers, and mathematicians of tomorrow. Creativity, curiosity, analytical thinking , and the ability to successfully utilize the engineering design process are characteristics and skills necessary for NASA's future workforce. Engineering design challenges, like the one shared in this guide, create authentic learning experiences that allow students to develop these skills through rigorous and engaging Science, Technology, Engineering, and Mathematics (STEM) content. This design challenge directly correlates with work being done in the Simulated Lunar Operations (SLOPE) facility at NASA's Glenn Research Center. Engineers are testing wheels matching those on the Curiosity rover on Mars and are studying the challenges regarding their longevity. These engineers have worked hand-in-hand with our education team in developing this content to accurately simulate the research that they are doing. This facilitation guide is designed for versatility. It includes four lead-up investigations that provide background knowledge for the Engineering Design Challenge students dive into understanding the forces that interact to propel a vehicle across a sandbox—the same forces that push a car down the highway or move a rover on Mars. These lead-up investigations take approximately 45 minutes each to complete. The challenge problem can be implemented in as little as 1 week, but it can continue open-endedly as your students test and improve their designs.
- (4th) MARS COLONY STEM PROJECT TEACHERS PAY TEACHERS. Design a colony on Mars! Take your STEM classroom or program to the next level with this in-depth engineering design STEM challenge. Students will apply scientific concepts, math skills, critical thinking, research, and engineering design to plan a long term habitat on Mars. This creative and in-depth project is a great activity for your classroom or afterschool program! Designing a Mars Colony is real multidisciplinary project. Students will need to consider questions like: How will colonists get food? What is the Martian environment like? Will our colony have a government? How do we prevent boredom? As a student-driven assignment, the purpose of the teacher is to act as a facilitator. You will provide the structure to the project, but students will take an active role in research, design, and building. This product is based on a 5 week long engineering design project where student teams research and develop prototypes for a Mars Colony. Prototypes are built from recycled materials and presented to STEM professionals for judging. The depth of this project is dependent on the available time frame and classroom needs. The product includes instructions for prototype building, but this component is completely optional.

- Portfolio of Work
  - Google Slides. Create a portfolio and reflection of research and challenges completed in class.

- Google Docs. Write a fictional short story about space.
- Scratch. Design an animation using block programming.
- GOOGLE SITES. Make a website that has links to all projects. (if time allows)

Modifications

Individual accommodations

• Additional support

• Adapting lessons to meet various learning styles

Integration of 21st Century Skills

Focus on the development of 21st Century Content Skills:

- Global awareness
- Civic literacy
- Health and wellness awareness
- Environmental literacy

Focus on the Development of Learning and Thinking Skills:

- Critical Thinking and Problem Solving Skills
- Communication Skills
- Creativity and Innovation Skills
- Collaboration Skills
- Information and Media Literacy Skills
- Contextual Learning Skills

Focus on the Development of Life Skills:

- Leadership
- Ethics
- Accountability
- Adaptability

- Personal Productivity
- Personal Responsibility
- People Skills
- Self Direction
- Social Responsibility

Interdisciplinary Connections

- Academic and Technical Rigor - Projects are designed to address key learning standards identified by the school or district.
- Authenticity - Projects use a real world context (e.g., community problems) and address issues that matter to the students.
- Applied Learning - Projects engage students in solving problems calling for competencies expected in high-performance work organizations (e.g.,teamwork, problem-solving, communication, etc.).
- Active Exploration - Projects extend beyond the classroom by connecting to community explorations.
- Adult Connections - Projects connect students with the wider community.
- Assessment Practices - Projects involve students in regular, performance-based exhibitions and assessments of their work; evaluation criteria reflect personal, school, and real-world standards of performance.

WORKS CITED

"EGFI: Dream Up the Future." *Overview*, American Society for Engineering Education, teachers.egfi-k12.org/.