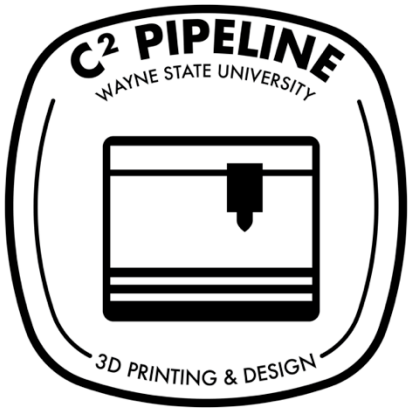
3D Printing & Design



Activities:

- Activity 1: Introduction to 3D Printing
- Activity 2: Using a 3D Printer
- Activity 3: Preparing Files for Printing
- Activity 4: Exploring Ways to "Make": Download, Scan, Design*
- Activity 5: Designing with Tinkercad Software*
- Activity 6: Designing with OpenSCAD Software*
- Activity 7: Designing with Sculptris Softward*
- Activity 8: Designing with 123D Software*

*Activities may extend beyond one activity based on student interest

Description:

3D printing is a tool that allows people to create new things, limited only by imagination. 3D printing and modeling projects should empower students to take chances and make mistakes. Students will be introduced to 3D printing and learn how to create their own print files.

Goals & Objectives:

Familiarize and educate students about the components of a 3D printer, how to operate a 3D printer, preparing & making files to print and designing objects to be printed.

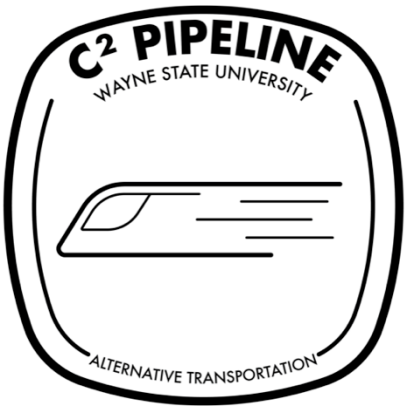
Evidence:

Do the Following:

- ☐ Explain basic knowledge of 3D printing, Makerbot Desktop and Thingiverse
- ☐ Identify components of a 3D printer
- ☐ Demonstrate knowledge of leveling and updating firmware
- ☐ Design print in Google Sketch Up or other available software
- ☐ Create and engineer a 3D model that addresses a need
- ☐ Evaluated and improved the model created to suit the need

Career Pathway	• Engineering & Technology • Science
Pathway Partners	• Engineering
Academic Subjects	

Alternative Transportation (Need for Green Speed)



Activities:

- Activity 1: Spooling Around with Ramp-Powered Cars
- Activity 2: Rubber-Band Powered Car
- Activity 3: Propeller-Powered Care
- Activity 4: Balloon-Powered Car
- Activity 5: Solar Panels
- Activity 6: Building a Solar Car
- Activity 7: Building a Solar Car, continued
- Activity 8: Mini Solar Challenge
- Activity 9: Bloodhound Supersonic Car

Description:

Students harness the power of the sun by learning about and designing their own solar cars. They will explore how solar panels generate electricity by measuring the maximum voltage the panels can generate in different lighting situations. Students will also design and test several different cars with various propulsion systems. They explore modifying their cars to best meet the design objectives and improve performance.

Goals & Objectives:

To promote the use of math, engineering principles and solar power technology to design and test a variety of vehicles.

Evidence:

Do the Following

- ☐ Before starting work on any other requirements for this digital badge, write in your own words the meaning of sustainability. Explain how you think conservation and stewardship of our natural resources relate to sustainability.
- ☐ Learn about the sustainability of different energy sources, including fossil fuels, solar, wind, nuclear, hydropower, and geothermal. Find out how the production and consumption of each of these energy sources affects the environment and what the term "carbon footprint" means. Discuss what you learn with your instructor, and explain how you think your family can reduce its carbon footprint.
- ☐ Design a car that converts the potential energy stored in a rubber band into kinetic energy
- ☐ Design a car run by a propeller. Described how a propeller works to convert torque into thrust.
- ☐ Design and build an electric car that has a motor connected to a solar panel. Identified factors that affect the solar car, including friction, position of the axles, weight of the car, and how much light shines on the solar panel.

Career Pathway	• Engineering & Technology • Science
Pathway Partners	• Engineering

Academic Subjects	• Science
	  ○ Physics
	  ○ Environmental Science

Anatomy in Clay

Activities:

Activity 1: Body Scavenger Hunt
Activity 2: Human Anatomy Puzzle
Activity 3: Larger Than Life: HumanAnatomy
Activity 4: Intro to the Body Systems
Activity 5: Body Systems Challenge
Activity 6: Anatomy in Clay: Directional
Activity 7: Anatomy in Clay: Directional continued
Activity 8: Practice with Clay
Activities 9-11: The Skeletal System
Activities 12-14: The Digestive System
Activities 15-16: The Urinary System
Activities 17-19: The Cardiovascular System
Activities 20-22: The Respiratory System
Activities 23-24: The Nervous System
Activities 25-26: The Lymphatic System
Activity 27: The Endocrine System
Activities 28-29: The Muscular System
Activity 30: The Integumentary System
Activity 31: Wrap Up & "Tony" Funeral

Description:

Students are introduced to the anatomy and chemistry of the human body. They will explore and construct each of the body systems by completing hands-on projects.

Goals & Objectives:

Familiarize and educate about the anatomy and chemistry of the human body utilizing hands on activities.

Evidence:

- ☐ *Students will be able to identify all body systems.*
- ☐ *Students will learn how the body system works.*
- ☐ *Students will be able to construct paper skeletons on their own.*

Career Pathway	• Health Care • Science
Pathway Partners	• Nursing • Medicine Pharmacy & Health
Academic Subjects	• Science ○ Anatomy • CTE ○ Art (Sculpture) ○ *Biology* ○ *Chemistry* • *A&P*

Audio Engineering

Activities:

- Activity 1: What is sound and the careers within the sound industry?
- Activity 2: Intro to the Equipment
- Activity 3: Using a Mic and Sound Board
- Activity 4: Software and Sample Recording
- Activity 5: Making Beats & Music Composition
- Activity 6: Recording Projects
- Activity 7: Recording Projects
- Activity 8: Recording Projects Marketing & Distribution

Description:

Students will learn about the science of sound waves, use of industry standard recording equipment, experience with recording software, and math involved with beats per minutes. Students will also gain experience with technology used in the growing and in demand industry of sound engineering. The skills learned in this class can also be beneficial to a number of other careers including; business, education, and medical.

Goals & Objectives:

Students gain knowledge and experience with sound engineering and recording.

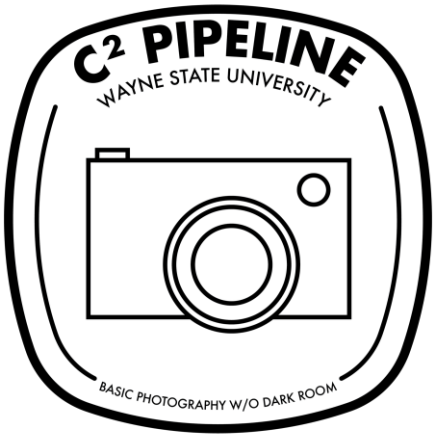
Evidence:

Do the following:

- ☐ Give a brief history of the changes in digital technology over time. Discuss with your instructor how digital technology in your lifetime compares with that of your parent's, grandparents, or other adult's lifetime.
- ☐ Describe the kinds of computers or devices you imagine might be available when you are an adult.
- ☐ Explain to your instructor how text, sound, pictures, and videos are digitized for storage.
- ☐ Describe the difference between lossy and lossless data compression, and give an example where each might be used.
- ☐ Describe two digital devices and how they are made more useful by their programming.
- ☐ Make a digital recording of your voice, transfer the file to a different device, and have your instructor play back the recording.
- ☐ Explain to your instructor each of these protections and why they exist: copyright, patents, trademarks, trade secrets.
- ☐ Explain when it is permissible to accept a free copy of a program from a friend.
- ☐ Describe why it is important to properly dispose of digital technology. List at least three dangerous chemicals that could be used to create digital devices or used inside a digital device.
- ☐ Do an Internet search for an organization that collects discarded digital technology hardware or devices for repurposing or recycling. Find out what happens to that waste. Share with your instructor what you found.
- ☐ Do ONE of the following:
  - Investigate three career opportunities that involve digital technology. Pick one and find out the education, training, and experience required for this profession. Discuss this with your instructor, and explain why this profession might interest you.
  - Visit a business or an industrial facility that uses digital technology. Describe four ways digital technology is being used there. Share what you learned with your instructor.

Career Pathway	• Engineering & Technology • Science
Pathway Partners	• Engineering
Academic Subjects	Science ○ Physical Reading CTE ○ Technology

Basic Photography without Dark Room Access



Activities:

- Session 1: Introduction
- Session 2: Process: Sun prints
- Session 3: Camera as a tool
- Session 4: Creating images
- Session 5: Editing images
- Session 6: Creating images
- Session 7: Guest artist visit
- Session 8: Polaroid transfer
- Session 9: Creating images
- Session 10: Gallery visit
- Session 11: Editing images
- Session 12: Creating images
- Session 13: Guest artist visit
- Session 14: Editing images
- Session 15: Final project

Description:

Students at all levels of experience in photography will learn about the many possibilities and applications of photography.

Goals & Objectives:

Introduce students to the history, technique, aesthetics, and practice of photography using non-darkroom activities to impart a sense of process.

Evidence:

Do the Following

- ☐ Explain how the following elements and terms affect the quality of a picture:
  a. Light- natural light/ambient, flash
  b. Exposure-aperture (f-stops), shutter speed, depth of field
  c. Composition-rule of thirds, leading lines, framing, depth
  d. Angle of view
  e. Stopping action
- ☐ Explain the basic parts and operation of a film camera or digital camera. Explain how an exposure is made when you take a picture.
- ☐ Discuss with your instructor the differences between a film camera and a digital camera. Describe how computer software allows you to adjust a digital photograph after it is taken.

Do ONE of the following:

- ☐ Produce a picture story using the photojournalistic technique of documenting an event. Share your plan with your instructor and get your instructor's input and approval before you proceed. Then, using either a film camera or a digital camera, produce your approved picture story. Process your images and select eight to 12 images that best tell your story. Arrange your images in order, and then mount the prints on a poster board. If you are using digital images, you may create a slide show on your computer or produce printouts for your poster board. Share your picture story with your instructor.
- ☐ Choose a topic that interests you to photograph for an exhibit or display. Get your instructor's approval, then photograph (digital or film) your topic. Process your images. Choose 20 of your favorite images and mount them on poster board. Share your display with your instructor. If you are using digital images, you may create a slide show on your computer or produce printouts for your poster board.

Career Pathway	• Engineering & Technology
Pathway Partners	
Academic Subjects	• CTE ○ Technology ○ Photography

Bio Tech Med (Biomedical Engineering)

Activities:

- Activity 1: Assistive Technology
- Activity 2: Gases, Liquids & Making the Arm
- Activity 3: Prototype Buzzer Circuit
- Activity 4: Designing a Touch Sensor
- Activity 5: X-Ray Machines and Density
- Activity 6: CT Scans: Improving X-Ray Imaging
- Activity 7: Ultrasound and Submarines
- Activity 8: Imaging with Sound

Description:

Students are introduced to ways in which engineers use science and math to create technology capable of seeing inside the human body – bio imaging. Students are also introduced to the ways in which engineers design technology to help people with disabilities. They explore the design considerations for developing a prosthetic arm to improve the quality of life for someone who has lost an arm.

During the first four activities, you will learn about, develop plans for, construct and test out a bionic arm utilizing hydraulic and pneumatic power systems. During the last four activities, you will explore the field of bio imaging, the technology behind ultrasounds, computerized tomography (CT) scans and Magnetic Resonance Imaging (MRI) scans.

Goals & Objectives:

To explore the components of biomedical engineering through hands on activities.

Evidence:

Do the Following

- ☐ *The learner will understand how a prosthetic limb fits.*
- ☐ *The learner will understand how a prosthetic is built.*
- ☐ *Why a prosthetic limb is needed.*
- ☐ *The mechanics of a prosthetic limb.*
- ☐ *CT Scans and MRI*
- ☐ Able to define assistive technology, gases, liquids, x-ray imaging, and ultrasound
- ☐ Participated in hands on activities to make a prosthetic arm, a buzzer circuit, and a touch sensor

Career Pathway	• Engineering & Technology • Science
Pathway Partners	• Engineering
Academic Subjects	• *Robotics* • *Health* • *Computer Science* • *Physics*

Build a Better Mouse Trap (Rube Goldberg)

Activities:

Description:

Students are introduced to Rube Goldberg, then takes they go on a journey building progressively more complicated machines. In the process, students will learn about the strengths and weaknesses of various structures, geometric shapes, basic forces of motion, the application of physical laws, and how to engineer for structural integrity. They will learn the important elements of planning and designing a project, including listing of materials and sketching designs.

Goals & Objectives:

To utilize scientific and engineering concepts to construct a Rube Goldberg machine.

Evidence:

Do the Following

- ☐ Select a manufactured item in your home (such as a toy or an appliance) and, under adult supervision and with the approval of your instructor, investigate how and why it works as it does. Find out what sort of engineering activities were needed to create it. Discuss with your instructor what you learned and how you got the information.
- ☐ Select an engineering achievement that has had a major impact on society. Using resources such as the Internet (with your parent's permission), books, and magazines, find out about the engineers who made this engineering feat possible, the special obstacles they had to overcome, and how this achievement has influenced the world today. Tell your instructor what you learned.
- ☐ Visit with an engineer (who may be your instructor or parent and do the following):
  a. Discuss the work this engineer does and the tools the engineer uses.
  b. Discuss with the engineer a current project and the engineer's particular role in it.
  c. Find out how the engineer's work is done and how results are achieved.
  d. Ask to see the reports that the engineer writes concerning the project.
  e. Discuss with your instructor what you learned about engineering from this visit.

Do the following:

- ☐ Transforming motion. Using common materials or a construction set, make a simple model that will demonstrate motion. Explain how the model uses basic mechanical elements like levers and inclined planes to demonstrate motion. Describe an example where the mechanism is used in a real product.
- ☐ Using materials. Do experiments to show the differences in strength in wood, metal, and plastic. Discuss with your instructor what you have learned.
- ☐ Find out about three career opportunities in engineering. Pick

	Evidence Cont. one and research the education, training, and experience required for this profession. Discuss this with your instructor, and explain why this profession might interest you. • Forces and structures • Designed a machine • Built machines to perform simple tasks • Springs and slopes • Engineered paper airplanes • Building a better mousetrap

Career Pathway	• Engineering • Science
Pathway Partners	• Engineering

Academic Subjects	• Science
	  ○ Physical
	  ○ Reading
	  ○ CTE
	  ○ Technology