

Lesson Plan	Coding Tool	None
	Cross-curricular	
Big Ideas (By possible Strand) - F: Demonstrate an understanding of the scientific principles related to fluid statics, fluid dynamics, and hydraulic and pneumatic systems. OR - C: Investigate forces, torque, work, coefficients of friction, simple machines, and mechanical advantage OR - B: Demonstrate an understanding of different kinds of motion and the relationships between speed, acceleration, displacement, and distance.	Specific Expectations - F: Describe common components used in hydraulic and pneumatic systems and explain their function - State Pascal’s principle, and explain its applications in the transmission of forces in fluid systems - State Bernoulli’s principle, and explain some of its applications - C: Use appropriate terminology related to mechanical systems, including, but not limited to: coefficients of friction, torque, mechanical advantage, work input, and work output - B: Use appropriate terminology related to motion, including, but not limited to: distance, displacement, position, speed, acceleration, instantaneous, force, and net force	

Description

For this lesson it is designed as a possible extension to the programmable hydraulic system lesson or as a stand alone lesson. There is an offline coding component while also tying to multiple possible strands of the curriculum.

Students will research 3 systems involved in fields of interest to themselves and they will have two tasks for each. For the coding aspect of this lesson students will write down a step by step process they believe is involved in the programming of the system that controls how it operates. An example of this is found as part of the introduction portion of this lesson.

Writing out the steps in this way is how programmers will begin every program they write. Each of these steps will likely become its own sub routine. Students can now practice these skills before ever learning a programming language. Subroutines in computer programming are small packages of code embedded within a main program designed to complete a very specific task.

Depending on the strand this is used in there are some options for the curriculum ties. If done as a culminating type assignment more than one of these strands may be implemented.

For Hydraulic and Pneumatic systems:

Students must choose hydraulic or pneumatic systems for their discussion and must also discuss how Pascal's principle and/or Bernoulli's principle is used in the design of each system. As an alternative, students could discuss the various components in their system and explain their functions.

For Mechanical Systems:

Students must discuss the forces and torque involved, the work done, and any mechanical advantage achieved as well as how it was achieved.

For Motion and Its Applications:

Students must discuss the motion involved in the entire system or parts of the system depending on the systems they have chosen using proper terminology including distance, displacement, position, speed, acceleration, and net force. Students may also complete distance vs time graphs, or velocity vs time graphs, or acceleration vs time graphs.

Materials

Students will need access to the internet so they will need a device capable of connecting online.

Computational Thinking Skills

- Decomposition
- Pattern Recognition
- Algorithm design

Introduction

Choose a system and discuss the steps together as a class. This will begin with a video of the system operating in its entirety followed by a group discussion. After this I would recommend playing the video piece by piece and pausing to write down each step as it happens. You may use this system. Click [here](#) for the link to the video, a possible solution to the steps included for the steel bar bending machine would be:

Initializing Step:

$x = 30$ (This variable will determine the initial angle of rotation for the steel bending machine)

Main Steps:

When pedal is pressed:

Rotate central unit counter clockwise x degrees

Rotate central unit clockwise x degrees

Move steel rod forward 8 inches

$x = x + 30$

Action

Students will be researching and choosing systems of their own. They will first describe the functions of the system before preceding to the coding and curriculum aspects of the assignment.

Consolidation/Extension

Students could be challenged to create a system and discuss the steps that will be necessary for their program to run. This could tie in well to any of the society and environment expectations within each strand. Students could discuss a potentially wasteful or harmful system and their system could be a potential solution. This would get students thinking about what programming steps would be necessary make their system operate properly again without needing the knowledge of any programming language.

Assessment

Attached is a rubric outlining the possible grading for each of the 3 streams outlined above.

Additional Resources

No Additional Resources at this time.
