

2021- 2022 FHAP Pacing Guide- Robotics

What is STEM?

STEM stands for Science, Technology, Engineering, and Math. Yet, STEM education can be hard to define. It is such a popular term that it means a lot of different things to a lot of different people. Although the science (biology, chemistry, etc.) and math (algebra, calculus, etc.) parts of the abbreviation might be easy to figure out, the technology and engineering parts might be less clear. Technology includes topics such as computer programming, analytics, and design. Engineering can include topics like flight, civil engineering, electronics, biomedical engineering, and robotics. The key term, when talking about STEM, is *integration*. STEM curriculum intentionally melds these disciplines. It's a blended approach that encourages hands-on experience and gives students the chance to gain and apply relevant, "real world" knowledge in the classroom. See the back of this document for further details on STEM principles. **Grades 8 and Up. Prerequisite: Successful completion of Pre-Algebra**

Robotics

*Note: pacing and activities may be adjusted and vary depending on timing

Quarter 1	Focus Topics	Related Topics	Major Projects
Robotic basics	Societal Uses of Robotics What is Engineering? Engineering design process Programming Motors Sensors	History of Robotics Future of Robotics	Basic programming and functioning of a simple Robot (Sphero)
Quarter 2			
Robot behaviors	Programming with motors and sensors Parts identification Building instructions Wiring configurations	Power supplies Circuits Motors	Building and programming a Lego Ev-3 Mindstorm robot
Quarter 3			
Radio controlled robotics systems	Transmitters Receivers Speed controllers Designing- Physical features	Chassis Direct drive Indirect drive Gearing End effectors Wheels Tank treads Friction Mobility	Plan and design a complete radio-controlled robot
Quarter 4			
Design challenge	Application of the design process to create a fully automated system	Design and development process Collaboration Communication	Build a robot with a fully automated system that will work on a continuous loop to meet certain criteria and constraints

Note: These units of focus are subject to change based on timing and resources. This document will be updated periodically and postings in Schoology will be the most up to date information of topics being covered. If you have any questions, comments, or concerns, please contact Ms. Jane (jwilson@d49.org)

NGSS SCIENTIFIC AND ENGINEERING PRACTICES

ASK QUESTIONS AND DEFINE PROBLEMS

- I formulate empirically answerable questions.
- I establish what is already known.
- I determine what questions have yet to be answered.
- I define constraints and specifications for a solution.

DEVELOP AND USE MODELS

- I construct mental and conceptual models to represent and understand phenomena.
- I use models to explain and predict behaviors of systems, or test a design.
- I refine my models in light of new empirical evidence.

PLAN AND CARRY OUT INVESTIGATIONS

- I identify questions to be investigated.
- I identify variables and controls.
- I design and perform experiments to test my hypothesis.
- I decide what data will be collected and how much, and what tools are needed.

ANALYZE AND INTERPRET DATA

- I use tables, graphs, spreadsheets, etc. to display and analyze data.
- I recognize patterns in data and see relationships between variables.
- I revise my initial hypothesis when the data doesn't support it.
- I analyze performance of a design under a range of conditions.

USE MATHEMATICS AND COMPUTATIONAL THINKING

- I use mathematics and statistics to analyze data.
- I express relationships between variables by writing mathematical models or equations.
- I use technology to collect and analyze data.
- I use mathematical models and computer simulations to test my predictions and designs.

CONSTRUCT EXPLANATIONS AND DESIGN SOLUTIONS

- I evaluate information and form hypotheses.
- I construct explanations or models of phenomena.
- I design a variety of solutions to a problem.

ENGAGE IN AN ARGUMENT FROM EVIDENCE

- I defend my explanation.
- I formulate evidence based on solid data.
- I examine my own understanding in light of the evidence.
- I collaborate with my peers in searching for the best explanation.

OBTAIN EVALUATE AND COMMUNICATE INFORMATION

- I communicate findings clearly and persuasively.
- I derive meaning from scientific text.
- I engage in discussions with scientific peers.
- I evaluate the validity of the findings of others.