8th Grade Design and Robotics

UNIT 1: Thinking Like a Robot

ESSENTIAL QUESTION

How does a robot ‘think’?

BIG IDEAS

- Students explore the difference between human logic and computer logic.
- Students understand how to think like a robot using algorithms and pseudocode.
- Students explore innovative, trending, and future technologies, and how robotics impacts our world.

GUIDING QUESTIONS

Content

- What is a robot?
- How are robots used today?
- What jobs do robots help people do?
- What is the difference between how humans think and how a robot processes its coding?
- What jobs/careers are impacted by robots?
- How are robots used to control machines/devices?
- What is an algorithm?
- What is pseudocode?
- What is the difference between algorithms and pseudocode?

Process

- How can a robot be made to move forward, backward, left, and right?
- How do we use algorithms?
- How do we use pseudocode?
- What careers are impacted by robotics?
- How can virtual simulations be utilized to learn how to code?

Reflective

- How have robots changed over time, and what can we imagine for the future?
- Why are robots important?
- How do robots help us solve problems and be more efficient?
- What can be learned from failures and successes?
- How do simulations of a robot help to understand how a robot thinks?
- What makes code efficient?
ESSENTIAL QUESTION

How do you create a robot?

BIG IDEAS

• Students understand how to assemble a basic robot to accomplish specific tasks.
• Students identify the types of sensors and how they can be utilized by robots.
• Students have opportunities to develop future ready skills which include: problem-solving, perseverance, team building, collaboration, conflict resolution, communication, and computational thinking.

GUIDING QUESTIONS

Content

• What types of parts are used to build a robot?
• What are the proper and safe ways to assemble and disassemble parts of the robot?
• What are the attributes of the sensors? (ie. gyro, bump, touch, distance, and color)
• What are the basic drive commands?
• What are encoders?
• What are gears, and how do they assist in mechanical advantage?

Process

• How do I follow step-by-step instructions?
• How do I make sure the robot is fully functional and able to complete the task?
• How can I troubleshoot problems that arise in assembling a robot?
• How can I troubleshoot problems that arise in coding?
• How are gear ratios used in robots?
● How does the bump sensor work?
● How does the gyro sensor work?
● How does the distance sensor work?
● How does the touch sensor work?
● How does the color sensor work?
● How do I calibrate the color sensor?
● How do sensors use the “wait until” command?
● How do we create and apply algorithms?
● How do we create and apply pseudocode?
● How are conditional statements (if/then) used in coding?
● How are loops used in coding?

Reflective
● What strategies can I use to complete a challenge?
● How can the skills I am learning be applied in other areas of my life?
● What skills are needed to troubleshoot mechanical problems?
● Why was each sensor paired with a specific element of coding?
● What can collaboration teach us about problem solving?
● What does conflict resolution look like?
● What does compromise look like?

FOCUS STANDARDS

● KSDE 41310.4. Recognize various tools, fasteners, and joining systems employed in selected engineering processes.
● KSDE 13302.5. Incorporate application knowledge of linear motion concepts
● STL 12. Students will develop the abilities to use and maintain technological products and systems.
● CSTA 2-AP-12. Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
● CSTA 2-AP-13. Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.
● CSTA 2-AP-14. Create procedures with parameters to organize code and make it easier to reuse.
● CSTA 2-AP-17. Systematically test and refine programs using a range of test cases.
● CSTA 2-AP-19. Document programs in order to make them easier to follow, test, and debug.
### ESSENTIAL QUESTION

**How can gears and belt drives help us complete a task?**

- Students will learn basic gearing and belt drive vocabulary.
- Students will be able to identify basic elements gearing and belt drive systems.
- Students will be able to calculate simple and compound gear ratios.
- Students will create gearing and belt drive systems to complete a task.

### BIG IDEAS

- Students will learn basic gearing and belt drive vocabulary.
- Students will be able to identify basic elements gearing and belt drive systems.
- Students will be able to calculate simple and compound gear ratios.
- Students will create gearing and belt drive systems to complete a task.

### GUIDING QUESTIONS

**Content**

- What are input gears?
- What are output gears?
- What are idler gears?
- What are simple gear ratios?
- What are compound gear ratios?
- What is speed?
- What is torque?
- What is the relationship between speed and torque?
- What is “motor stall”?
- What is a pulley?
- What is a tensioner?
- What is belt slip?
- What is mechanical advantage?
- What are the advantages of belt drives in machines?
- What are the limiting factors for gears and belt drives?

**Process**

- How can we use gears/pulleys to increase speed?
- How can we use gears/pulleys to increase torque?
- How can gears change the direction of motion at the output?
- How can pulleys change the direction of motion at the output?
- How can we calculate the mechanical advantage of gear ratios and belt drives?
- How does the physical arrangement of gears affect the output of the system?

**Reflection**

- How did the mechanical advantage from your gearing/pulley system help you complete the goal?
• How did your gearing/pulley system change during the course of the project?
• What problems did you troubleshoot while building your gearing/pulley system?
• How reliable was your gearing/pulley system?
• How might you improve your gearing/pulley system if given more time?
• Where do we see gear ratios in our world?
• Where do we see belt drives in our world?

FOCUS STANDARDS

• KSDE 13302.1. Demonstrate working knowledge of gears and gear drives
• KSDE 13302.2. Calculate gear ratios
• KSDE 13302.6. Apply working knowledge of belt and belt drives

8th Grade Design and Robotics
UNIT 4: Advanced Design

ESSENTIAL QUESTION

What is good design?

How does the engineering design process give us an effective way to solve problems?

BIG IDEAS

• Students will understand how to use the engineering design process to create, innovate, and overcome challenges.
• Students will see the value of designing and collaborating with others.
• Students consider how to design for the world around us.

GUIDING QUESTIONS

Content
• What are the steps of the engineering design process?
• What are strategies to use to problem-solve?
• What are the qualities of a good teammate?

Process
• How can observation help troubleshoot an issue?
● How can I be a good teammate?
● How can I help others show the qualities of a good teammate?
● How can I deal with others who are not acting as good teammates?
● How can teams collaborate effectively?
● How can I clearly define the problem?
● How can I effectively brainstorm?
● How can I communicate my ideas through good design?
● How can I turn my idea into a prototype?
● How can I test my prototypes against the defined problem?
● How can I improve on my most recent prototype?
● How do we effectively troubleshoot a problem with a robot?

Reflective
● What are the benefits of clearly defining the problem?
● What purpose does observation serve?
● How can I apply the design process to address problems I have in life?
● How does design impact the world around us?
● How do other people play a role in influencing our designs?
● Why is there no one right way to design?
● How can using the design process help me grow as a student and a human being?
● How can empathy help me better understand why people do what they do?
● What can I learn about myself through prototyping?
● Did I struggle? What did I learn from my struggle?
● Why is it important to consider multiple points of view?

FOCUS STANDARDS

● KSDE 41310.2. Understand the steps in the engineering design process.
● KSDE 41310.12. Describe the purpose and importance of working in a team to solve an engineering problem.
● STL 6. Students will develop an understanding of the role of society in the development and use of technology.
● STL 8. Students will develop an understanding of the attributes of design.
● STL 11. Students will develop the abilities to apply the design process.