8th Grade Design and Robotics

UNIT 1: Thinking Like a Robot

ESSENTIAL QUESTION	BIG IDEAS
How does a robot 'think'?	• 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?

FOCUS STANDARDS

- KSDE 41310.2. Understand the steps in the engineering design process.
- STL 11. Students will develop the abilities to apply the design process.
- CSTA 2-AP-10. Use flowcharts and/or pseudocode to address complex problems as algorithms.
- STL 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
- KSDE 41310.6 Recognize and follow safety rules for using lab tools and machines.
- KSDE 41310.13. List benefits of robot use in today's world and their impact on society.

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UNIT 2: Robot Construction and Programming

ESSENTIAL QUESTION	BIG IDEAS
How do you create a robot?	• 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.

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UNIT 3: Mechanisms

ESSENTIAL QUESTION	BIG IDEAS
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.

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

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UNIT 4: Advanced Design

ESSENTIAL QUESTION	BIG IDEAS
What is good design? **How does the engineering design process give us an effective way to solve problems?**	• 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.