

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 impact our world.

GUIDING QUESTIONS

Content

- What is a robot?
- What is the difference between how humans think and how a robot processes its coding?
- How are robots used today?
- How have robots changed over time, and what can we imagine for the future?
- How are robots used to control machines/devices?
- What jobs do robots help people do?
- What jobs/careers are impacted by robots?
- What is an algorithm? What is pseudocode?
- What is the difference between algorithms and pseudocode?

Process

- How can virtual simulations be utilized to learn how to code?
- 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 involve robotics and their impact on the world?

Reflective

- Why are robots important?
- What makes code efficient?
- How do robots help us solve problems and be more efficient?
- Why is it important to consider multiple points of view?
- What can be learned from failures and successes?
- How do simulations of a robot help to understand how a robot thinks?

FOCUS STANDARDS

- **1.0 Empowered Learner:**

1a. Students articulate personal learning goals, select and manage appropriate technologies to achieve them, and reflect on their successes and areas of improvement and work toward their goals.

1b. Students identify and develop online networks within school policy, and customize their learning environments in ways that support their learning, in collaboration with an educator.

1c. Students actively seek performance feedback from people, including teachers, and from functionalities embedded in digital tools to improve their learning process, and they select technology to demonstrate their learning in a variety of ways.

1d. Students are able to navigate a variety of technologies and transfer their knowledge and skills to learn how to use new technologies.

- **2.0 Digital Citizen:**

2a. Students manage their digital identities and reputations within school policy, including demonstrating an understanding of how digital actions are never fully erasable.

2b. Students demonstrate and advocate for positive, safe, legal and ethical habits when using technology and when interacting with others online.

2d. Students demonstrate an understanding of what personal data is and how to keep it private and secure, including the awareness of terms such as encryption, HTTPS, password, cookies and computer viruses; they also understand the limitations of data management and how data-collection technologies work.

- **3.0 Knowledge Constructor:**

3a. Students demonstrate and practice the ability to effectively utilize research strategies to locate appropriate digital resources in support of their learning.

3b. Students practice and demonstrate the ability to evaluate resources for accuracy, perspective, credibility and relevance.

3d. Students locate and collect resources from a variety of sources and organize assets into collections for a wide range of projects and purposes.

3d. Students explore real-world issues and problems and actively pursue an understanding of them and solutions for them.

- **6.0 Creative Communicator:**

6a. Students select appropriate platforms and tools to create, share and communicate their work effectively.

6b. Students create original works or responsibly repurpose other digital resources into new creative works.

6c. Students communicate complex ideas clearly using various digital tools to convey the concepts textually, visually, graphically, etc.

6d. Students publish or present content designed for specific audiences and select platforms that will effectively convey their ideas to those audiences.

CONTENT LITERACY SKILLS

Students will employ critical thinking, reading, writing, speaking, and listening skills during this unit. They will also practice problem solving tactics in their individual and group efforts.

SUPPORTING RESOURCES

[Middle School Computers Canvas Page](#)

SOCIAL-EMOTIONAL SKILLS

Responsible Decision Making

The ability to successfully regulate one's emotions, thoughts, and behaviors in different situations — effectively managing stress, controlling impulses, and motivating oneself. The ability to set and work toward personal and academic goals.

- Impulse control
- Stress management
- Self-discipline
- Self-motivation
- Goal-setting
- Organizational skills

The focus on how computer science impacts the world and how to establish successful classroom culture and expectations gives students opportunities to develop skill in self-discipline, self-motivation, goal setting and organizational skills.

KEY LEARNING EXPERIENCES

- Students will investigate computer science impacts on the world and demonstrate learning through blended learning applications and presentations.

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UNIT 2: Robot Construction

ESSENTIAL QUESTION

How do you create a robot?

BIG IDEAS

- Students understand how to assemble a basic robot to accomplish specific tasks.
- Students understand how to utilize simple machines in robots.
- 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 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. bump, gyro, distance, touch, and color)
- What are the basic drive commands (for basic motor commands) and encoders (to move individual motors)?
- What simple machines are employed in a robot, and how do each of them work to give mechanical advantage?
- What are gears, and how do they assist in mechanical advantage?
- What are first, second and third class levers?
- How are conditional statements (if/then) used in coding?
- How are loops used in coding?

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?
- What are some strategies to use when I have a problem?
- How are gear ratios used in robots?
- How does the bump sensor work?
- How does the gyro sensor and wait until command 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 we create algorithms? How do we create pseudocode?
- How can I troubleshoot problems that arise in coding?

Reflective

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

FOCUS STANDARDS

- **1.0 Empowered Learner**

1b. Students identify and develop online networks within school policy, and customize their learning environments in ways that support their learning, in collaboration with an educator.

1c. Students actively seek performance feedback from people, including teachers, and from functionalities embedded in digital tools to improve their learning process, and they select technology to demonstrate their learning in a variety of ways.

1d. Students are able to navigate a variety of technologies and transfer their knowledge and skills to learn how to use new technologies.

- **2.0 Digital Citizen**

2a. Students manage their digital identities and reputations within school policy, including demonstrating an understanding of how digital actions are never fully erasable.

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- **3.0 Knowledge Constructor:**

3c. Students locate and collect resources from a variety of sources and organize assets into collections for a wide range of projects and purposes.

3d. Students explore real-world issues and problems and actively pursue an understanding of them and solutions for them.

- **4.0 Innovative Designer**

4a. Students engage in a design process and employ it to generate ideas, create innovative products or solve authentic problems.

4c. Students engage in a design process to develop, test and revise prototypes, embracing the cyclical process of trial and error and understanding problems or setbacks as potential opportunities for improvement.

4d. Students demonstrate an ability to persevere and handle greater ambiguity as they work to solve

open-ended problems.

- **5.0 Computational Thinker**

5a. Students practice defining problems to solve by computing for data analysis, modeling or algorithmic thinking.

5c. Students break problems into component parts, identify key pieces and use that information to problem solve.

- **6.0 Creative Communicator**

6a. Students select appropriate platforms and tools to create, share and communicate their work effectively.

6b. Students create original works or responsibly repurpose other digital resources into new creative works.

6c. Students communicate complex ideas clearly using various digital tools to convey the concepts textually, visually, graphically, etc.

6d. Students publish or present content designed for specific audiences and select platforms that will effectively convey their ideas to those audiences.

- **7.0 Global Collaborator**

7b. Students use collaborative technologies to connect with others, including peers, experts and community members, to learn about issues and problems or to gain broader perspective.

7c. Students determine their role on a team to meet goals, based on their knowledge of technology and content, as well as personal preference.

CONTENT LITERACY SKILLS

Students will employ critical thinking, reading, writing, speaking, and listening skills during this unit. They will also practice problem solving tactics in their individual and group efforts.

SUPPORTING RESOURCES

[Middle School Computers Canvas Page](#)

SOCIAL-EMOTIONAL SKILLS

The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. The ability to communicate clearly, listen well, cooperate with others, resist inappropriate social pressure, negotiate conflict constructively, and seek and offer help when needed.

- **Communication**
- **Social engagement**
- **Relationship-building**
- **Teamwork**

The focus in this unit on intentional skill development in the areas of problem solving, computational thinking, team building, and classroom structures developed allows students to develop the skill of communication, social engagement, relationship building and teamwork.

KEY LEARNING EXPERIENCES

- Students will participate in team building activities.
- Students will participate in problem solving activities.
- Students will participate in structured activities that train and teach students how the classroom will be organized for future student success.
- Students will participate in a design thinking challenge. Students will utilize the design thinking process to present their process.

8th Grade ‘Design and Robotics’



UNIT 3: Design Process

ESSENTIAL QUESTION

BIG IDEAS

What is good design?

- Students use the design process to create, innovate, and overcome challenges.
- Students have opportunities to empathize, define, ideate, prototype, and test.
- Students design individually, with a partner, or with a team.
- Students consider how to design for the world around us.

What is the best way to design the solution to an issue/problem?

GUIDING QUESTIONS

Content

- What is the design process?
 - Empathize
 - Define
 - Ideate
 - Prototype
 - Test
- What is the ‘Robotics Problem Solving Cycle?’
 - Establish Problem - Empathize with an issue and define a problem and its causes
 - Consider Solutions - Ideate a Solution
 - Act & Test - Prototype a Solution
 - Review Troubleshooting - Test and Troubleshoot
- What does it mean to empathize? Define? Ideate? Prototype? Test?
- Why should I empathize? Define? Ideate? Prototype? Test?
- How do I empathize? Define? Ideate? Prototype? Test?
- What are strategies to use to problem-solve?

Process

- What purpose does observation serve?
- Consider the statement, “Actions speak louder than words”. I observe that what someone says and what they do are two different things. What does that mean?
- What is the purpose of a guiding statement?
- What are some important structures to understand when ideating?

- How can I describe all the steps in the procedure?

Reflective

- 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?
- Is there 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?

FOCUS STANDARDS

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- **4.0 Innovative Designer**

4a. Students engage in a design process and employ it to generate ideas, create innovative products or solve authentic problems.

4b. Students select and use digital tools to support a design process and expand their understanding to identify constraints and trade-offs and to weigh risks.

4c. Students engage in a design process to develop, test and revise prototypes, embracing the cyclical process of trial and error and understanding problems or setbacks as potential opportunities for improvement.

4d. Students demonstrate an ability to persevere and handle greater ambiguity as they work to solve open-ended problems.

- **5.0 Computational Thinker**

5a. Students practice defining problems to solve by computing for data analysis, modeling or algorithmic thinking.

5b. Students find or organize data and use technology to analyze and represent it to solve problems and make decisions.

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- **6.0 Creative Communicator**

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- **7.0 Global Collaborator**

7a. Students use digital tools to interact with others to develop a richer understanding of different perspectives and cultures.

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7c. Students determine their role on a team to meet goals, based on their knowledge of technology and content, as well as personal preference.

7d. Students select collaborative technologies and use them to work with others to investigate and develop solutions related to local and global issues.

CONTENT LITERACY SKILLS

Students will employ critical thinking, reading, writing, speaking, and listening skills during this unit. They will also practice problem solving tactics in their individual and group efforts.

SUPPORTING RESOURCES

SOCIAL-EMOTIONAL SKILLS

The ability to make constructive choices about personal behavior and social interactions based on ethical standards, safety concerns, and social norms. The realistic evaluation of consequences of various actions, and a consideration of the well-being of oneself and others.

- **Identifying problems**
- **Analyzing situations**
- **Solving problems**
- **Evaluating**
- **Reflecting**
- **Ethical responsibility**

The focus of this unit is on design. The design process in this unit allows students to develop the skills of identifying problems, analyzing situations, solving problems, evaluating and reflecting.

KEY LEARNING EXPERIENCES

- Demonstrations and labs will allow students to experience the design process individually and collaboratively.

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UNIT 4: Advanced Designs

ESSENTIAL QUESTION

How do you build a robot and modify it to complete a challenge?

BIG IDEAS

- Students assemble and complete a challenge with a fully functional robot.
- Students problem solve and persevere through a design challenge.
- Students collaborate to deepen knowledge of design and building processes.
- Students problem solve and persevere through design challenges by utilizing team members, classroom structures and supports previously established.
- Students will assemble and complete challenges with a fully functional robot.

GUIDING QUESTIONS

Content

- What skills do I need to modify a robot?
- How do I pair and use a controller?

Process

- How do I code a robot to complete a series of tasks or challenges?
- How do I improve my current robot to overcome new obstacles?

Reflection

- Why do we change?
- What did I learn from a failure?
- Why is it important to consider multiple solutions to an issue?

Capstone Design and Robotics Strands

- Robotics - Design Your Own Challenge
- Laser Engraver - Cut Something that gets built
- 3D Printer - Movable Prints

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CONTENT LITERACY SKILLS

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SUPPORTING RESOURCES

[Middle School Computers Canvas Page](#)

[Learn to Code 1 and 2, Teacher Guide on iBooks](#)

SOCIAL-EMOTIONAL SKILLS

The ability to make constructive choices about personal behavior and social interactions based on ethical standards, safety concerns, and social norms. The realistic evaluation of consequences of various actions, and a consideration of the well-being of oneself and others.

- **Identifying problems**
- **Analyzing situations**
- **Solving problems**
- **Evaluating**
- **Reflecting**
- **Ethical responsibility**

The focus in this unit is on processes. The process of coding in this unit allows students to develop the skill of identifying problems, analyzing situations, solving problems, evaluating and reflecting.

KEY LEARNING EXPERIENCES

- Students will complete Learn to Code 1 in Swift Playgrounds.
- Students will complete Learn to Code 2 in Swift Playgrounds.