HOWELL TOWNSHIP
PUBLIC SCHOOLS

COMPUTERS CURRICULUM EXPANSION

ROBOTICS

GRADE K-8

BOARD APPROVED: August 23, 2017

Unit of Study- Engineering: Robotics
Grade K

Suggested Timeframe: 4 lessons

Learning Goals
8.2.2.B.4- Identify how the ways people live and work has changed because of technology. **8.2.5.E.2-** Demonstrate an understanding of how a computer takes input of data, processes and stores the data through a series of commands, and outputs information. **8.2.5.E.3-** Using a simple, visual programming language, create a program using loops, events and procedures to generate specific output. **8.2.5.E.4-** Use appropriate terms in conversation (e.g., algorithm, program, debug, loop, events, procedures, memory, storage, processing, software, coding, procedure, and data).

Essential Questions	Enduring Understanding
Can you select the proper sequence to move a mobile robot to go around an obstacle? "Can you make your robot find the honey (treasure) on the obstacle course?" Can you have different algorithms for the same event?	The students will understand that… robots can be programmed to move in different ways to accomplish the same task. It helps to plan a route before going on a journey.

Learning Targets
Students will be able to: ● define and utilize computer science vocabulary (algorithm, event, debug) ● form an algorithm ● create an event ● debug an issue found to make the code run ● code a robot to perform a task

Instructional Activities
To assist in meeting the goals of this unit of study, students may: ● Program the steps of a robot for simple maneuvers including: move forward, move backward, turn right, and turn left. ● Set up an obstacle course for the robot to complete. ● Compare two different types of algorithm codes that complete the same event.

Sample Assessments
To show evidence of meeting the goals unit of study, students may be assessed as follows: ● successfully writing an algorithm. ● state how computer science affects the world that we live in. ● correctly use computer science terminology in conversations. ● completing an event. ● teacher observation ● teacher created assessments ● completed projects

Modifications	
Special Education	Adhere to IEP/504s and provide extra time, guided practice/notes.
English Language Learners	Provide bilingual subtitles and vocabulary introduction mini-lessons.
Gifted Students	Provide extension activities related to the topic being discussed.

Resources
● Sampling of robotics: BeeBot, Osmo, Codapillar, etc. ● Literacy Connections: ○ First Robotics By: Nancy Benovich Gilby ○ Artificial Intelligence By: David Jeffers ○ Robots at Work and Play By: Tony Hyland ○ Check the catalog on Destiny for additional literacy connections about robotics

In this unit plan, the following 21st Century Life and Careers skills are addressed:				
Check ALL that apply— **21st Century Themes**			**Indicate whether these skills are:** · **E—encouraged** · **T—taught** · **A—assessed**	**Career Ready Practices**
9.1	**Personal Financial Literacy**			**CRP1**. Act as a responsible and contributing citizen and employee.
	Income and Careers		ETA	**CRP2.** Apply appropriate academic and technical skills.
	Money Management			**CRP3.** Attend to personal health and financial well-being.
	Credit and Debt Management		ET	**CRP4.** Communicate clearly and effectively and with reason.
	Planning, Saving, and Investing			**CRP5.** Consider the environmental, social and economic impacts of decisions.
	Becoming a Critical Consumer		E	**CRP6.** Demonstrate creativity and innovation.
	Civic Financial Responsibility			**CRP7.** Employ valid and reliable research strategies.
	Insuring and Protecting		ET	**CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
9.2	**Career Awareness, Exploration, and Preparation**			**CRP9.** Model integrity, ethical leadership and effective management.
X	Career Awareness		E	**CRP10.** Plan education and career paths aligned to personal goals.
X	Career Exploration		ET	**CRP11.** Use technology to enhance productivity.
X	Career Preparation			**CRP12.** Work productively in teams while using cultural global competence.

Unit of Study- Engineering: Robotics
Grade 1

Suggested Timeframe: 4 lessons

Learning Goals
8.2.2.B.4- Identify how the ways people live and work has changed because of technology. **8.2.5.E.2-** Demonstrate an understanding of how a computer takes input of data, processes and stores the data through a series of commands, and outputs information. **8.2.5.E.3-** Using a simple, visual programming language, create a program using loops, events and procedures to generate specific output. **8.2.5.E.4-** Use appropriate terms in conversation (e.g., algorithm, program, debug, loop, events, procedures, memory, storage, processing, software, coding, procedure, and data).

Essential Questions	Enduring Understanding
How can you use the computer to make your robot do different things? What's a gear used for? What happens if one gear moves clockwise and the other moves counter clockwise on a robot?	Students will understand that… Computers are used to program robots. Gears transfer mechanical energy from place to place. Clockwise and counterclockwise moves a robot in different directions.

Learning Targets
Students will be able to: ● define and utilize computer science vocabulary (algorithm, event, gear, debug) ● form an algorithm ● create an event ● debug an issue found to make the code run ● code a robot to perform a task ● Define how gears are moved when code is sent to the robot.

Instructional Activities
To assist in meeting the goals of this unit of study, students may: ● Study the basic internal components of the robot (gears) by sending code to the robot to see how the gears move. Do gears move counterclockwise or clockwise when a robot moves forward? ● Use a iPad to move the robot based on an algorithm the students create. ● Compare the connection of gears to real world applications.

Sample Assessments
To show evidence of meeting the goals unit of study, students may be assessed as follows: ● successfully writing an algorithm. ● state how computer science affects the world that we live in. ● correctly use computer science terminology in conversations. ● completing an event. ● teacher observation ● teacher created assessments ● completed projects

Modifications	
Special Education	Adhere to IEP/504s and provide extra time, guided practice/notes.
English Language Learners	Provide bilingual subtitles and vocabulary introduction mini-lessons.
Gifted Students	Provide extension activities related to the topic being discussed.

Resources
● Sampling of robotics: mBots, littleBits, Osmo, Bee Bots, etc. ● Literacy Connections: ○ First Robotics By: Nancy Benovich Gilby ○ Artificial Intelligence By: David Jeffers ○ Robots at Work and Play By: Tony Hyland ○ Check the catalog on Destiny for additional literacy connections about robotics

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	Income and Careers		ETA	**CRP2.** Apply appropriate academic and technical skills.
	Money Management			**CRP3.** Attend to personal health and financial well-being.
	Credit and Debt Management		ET	**CRP4.** Communicate clearly and effectively and with reason.
	Planning, Saving, and Investing			**CRP5.** Consider the environmental, social and economic impacts of decisions.
	Becoming a Critical Consumer		E	**CRP6.** Demonstrate creativity and innovation.
	Civic Financial Responsibility			**CRP7.** Employ valid and reliable research strategies.
	Insuring and Protecting		ET	**CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
9.2	**Career Awareness, Exploration, and Preparation**			**CRP9.** Model integrity, ethical leadership and effective management.
X	Career Awareness		E	**CRP10.** Plan education and career paths aligned to personal goals.
X	Career Exploration		ET	**CRP11.** Use technology to enhance productivity.
X	Career Preparation			**CRP12.** Work productively in teams while using cultural global competence.

Unit of Study- Engineering: Robotics
Grade 2

Suggested Timeframe: 4 lessons

Learning Goals
8.2.2.B.4- Identify how the ways people live and work has changed because of technology. **8.2.5.E.2-** Demonstrate an understanding of how a computer takes input of data, processes and stores the data through a series of commands, and outputs information. **8.2.5.E.3-** Using a simple, visual programming language, create a program using loops, events and procedures to generate specific output. **8.2.5.E.4-** Use appropriate terms in conversation (e.g., algorithm, program, debug, loop, events, procedures, memory, storage, processing, software, coding, procedure, and data).

Essential Questions	Enduring Understanding
What are two different ways that you can use the same robot? What types of difficult jobs can a robot perform?	The students will understand that… Robots are designed for specific and multiple purposes. Businesses use robots for difficult tasks that humans cannot perform.

Learning Targets
Students will be able to: ● define and utilize computer science vocabulary (algorithm, event, sensors, debug) ● form an algorithm ● create an event ● debug an issue found to make the code run ● code a robot to perform a task

Instructional Activities
To assist in meeting the goals of this unit of study, students may: ● Create two different uses for the same type of robot. An example of this would be the mBot robot to help move materials or using the robot in Robot Wars. ● Have them personalize their learning by deciding what is the 'job' of their robot. ● Solve a task with their robot that a human may have difficulty performing.

Sample Assessments
To show evidence of meeting the goals unit of study, students may be assessed as follows: ● successfully writing an algorithm. ● state how computer science affects the world that we live in. ● correctly use computer science terminology in conversations. ● completing an event. ● teacher observation ● teacher created assessments ● completed projects

Modifications	
Special Education	Adhere to IEP/504s and provide extra time, guided practice/notes.
English Language Learners	Provide bilingual subtitles and vocabulary introduction mini-lessons.
Gifted Students	Provide extension activities related to the topic being discussed.

Resources
● Sampling of robotics: mBots, Ozobots, littleBits, etc. ● Literacy Connections: ○ First Robotics By: Nancy Benovich Gilby ○ Artificial Intelligence By: David Jeffers ○ Robots at Work and Play By: Tony Hyland ○ Check the catalog on Destiny for additional literacy connections about robotics

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	Income and Careers		ETA	**CRP2.** Apply appropriate academic and technical skills.
	Money Management			**CRP3.** Attend to personal health and financial well-being.
	Credit and Debt Management		ET	**CRP4.** Communicate clearly and effectively and with reason.
	Planning, Saving, and Investing			**CRP5.** Consider the environmental, social and economic impacts of decisions.
	Becoming a Critical Consumer		E	**CRP6.** Demonstrate creativity and innovation.
	Civic Financial Responsibility			**CRP7.** Employ valid and reliable research strategies.
	Insuring and Protecting		ET	**CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
9.2	**Career Awareness, Exploration, and Preparation**			**CRP9.** Model integrity, ethical leadership and effective management.
X	Career Awareness		E	**CRP10.** Plan education and career paths aligned to personal goals.
X	Career Exploration		ET	**CRP11.** Use technology to enhance productivity.
X	Career Preparation			**CRP12.** Work productively in teams while using cultural global competence.

Unit of Study- Engineering: Robotics
Grade 3

Suggested Timeframe: 4 lessons

Learning Goals
8.2.5.A.4- Compare and contrast how technologies have changed over time due to human needs and economic, political and/or cultural influences. **8.2.5.B.2-** Examine systems used for recycling and recommend simplification of the systems and share with product developers. **8.2.5.B.3-** Investigate ways that various tech **8.2.5.B.6-** Compare and discuss how technologies have influenced history in the past century. **8.2.5.E.1-** Identify how computer programming impacts our everyday lives.

Essential Questions	Enduring Understanding
Can you create the same event with two different types of coding languages? Are sensors the same for every type of robot?	Students understand that... There are different languages to make a robot move, including light codes and computer coding (Blockly, Java, etc.) Sensors allow a robot to interact intelligently with its environment.

Learning Targets
Students will be able to: ● define and utilize computer science vocabulary (algorithm, event, sensors, debug) ● form an algorithm ● create an event ● debug an issue found to make the code run ● code a robot to perform a task

Instructional Activities
To assist in meeting the goals of this unit of study, students may: ● Program a robot using a variety of coding languages. An example of this would be using Ozobot robots to draw the light codes and then replicate this event by coding the Ozobot on the computer with OzoBlockly. ● Take apart a robot and look at the physical sensors on the robot.

Sample Assessments
To show evidence of meeting the goals unit of study, students may be assessed as follows: ● successfully writing an algorithm. ● state how computer science affects the world that we live in. ● correctly use computer science terminology in conversations. ● completing an event. ● teacher observation ● teacher created assessments ● completed projects

Modifications	
Special Education	Adhere to IEP/504s and provide extra time, guided practice/notes.
English Language Learners	Provide bilingual subtitles and vocabulary introduction mini-lessons.
Gifted Students	Provide extension activities related to the topic being discussed.

Resources
● Sampling of robotics: Ozobots, Sphero Sprk+, etc. ● OzoBlockly, markers, paper ● Google Chrome ● Safari ● Literacy Connections: ○ First Robotics By: Nancy Benovich Gilby ○ Artificial Intelligence By: David Jeffers ○ Robots at Work and Play By: Tony Hyland ○ Check the catalog on Destiny for additional literacy connections about robotics

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	Income and Careers		ETA	**CRP2.** Apply appropriate academic and technical skills.
	Money Management			**CRP3.** Attend to personal health and financial well-being.
	Credit and Debt Management		ET	**CRP4.** Communicate clearly and effectively and with reason.
	Planning, Saving, and Investing		E	**CRP5.** Consider the environmental, social and economic impacts of decisions.
	Becoming a Critical Consumer		ETA	**CRP6.** Demonstrate creativity and innovation.
	Civic Financial Responsibility		E	**CRP7.** Employ valid and reliable research strategies.
	Insuring and Protecting		ETA	**CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
9.2	**Career Awareness, Exploration, and Preparation**			**CRP9.** Model integrity, ethical leadership and effective management.
X	Career Awareness		ET	**CRP10.** Plan education and career paths aligned to personal goals.
X	Career Exploration		ET	**CRP11.** Use technology to enhance productivity.
X	Career Preparation			**CRP12.** Work productively in teams while using cultural global competence.

Unit of Study- Engineering: Robotics
Grade 4

Suggested Timeframe: 4 lessons

Learning Goals
8.2.5.A.4- Compare and contrast how technologies have changed over time due to human needs and economic, political and/or cultural influences. **8.2.5.B.2-** Examine systems used for recycling and recommend simplification of the systems and share with product developers. **8.2.5.B.3-** Investigate ways that various tech **8.2.5.B.6-** Compare and discuss how technologies have influenced history in the past century. **8.2.5.E.1-** Identify how computer programming impacts our everyday lives.

Essential Questions	Enduring Understanding
How can math be used to help in building things? Can you build a robot to do a human activity like moving or picking up an object?	The students will understand that… You can predict how machines will operate and then test your predictions. Sensors enable robot to interact with the world in intelligent ways when so programmed. Robots can be created and programmed to do human like activities. Simple machines are used to make work easier. Mathematics is used in engineering.

Learning Targets
Students will be able to: ● define and utilize computer science vocabulary (algorithm, event, sensors, debug) ● form an algorithm ● create an event ● debug an issue found to make the code run ● code a robot to perform a task

Instructional Activities
To assist in meeting the goals of this unit of study, students may: ● Work in groups to code a robot to move/pick up an object. ● Use math skills to create if/then statements when the robot is moving. ● Create a robot that could make work easier.

Sample Assessments
To show evidence of meeting the goals unit of study, students may be assessed as follows: ● successfully writing an algorithm. ● state how computer science affects the world that we live in. ● correctly use computer science terminology in conversations. ● completing an event. ● teacher observation ● teacher created assessments ● completed projects

Modifications	
Special Education	Adhere to IEP/504s and provide extra time, guided practice/notes.
English Language Learners	Provide bilingual subtitles and vocabulary introduction mini-lessons.
Gifted Students	Provide extension activities related to the topic being discussed.

Resources
● Sampling of robotics: Sphero Sprk +, mBots, Ozobots, WeDo, etc. ● Literacy Connections: ○ First Robotics By: Nancy Benovich Gilby ○ Artificial Intelligence By: David Jeffers ○ Robots at Work and Play By: Tony Hyland ○ Check the catalog on Destiny for additional literacy connections about robotics

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	Money Management			**CRP3.** Attend to personal health and financial well-being.
	Credit and Debt Management		ET	**CRP4.** Communicate clearly and effectively and with reason.
	Planning, Saving, and Investing		E	**CRP5.** Consider the environmental, social and economic impacts of decisions.
	Becoming a Critical Consumer		ETA	**CRP6.** Demonstrate creativity and innovation.
	Civic Financial Responsibility		E	**CRP7.** Employ valid and reliable research strategies.
	Insuring and Protecting		ETA	**CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
9.2	**Career Awareness, Exploration, and Preparation**			**CRP9.** Model integrity, ethical leadership and effective management.
X	Career Awareness		ET	**CRP10.** Plan education and career paths aligned to personal goals.
X	Career Exploration		ET	**CRP11.** Use technology to enhance productivity.
X	Career Preparation			**CRP12.** Work productively in teams while using cultural global competence.

Unit of Study- Engineering: Robotics
Grade 5

Suggested Timeframe: 4 lessons

Learning Goals
8.2.5.A.4- Compare and contrast how technologies have changed over time due to human needs and economic, political and/or cultural influences. **8.2.5.B.2-** Examine systems used for recycling and recommend simplification of the systems and share with product developers. **8.2.5.B.3-** Investigate ways that various tech **8.2.5.B.6-** Compare and discuss how technologies have influenced history in the past century. **8.2.5.E.1-** Identify how computer programming impacts our everyday lives.

Essential Questions	Enduring Understanding
How can you build and program a robot to move in different ways? How can you use mathematics to make programming a robot easier?	Robots can move in different ways under the control of a program the students create. Mathematics can be used to help make a engineering task much easier.

Learning Targets
Students will be able to: ● define and utilize computer science vocabulary (algorithm, event, sensors, debug) ● form an algorithm ● create an event ● debug an issue found to make the code run ● code a robot to perform a complex task

Instructional Activities
To assist in meeting the goals of this unit of study, students may: ● Use if/then statements to have a robot decide on a path. ● Use mathematics to change the speed of a robot.

Sample Assessments
To show evidence of meeting the goals unit of study, students may be assessed as follows: ● successfully writing an algorithm. ● state how computer science affects the world that we live in. ● correctly use computer science terminology in conversations. ● completing an event. ● teacher observation ● teacher created assessments ● completed projects

Modifications	
Special Education	Adhere to IEP/504s and provide extra time, guided practice/notes.
English Language Learners	Provide bilingual subtitles and vocabulary introduction mini-lessons.
Gifted Students	Provide extension activities related to the topic being discussed.

Resources
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	Money Management			**CRP3.** Attend to personal health and financial well-being.
	Credit and Debt Management		ETA	**CRP4.** Communicate clearly and effectively and with reason.
	Planning, Saving, and Investing		E	**CRP5.** Consider the environmental, social and economic impacts of decisions.
	Becoming a Critical Consumer		ETA	**CRP6.** Demonstrate creativity and innovation.
	Civic Financial Responsibility		E	**CRP7.** Employ valid and reliable research strategies.
	Insuring and Protecting		ETA	**CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
9.2	**Career Awareness, Exploration, and Preparation**			**CRP9.** Model integrity, ethical leadership and effective management.
X	Career Awareness		ET	**CRP10.** Plan education and career paths aligned to personal goals.
X	Career Exploration		ET	**CRP11.** Use technology to enhance productivity.
X	Career Preparation			**CRP12.** Work productively in teams while using cultural global competence.