# Robotics (Grade 7)

Content Area: **Technology**
Course(s): **Williamstown Middle School Course**
Time Period: **6 weeks**
Length: **1 Cycle (30 Days)**
Status: **Published**

## Unit Overview

This is an introduction course in computer programming through robotics. We will be utilizing Lego Mindstorm kits, EV3 software and various Lego Robotics materials. The objective of this course is to introduce the student to basic programming as well as problem solving strategies. Students will develop, build and program a LEGO Mindstorm robot with the goal of successfully navigating challenges.

Topics may include motor control, gear ratios, torque, friction, sensors, timing, program loops, logic gates, decision-making, timing sequences. As students program, they learn about technology, sensors, and applied logic through the use of conditional statements, loops, and wait states. Students learn to manage the digital technologies that control the world they live in. Students will work hands-on in teams and individually to design, build, program, and document their progress. Students will participate in challenges inspired by LEGO Education provided challenge mats and previous US First Lego League challenges. Through this process, they learn about systems, resource allocation, and time management. Their final challenge will include a presentation based on their robot design. By participating in friendly classroom competitions, team members, through gracious professionalism, work together to solve open-ended challenges where they develop innovative problem solving skills needed to compete in the global economy. This leads to an increased awareness of STEM-related careers.

We hope that this class will provide motivation for students to continue in computer science and engineering courses.

## Transfer

Students will be able to independently use their learning to...

1. Identify and explain the elements of a robotic devices.
2. Identify Lego pieces in the Mindstorms kit.
3. Demonstrate the ability to organize and manage parts, pieces and lab equipment orderly and safely.
4. Experiment with structures using Lego constructive pieces.
5. Identify the input and output devices to a Lego EV3 robot.
6. Recognize the importance of design in a computer program.
7. Identify the programming environment of EV3.
8. Use Icons & settings to understand how they work.
9. Apply program to test sensor devices.
10. Build a basic robot & program robot.
11. Evaluate sensor feedback.
12. Apply measurement and geometry to calculate robot navigation.
13. Calculate & apply sensor threshold values in a problem-based environment.
14. Understand sequential programming and conditional statements.
15. Demonstrate the appropriate use of time in the completion of as assignment.
16. Build robot using intermediate design and program multi-step challenge.

17. Redesign & add structural & sensor elements to robot for challenges.
18. Participate in culminating field challenge.
19. Present robot design using multimedia software.

## Meaning

## Understandings

Students will understand that...

1. Robot elements are combined to create useful robotics for society.

2. Interaction between humans and robotic technology affect everyday life.

3. Participatory and competitive challenges with technology improve motivation and achievement.

4. Digital technologies are used to develop and communicate ideas in a global environment.

5. The robot is only as smart as we make it. We must code it for every possible situation and try to forsee all possible problems and create solutions to problems that don't yet exist.

6. Successful navigation through a challenge can only be achieved through multiple iterations of a robot and coding.

7. Failure is part of the design and creation process. We learn from our mistakes and reiterate. We "Learn by Doing"

8. Not all Robot Building solutions are found in a book and may require critical thinking and problem solving skills to create custom solutions to solve a problem.

## Essential Questions

Students will keep considering...

1. How has the role of robots in society evolved as technology changed?

2. How can interaction between humans and robotic technology affect everyday life?

3. How can participatory and competitive challenges with technology improve motivation and achievement?

4. How can digital technologies be used to develop and communicate ideas in a global environment?

## Application of Knowledge and Skill

### Students will know...

Students will know...

1. The purpose of Robotics in our society and how the advancements can help society as well as the limitations of a pre-programmed machine.

2. How to utilize visual step by step instructions to build a basic robot

3. How to take a basic robot and add to it to increase effectiveness, usefulness and ability

4. How to creatively program (code) the robot to move and successfully perform tasks

5. How to hypothesize possible problems when a robot is running autonomously and program possible solutions to enable the robot to still be successful in its goal.

### Students will be skilled at...

Students will be skilled at...

1. Labeling the elements of a robot.

2. Building and programming a robot to perform pre-defiined tasks.

3. Collaborating with team/class-mates in order to find possible solutions to a problem.

4. Analyzing advancements in robotics that create societal concerns regarding ethical practices with technology.

5. Demonstrating that robots communicate with the computer through a set of instructions referred to as a computer language, which instructs robots on input, process, and output.

6. Selecting and using appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.

7. Solving, through the design process, a challenge, that will incorporate science, math and technology principles throughout the design process.

8. Annotating their design and learning efforts in a collaborative environment using digital tools to facilitate the communication process.

9. Using digital tools and media-rich resources to create and publish presentation information on their robot design and how it would be used to overcome a local or global issue or event.

## Academic Vocabulary

# Vocab - Robotics

EV3, Motor (Small, Large), Sensor, Ports, Brick, Code, Construct, Engineering, Firmware, Interactive Servo Motor, Light Sensor, Infrared Remote Control, Infrared Beacon, Deconstruct, Touch Sensor, Color Sensor, Ultrasonic Sensor, Connector Cable, Straight Beams, Angular Beams, Axles, Angle Connectors, Gears, Wheels, Tires, Tire Sprockets, Ball Socket and Steele Ball, Axle Connector, H-Frame, Knob Wheel, Pins and Axle Pins,

## Learning Goal 1

Students will understand how robot elements are combined to create useful robotics for society.

| | |
|---|---|
| 12.9.3.ST | Science, technology, engineering & mathematics |
| TECH.8.1.8 | Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. |
| TECH.8.2.8 | Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. |

## Target 1

Students will be able to define the Elements of a Robot in the 21st Century.

| | |
|---|---|
| 12.9.3.ST-ET.2 | Display and communicate STEM information. |

| | |
|---|---|
| TECH.8.1.8.A.2 | Create a document (e.g., newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability. |
| TECH.8.1.8.A.CS1 | Understand and use technology systems. |
| TECH.8.1.8.A.CS2 | Select and use applications effectively and productively. |
| TECH.8.1.8.B.CS1 | Apply existing knowledge to generate new ideas, products, or processes. |
| TECH.8.1.8.B.CS2 | Create original works as a means of personal or group expression. |

## Target 2

Students will understand that robots are machines that are built and programmed to perform predefined tasks and will be able to use digital tools to maniupulate the robot for specified purposes.

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|---|---|
| TECH.8.1.8.A | Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations. |
| TECH.8.1.8.A.1 | Demonstrate knowledge of a real world problem using digital tools. |
| TECH.8.1.8.A.3 | Use and/or develop a simulation that provides an environment to solve a real world problem or theory. |
| TECH.8.1.8.A.CS1 | Understand and use technology systems. |
| TECH.8.1.8.A.CS2 | Select and use applications effectively and productively. |
| TECH.8.1.8.B.CS1 | Apply existing knowledge to generate new ideas, products, or processes. |
| TECH.8.1.8.B.CS2 | Create original works as a means of personal or group expression. |
| TECH.8.1.8.F.CS1 | Identify and define authentic problems and significant questions for investigation. |
| TECH.8.1.8.F.CS2 | Plan and manage activities to develop a solution or complete a project. |
| TECH.8.1.8.F.CS3 | Collect and analyze data to identify solutions and/or make informed decisions. |
| TECH.8.1.8.F.CS4 | Use multiple processes and diverse perspectives to explore alternative. |
| TECH.8.2.8.A.2 | Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system. |
| TECH.8.2.8.A.3 | Investigate a malfunction in any part of a system and identify its impacts. |
| TECH.8.2.8.C.1 | Explain how different teams/groups can contribute to the overall design of a product. |
| TECH.8.2.8.C.2 | Explain the need for optimization in a design process. |
| TECH.8.2.8.C.4 | Identify the steps in the design process that would be used to solve a designated problem. |
| TECH.8.2.8.E.1 | Identify ways computers are used that have had an impact across the range of human activity and within different careers where they are used. |

## Learning Goal 3

Students will be able to design, develop and complete robotic activities and challenges

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|---|---|
| TECH.8.1.8 | Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. |
| TECH.8.2.8 | Technology Education, Engineering, Design, and Computational Thinking - Programming: |

| | |
|---|---|
| | All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. |

## Target 1

Students will be able to solve, through a design process, a challenge, that will incorporate science, math and technology principles throughout the design process.

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|---|---|
| TECH.8.1.8.A.3 | Use and/or develop a simulation that provides an environment to solve a real world problem or theory. |
| TECH.8.1.8.A.4 | Graph and calculate data within a spreadsheet and present a summary of the results. |
| TECH.8.1.8.A.5 | Create a database query, sort and create a report and describe the process, and explain the report results. |
| TECH.8.1.8.A.CS1 | Understand and use technology systems. |
| TECH.8.1.8.A.CS2 | Select and use applications effectively and productively. |
| TECH.8.1.8.B.CS1 | Apply existing knowledge to generate new ideas, products, or processes. |
| TECH.8.1.8.B.CS2 | Create original works as a means of personal or group expression. |
| TECH.8.1.8.D.CS2 | Demonstrate personal responsibility for lifelong learning. |
| TECH.8.1.8.E.CS3 | Evaluate and select information sources and digital tools based on the appropriateness for specific tasks. |
| TECH.8.1.8.F.CS1 | Identify and define authentic problems and significant questions for investigation. |
| TECH.8.1.8.F.CS2 | Plan and manage activities to develop a solution or complete a project. |
| TECH.8.2.8.D.1 | Design and create a product that addresses a real world problem using a design process under specific constraints. |
| TECH.8.2.8.D.2 | Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook. |
| TECH.8.2.8.D.3 | Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution. |

## Target 2

Students will be able to annotate their design and learning efforts in a collaborative environment using digital tools to facilitate the communication process.

| | |
|---|---|
| TECH.8.1.8.A.2 | Create a document (e.g., newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability. |
| TECH.8.1.8.A.3 | Use and/or develop a simulation that provides an environment to solve a real world problem or theory. |
| TECH.8.1.8.A.CS1 | Understand and use technology systems. |
| TECH.8.1.8.A.CS2 | Select and use applications effectively and productively. |
| TECH.8.1.8.C.CS2 | Communicate information and ideas to multiple audiences using a variety of media and |

| | |
|---|---|
| | formats. |
| TECH.8.1.8.E.CS1 | Plan strategies to guide inquiry. |
| TECH.8.1.8.E.CS4 | Process data and report results. |
| TECH.8.2.8.C.5b | Create a technical sketch of a product with materials and measurements labeled. |
| TECH.8.2.8.E.4 | Use appropriate terms in conversation (e.g., programming, language, data, RAM, ROM, Boolean logic terms). |

## Summative Assessment

Students' will be evaluated for overal learning through the use of a high stakes common assessment "final exam". The exam will utilize a combination of multiple choice, matching, word bank and fill-in-the-blank questions as well as a rubric based final project.

## 21st Century Life and Careers

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|---|---|
| CRP.K-12.CRP1 | Act as a responsible and contributing citizen and employee. |
| CRP.K-12.CRP2 | Apply appropriate academic and technical skills. |
| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP5 | Consider the environmental, social and economic impacts of decisions. |
| CRP.K-12.CRP6 | Demonstrate creativity and innovation. |
| CRP.K-12.CRP8 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.K-12.CRP11 | Use technology to enhance productivity. |

## Formative Assessment and Performance Opportunities

Assessment throughout the 30 day cycle will be a combination of the following...

- Daily quick warm up exercises regarding previously learned information.

- Quizzes

- Assigned activities and group/individual project based assignments assessed using performance based rubric

- Self Assessment and group assessment

- Class participation

- Oral Presentation

- Exit Tickets

- Student Interviews

## Differentiation/Enrichment

- Individualized project topics
- Lesson extension
- Manipulative items
- Review and Practice exercises
- Self-Reflections
- Small group instruction
- Video and other visual presentations

## Unit Resources

http://www.ortop.org/

http://drgraeme.net/

http://www.nxtprograms.com/index.html

http://ceeo.tufts.edu/

http://ri.cmu.edu/

https://www.lego.com/en-us/mindstorms/?domainredir=mindstorms.lego.com

http://www.domabotics.com/

http://www.nebomusic.net/robotfindlost.html

https://www.robofest.net/

http://www.firstlegoleague.org/

http://stemrobotics.cs.pdx.edu/node/2643

http://robotics.benedettelli.com/wp-content/uploads/2014/04/Benedettelli_EV3L_EDU_CH1.pdf

ftp://www.sd78.bc.ca/downloads/public/SD78%20Documents%20&%20Forms/Coding/Codingrobotics/introduction-to-robotics-tablet-engb-5c71a011b63cd0c086f41ff03c4d8a67.pdf

https://quizlet.com/99203968/engineering-in-lego-ev3-robotics-lego-vocabulary-flash-cards/

- Chromebook
- EV3 Programming Software
- GSuite Applications
- LEGO Education EV3 Kit (Core Kit)

- Movie Snippets as Available
- Windows Laptop