MIDLAND PARK PUBLIC SCHOOLS
Midland Park, New Jersey
CURRICULUM

Robotics – Grade 6

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Superintendent of Schools:
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Approved by the Midland Park Board of Education on September 2017

NJSLS born on 9/2017

Intro to Robotics (Marking Period Course or Approximately 7- 8 weeks)

Course Description

Intro to Robotics is designed to enhance the students' exposure to computer programming, engineering, and STEAM principles. It will build upon their coding skills gained through their previous Computers classes. Students will work independently as well as in pairs to construct a robot. Problem solving skills will be required to successfully follow multi-step directions and troubleshoot any mistakes encountered along the way. Communication between students will be essential to this process. This course will culminate with students using the robot they have built and applying it to real world scenarios. Throughout this course students will rely on their communication, problem-solving, programming, scientific and mathematical skills to complete their assigned tasks.

Suggested Course Sequence:

Unit 1: Introduction To Robotics and Artificial Intelligence- 1-2 weeks

Unit 2: Building and Coding Basics - 1-2 weeks

Unit 3: Coding to Solve Problems- 1-2 weeks

Unit 4: Problem Solving and Advanced Programming with Robotics - 1-2 weeks

Content Area: Technology/Robotics

Unit Title: Introduction To Robotics and Artificial Intelligence

Grade Level: 6

Unit Summary: This unit will cover the basics of robots and how they have changed over time. It will introduce the concept of artificial intelligence and how it may impact our world in the future. Students will look for real world examples and explain the pros and cons.

Interdisciplinary Connections: Science, Technology, Engineering, Mathematics, Social Studies

21st Century Themes and Skills:

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology):

CPI#:	Statement:
NJSLS 8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
NJSLS 8.1.8.B.1	Synthesize and publish information about a local or global issue or event
NJSLS 8.1.8.D.3	Demonstrate an understanding of fair use and Creative Commons to intellectual property.
NJSLS 8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.
NJSLS 8.2.8.A.1	Research a product that was designed for a specific demand and identify how the product has changed to meet new demands
NJSLS 8.2.8.A.5	Describe how resources such as material, energy, information, time, tools, people, and capital contribute to a technological product or system.
NJSLS 8.2.8.B.4	Research examples of how humans can devise technologies to reduce the negative consequences of other technologies and present your findings.
NJSLS 8.2.8.B.5	Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries and societies.
NJSLS 9.3.ST.4	Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.
NJSLS 9.3.ST-SM.3	Analyze the impact that science and mathematics has on society.

Unit Essential Question(s):

- **How have robots impacted manufacturing methods?**
- **How will the increase of robots, automation and artificial intelligence change our world?**

Unit Enduring Understandings:

- Basic history of robotics
- Pros and cons of the impacts of artificial intelligence on society

Unit Learning Targets/Objectives:

Students will…

- Understand the history of robotics.
- Identify pros and cons of increased use of robots and automation.

- Evaluate impact artificial intelligence may have on society in the future.
- Identify new technologies and their pros and cons
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Formative Assessments:
Discussion, Teacher observations, Homework assignments, quiz

Summative/Benchmark Assessments:
Brief report on a new technology student has chosen to research

Resources/Materials (copy hyperlinks for digital resources):
Variety of videos from the Internet

Walking Robot
https://youtube.com/embed/rVlhMGQgDkY?rel=0

Model T assembly line-
http://safeshare.tv/x/ ShbgvwazCZ

Amazon Warehouse:
http://www.chonday.com/Videos/how-the-amazon-warehouse-works

Modifications:
Special Education Students - Allow errors, Rephrase questions, directions, and explanations, Modify expectations, check for understanding, peer tutoring
English Language Learners - Allow errors in speaking, Rephrase questions, directions, and explanations, Use Google Translate when necessary
At-Risk Students - Consult with Guidance Counselors and follow I&RS procedures/action plans
Gifted and Talented Students – Make Peer Leaders, provide extension activities

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
Course Intro	What is this course all about?	1 day
History of Robotics	How has robotics evolved	1 day
Current uses of robots and impacts on society	What are we using robots for today?	1 day
Artificial Intelligence	Basics of AI	1 day
Pros and cons of Robotics/AI	Understand impacts of robotics on society	1-2 days
Independent Research	Identify a specific form of robotic, automation or AI	2 Days

	and how it will impact society	

Teacher Notes:
Resources will change and be added over time and as new technologies are developed

Additional Resources
Click links below to access additional resources used to design this unit:

Content Area: Technology/Robotics

Unit Title: Building and Coding Basics

Grade Level: 6

Unit Summary: Students will be introduced to their LEGO Mindstorm kits and assigned a partner. Expectations and care guidelines will be reviewed. Students will unpack and organize kits and then begin construction of their robots. Upon completion of a basic LEGO robot they will begin input of basic commands.

Interdisciplinary Connections: Science, Technology, Engineering, Mathematics

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies. .
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals. .
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
NJSLS 9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
NJSLS 9.3.ST-ET.4	Apply the elements of the design process.
NJSLS 9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
NJSLS 9.3.ST-SM.1	Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
NJSLS 9.3.ST-SM.2	Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
NJSLS 8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
NJSLS 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.
NJSLS 8.2.8.A.3	Investigate a malfunction in any part of a system and identify its impacts.
NJSLS 8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
NJSLS 8.2.8.C.2	Explain the need for optimization in a design process.
NJSLS 8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem

Unit Essential Question(s):

- What's the most efficient way to build the robot and prepare for programming?
- How can we make the robot follow basic commands

Unit Enduring Understandings:

- Teamwork and communication is key to efficient and successful problem solving and robot building.

Unit Learning Targets/Objectives:

Students will...

- Organize their LEGO Mindstorm kits with their partner
- Construct a LEGO robot with their partner based on the instructions given

- Program their robot to move in a straight line, turn, move backwards
- Determine length of movements

Formative Assessments:
Self Assessment, Discussion, Teacher observations

Summative/Benchmark Assessments):
Students will work as a team to complete the construction of a robot

Resources/Materials (copy hyperlinks for digital resources):

Modifications:
Special Education Students - Allow errors, Rephrase questions, directions, and explanations, Modify expectations, check for understanding, allow additional time, alternative assessment, peer tutoring
English Language Learners - Allow errors in speaking, Rephrase questions, directions, and explanations, Use Google Translate when necessary, Allow additional time, alternative assessment
At-Risk Students - Consult with Guidance Counselors and follow I&RS procedures/action plans
Gifted and Talented Students – Make Peer Leaders, provide extension activities

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
Kit Organization	Organize and familiarize with the LEGO kit	2 days
Robot construction	Construct a basic LEGO robot	5-6 days
Robot Movement	Make the robots perform simple movements	2 days
Robot Programs	String multiple commands together to move the robot	2-3 days

Teacher Notes:
Follow teacher guide and use YouTube videos to supplement lessons

Additional Resources
Click links below to access additional resources used to design this unit:

Content Area: Technology/Robotics

Unit Title: Coding to Solve Problems

Grade Level: 6

Unit Summary: Students will delve into programming their robots during their units. They will work together to determine distances and ratios to make their robots move precisely to specific locations. Student pairs will complete a variety of tasks with their robots through programming. Tools may be need to be added to robots in order to complete some tasks.

Interdisciplinary Connections: Math, English, Science

21st Century Themes and Skills:

-CRP1 Act as a responsible and contributing citizen & employee.
-CRP2 Apply appropriate academic and technical skills.
-CRP4 Communicate clearly & effectively and with reason.
-CRP6 Demonstrate creativity & innovation.
-CRP8 Utilize critical thinking to make sense of problems & persevere in solving them.
-CRP11 Use technology to enhance productivity.
-CRP12 Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
NJSLS 8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools
NJSLS 8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory
NJSLS 8.1.8.F.1	Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.
NJSLS 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
NJSLS 8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
NJSLS 8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
NJSLS 8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.
NJSLS 9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
NJSLS 9.3.ST-ET.4	Apply the elements of the design process.
NJSLS 9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
NJSLS 9.3.ST-SM.1	Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
NJSLS 9.3.IT-PRG.6	Program a computer application using the appropriate programming language.

Unit Essential Question(s):

- **How can we most efficiently program a robot to perform specific tasks?**
- **How can we determine the distance each movement covers in a specific command?**

Unit Enduring Understandings:

- **Robots can perform a myriad of tasks if programmed correctly**

Unit Learning Targets/Objectives:

Students will...

- Program their robot to perform specific tasks
- Work together to solve problems
- Perform a multitude of tasks with their robots

Formative Assessments:
Discussion, Self Assessment, Teacher Observation

Summative/Benchmark Assessments:
Completion of assigned tasks for robots

Resources/Materials (copy hyperlinks for digital resources):

Classroom Activities for the Busy Teacher: EV3 (book)

LEGO MINDSTORMS EV3 Discovery Book (book)

Modifications:
Special Education Students - Allow errors, Rephrase questions, directions, and explanations, Modify expectations, check for understanding, additional time, alternative assessment, peer tutoring
English Language Learners - Allow errors in speaking, Rephrase questions, directions, and explanations, Use Google Translate when necessary, additional time, alternative assessment
At-Risk Students - Consult with Guidance Counselors and follow I&RS procedures/action plans
Gifted and Talented Students – Make Peer Leaders, provide extension activities

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
Robot Programming Activities	**Work with a partner to perform a wide variety of activities that will require precise programming**	4-5 days
Add tools to robot	**Add pieces that will allow robot to pick up objects**	1 day
Program robot to lift and move objects	**Program robots to get to an object and then lift it and move it to a target location**	3-4 days

Teacher Notes:
Follow activity guides and allow more advanced groups to move ahead.

Additional Resources
Click links below to access additional resources used to design this unit:

Content Area: Technology Robotics

Unit Title: Problem Solving and Advanced Programming with Robotics

Grade Level: 6

Unit Summary: This final unit will allow students to challenge themselves and their classmates. They will need to program their robots to complete mazes, follow lines and move objects to specific locations. They will also be able to write a code to solve a problem and then see if their classmates can write a code that will also solve the same problem.

Interdisciplinary Connections: Science, Math

21st Century Themes and Skills:

-CRP1 Act as a responsible and contributing citizen & employee.
-CRP2 Apply appropriate academic and technical skills.
-CRP4 Communicate clearly & effectively and with reason.
-CRP6 Demonstrate creativity & innovation.
-CRP8 Utilize critical thinking to make sense of problems & persevere in solving them.
-CRP11 Use technology to enhance productivity.
-CRP12 Work productively in teams while using cultural global competence.

Standards (Content and Technology):

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NJSLS 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
NJSLS 8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
NJSLS 8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
NJSLS 8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.
NJSLS 9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
NJSLS 9.3.ST-ET.4	Apply the elements of the design process.
NJSLS 9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
NJSLS 9.3.ST-SM.1	Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
NJSLS 9.3.ST-PRG.6	Program a computer application using the appropriate programming language.

Unit Essential Question(s):

- **How can we use robots to make tasks easier?**
- **How can we program robots most efficiently to complete tasks?**

Unit Enduring Understandings:

- **Knowledge of robotics and programming principles**

Unit Learning Targets/Objectives:

Students will...

- Work with a partner to solve problems and complete activities

- Communicate with other groups to see what methods they are using
- Observe how the designed program works and make adjustments
- Investigate how to solve problems stated
- Apply problem solving skills to activity
- Calculate movements needed
- Apply knowledge from class to solve problems

Formative Assessments:
Discussion, Self Assessment, Teacher Observation

Summative/Benchmark Assessments):
Successfully completed mazes and other challenges

Resources/Materials (copy hyperlinks for digital resources):

Classroom Activities for the Busy Teacher: EV3 (book)

LEGO MINDSTORMS EV3 Discovery Book (book)

Modifications:
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English Language Learners - Allow errors in speaking, Rephrase questions, directions, and explanations, Use Google Translate when necessary, additional time, alternative assessment
At-Risk Students - Consult with Guidance Counselors and follow I&RS procedures/action plans
Gifted and Talented Students – Make Peer Leaders, provide extension activities, Have them create problems for classmates to solve

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
Challenge Activities	**Challenge students to complete a variety of levels of robotics challenges**	4 days
Mazes	**Create mazes for student pairs to program their robots to solve**	4 days
Student challenges	**Explore what each pair of students can make their robot do.**	5 days

Teacher Notes:

New challenges can be added and found on-line
Use YouTube to help students visualize some of the activities

Additional Resources
Click links below to access additional resources used to design this unit: