



# Township of Ocean Schools

Assistant Superintendent  
Office of Teaching and Learning

## **SPARTAN MISSION:**

*Meeting the needs of all students with a proud tradition of academic excellence.*

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

## **Curriculum Development Timeline**

**School:** Township of Ocean Intermediate School

**Course:** Design and Modeling, Grade 6

**Department:** Applied Technology

| Board Approval | Supervisor      | Notes                                 |
|----------------|-----------------|---------------------------------------|
| August 2019    | Patrick O'Neill | Name Change/Revisions                 |
| August 2021    | Patrick O'Neill | Alignment to Standards                |
| August 2022    | Derek Tranchina | Incorporate State Mandate             |
| August 2024    | Erin Leahy      | Updated to Include New State Mandates |

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| Township of Ocean Pacing Guide |                                                                                                |
|--------------------------------|------------------------------------------------------------------------------------------------|
| Week                           | Marking Period 1 & 3                                                                           |
| 1                              | Maker Mentality: Identify and Solve Problems                                                   |
| 2                              | Maker Mentality: Identify and Solve Problems                                                   |
| 3                              | Maker Mentality: Identify and Solve Problems                                                   |
| 4                              | Maker Mentality: Identify and Solve Problems                                                   |
| 5                              | Maker Mentality: Identify and Solve Problems                                                   |
| 6                              | Introduction to Robotics                                                                       |
| 7                              | Introduction to Robotics                                                                       |
| 8                              | Introduction to Robotics                                                                       |
| 9                              | Introduction to Robotics                                                                       |
| 10                             | Introduction to Robotics                                                                       |
| Week                           | Marking Period 2 & 4                                                                           |
| 11                             | Introduction to Robotics                                                                       |
| 12                             | Introduction to Robotics                                                                       |
| 13                             | STEAM project (team or independent) on a self-selected topic related to the essential question |
| 14                             | STEAM project (team or independent) on a self-selected topic related to the essential question |
| 15                             | STEAM project (team or independent) on a self-selected topic related to the essential question |
| 16                             | STEAM project (team or independent) on a self-selected topic related to the                    |

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|    | essential question                                                                             |
|----|------------------------------------------------------------------------------------------------|
| 17 | STEAM project (team or independent) on a self-selected topic related to the essential question |
| 18 | STEAM project (team or independent) on a self-selected topic related to the essential question |
| 19 | STEAM project (team or independent) on a self-selected topic related to the essential question |
| 20 | STEAM project (team or independent) on a self-selected topic related to the essential question |

**Climate Change:** STEAM Project Unit

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### Core Instructional & Supplemental Materials including various levels of Texts

- Google Classroom postings
- Endeavor STEM careers module login on everfi.com
- Class set of headsets
- LEGO EV3 kits
- Laptop cart with LEGO EV3 Mindstorms, LEGO WeDo, and SketchUp Pro 2017 software
- Class set of mice
- Makey Makey kits
- Merge Cubes
- 3D printers
- Snap Circuit kits
- 9V batteries, hobby motors, wires, wire cutter/strippers

#### STEM supplies:

hot glue guns, glue sticks, cardboard, utility knives, cutting mats, safety, goggles, wooden dowels, hand saws, screwdrivers, power drills, screws, clamps, wood glue, plastic cups, pipe cleaners, paper plates, scissors, glue, masking tape, shoeboxes, construction paper, popsicle sticks

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Time Frame                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5 Weeks |
| Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |
| Maker Mentality: Identify and Solve Problems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| Alignment to Standards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |
| <ul style="list-style-type: none"><li>• 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.</li><li>• 8.2.12.ED.1: Use research to create a product or system that addresses a problem and make modifications based on input from potential consumers.</li><li>• 8.2.12.ED.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.</li><li>• 8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and</li></ul> |         |

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- maintenance of a chosen product.
- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
- 8.2.12.NT.2: Redesign an existing product to improve form or function.

### Learning Objectives and Activities

SWBAT answer the following questions:

- Why is it important for an engineer to be aware of the criteria and constraints when designing a product?
- What forces are involved in the game of volleyball?
- Using the design process, how can we design a machine that plays volleyball to meet the criteria and constraints?
- How can we safely use tools to construct our design?
- What strategies and processes can I use to become a more effective problem solver?

SWBAT understand the following concepts:

- Computational thinking practices are critical for all students to learn and form the cornerstone of the language of innovation, and will drive all future STEM discoveries and careers.
- All machines utilize potential and kinetic energy to make them go.
- The lever, wheel and axle, pulley, inclined plane, wedge and screw help us to do work with less energy.
- Everyday machines use one or more of these simple machines to make a compound machine.
- Models can help us make sense of the natural world as we observe phenomena.

SWBAT to "do":

- Different types of forces in systems stations.
- Volleyball Machine redesign: Students will design and test possible modifications to the design to help the group choose the best model to try further modifications on to optimize the design.
- Simple Machine stations to gather information.
- Brainstorming toys that utilize simple machines or demonstrate forces.
- Planning a design for a new toy for Kindergarteners to observe forces.
- Building and testing, Evaluate solution to optimize and then present their solution through a commercial.

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### Assessments

#### **Formative:**

- Class and group discussions while working on projects
- Student self-reflection/journaling during the design process
- Peer feedback (P-Q-P) while working on projects

#### **Summative:**

- Criteria on each project Design Brief met
- Independent and group project rubrics

#### **Benchmark:**

- Pre-assessment performance based vs final project
- Pre-assessment vs summative content information test

#### **Alternative:**

- Self-reflection
- Contest entries
- Peer Review

### Interdisciplinary Connections

#### **NGSS**

MS-ETS1-2: Students will evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of a problem during the volleyball machine redesign.

#### **ELA**

W.WP.6.4: With some guidance and support from peers and adults, develop and strengthen writing as needed by planning; flexibly making editing and revision choices; sustaining effort to fit composition needs and purposes; and attempting to address purpose and audience.

W.WR.6.5: Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

### Career Readiness, Life Literacies, and Key Skills

- 9.4.12.Cl.2: Identify career pathways that highlight personal talents, skills and abilities.
- 9.4.12.Cl.3: Investigate new challenges and opportunities for personal growth,

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advancement and transition.

- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.3: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political, economic, cultural).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

### Technology Integration

8.1 Educational Technology- All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- See Alignment to Standards Section Above.
- Students will use internet based game sites such as Quizizz, Kahoot and Quizlet live to reflect on their learning progress.
- Students will use PLTW.org to further investigate lesson concepts and demonstrate understanding of standards.
- Additional resources and extension activities will be posted on Google Classroom in order to encourage students to reflect on their learning and expand on their knowledge.

### Career Education

CRP2. Apply appropriate academic and technical skills.  
CRP4. Communicate clearly and effectively and with reason.  
CRP6. Demonstrate creativity and innovation.  
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.  
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.





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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Time Frame                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 6 Weeks |
| Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |         |
| Introduction to Robotics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |
| Alignment to Standards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |
| <ul style="list-style-type: none"><li>• 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.</li><li>• 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.</li><li>• 8.1.12.CS.2: Model interactions between application software, system software, and hardware.</li><li>• 8.1.12.CS.3: Compare the functions of application software, system software, and hardware.</li><li>• 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills and abilities.</li><li>• 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task</li><li>• 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.</li><li>• 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specific task</li><li>• 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.</li><li>• 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills and abilities.</li></ul> |         |
| Learning Objectives and Activities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |
| <p>SWBAT answer the following questions:</p> <ul style="list-style-type: none"><li>• Can I build a robot to do things that I can control?</li><li>• How does energy move in a system?</li><li>• How does electrical energy work?</li><li>• How can we use computer modeling to create a 3d object?</li><li>• How can students make one of their ideas using the LEGO® set, and can use other materials if needed to build their ideas, encouraging them to break problems down into smaller parts?</li><li>• Why do we use an iterative process to solve problems?</li><li>• Why do we use models to help our thinking become visible?</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |

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SWBAT understand the following concepts:

- Problem solving involves a community of learners, not an individual working alone.
- Productive talk is instrumental in a group's growth of ideas.
- Solving problems is a messy endeavor and takes multiple revisions.
- Modeling is a key part of making sense of your solution and can be used in the presentation of your ideas.
- Computational thinking practices are critical for all students to learn and form the cornerstone of the language of innovation, and will drive all future STEM discoveries and careers.
- Students will consider problems analytically and use data to inform decisions through real and approachable educational robotics system of the EV3.
- Robotic technologies are a part of our modern industrial society and future careers will rely on understanding how to use them.

SWBAT to "do":

- Investigating Building Circuits: Snap Circuit kits, scribblebot (group) and bristlebot (individual)
- Tinkercad software to make printable object that is 50 x 50 x 50 mm or less to familiarize with the "rules" to successfully print a 3D object.
- Students will observe different forms of energy and how it moves in a system (electrical circuit). Using this knowledge of circuits, students will design a part of their toy to include a part to be powered by electricity and a part that can be fabricated using a 3D printer (such as a functional handle or logo character).
- EV3 Goal
  - #1 Programming is Precise:  
If you want a robot to do something, you need to communicate that idea with mathematical and logical precision, or it won't quite be what you intended.
  - #2 Sensors, Programs and Actions:  
Data from sensors gives a robot information about its environment. A program uses that data to make decisions, and the robot acts on those decisions. Data underlies the core of the entire process.
  - #3 Make Sense of Systems:  
To understand the way something works, construct a mental "model" of it in your head that captures the important features and rules of the system. This helps you make sense of it, and also gives you a tool to "play out" similar or new scenarios in your head to predict what would





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happen.

- #4 Break Down Problems and Build Up Solutions:  
To solve a difficult problem, try breaking it down into smaller problems. Then, solve the smaller problems, building up towards a solution to the big problem.
- #5 Computational Thinking Applies Everywhere  
These skills-- mathematical and logical clarity, using data, systems thinking with mental models, and problem-solving --are not just for robotics. They are the key to solving many problems in the world.

## Assessments

### **Formative:**

- Self-quizzes embedded in the EV3 tutorials
- Note-taking of key ideas about software/hardware usage

### **Summative:**

- Student Worksheet for each open-ended, themed challenge scenario is helpful for basic documentation of the activity. Students can also refer to it when presenting their work in front of the class or as a portfolio for performance evaluations or for student self evaluation.
- Robot to complete the Obstacle Orchard Challenge or the Line Tracking Challenge

### **Benchmark:**

- Pre-assessment performance based vs final project
- Pre-assessment vs summative content information test

### **Alternative:**

- Group share/debriefing of progress so far in the challenge at the end of each class

## Interdisciplinary Connections

### **ELA**

RST.6-8.3 Students will follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks when making sense of the systems.

W.WR.6.5 Conduct short research projects to answer a question, drawing on several sources

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and refocusing the inquiry when appropriate.

Mathematics:

7.EE.3: Students will solve multi-step real-life and mathematical problems posed with positive

and negative rational numbers in any form (whole numbers, fractions, and decimals), using

tools strategically during goal #5 Computational thinking applies everywhere.

### Career Readiness, Life Literacies, and Key Skills

- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement and transition
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice.
- 9.4.12.CT.3: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political, economic, cultural).
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CRP1. Act as a responsible and contributing citizen and employee.  
CRP2. Apply appropriate academic and technical skills.  
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CRP6. Demonstrate creativity and innovation.  
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.  
CRP11. Use technology to enhance productivity.  
CRP12. Work productively in teams while using cultural global competence.

| Time Frame                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7 Weeks |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |
| STEAM project (team or independent)<br>on a self-selected topic related to the essential question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |
| Alignment to Standards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |
| <ul style="list-style-type: none"><li>8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.</li><li>8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.</li><li>8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.</li><li>8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs and risks, related to the use of the innovation.8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.</li><li>8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.</li></ul> |         |
| Learning Objectives and Activities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |

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SWBAT answer the following questions:

- What problem would you wish had a solution?
- How can we use technology to engineer solutions to environmental problems/challenges? \*

SWBAT understand the following concepts:

- Renewable resources are a more sustainable way to produce energy.
- Due to nonpoint source pollution, ocean animals are impacted by plastic pollution.
- World population is estimated to rise to 9 billion people by 2050 and food and clean water supplies are limited. Growing a school garden could help us become more sustainable.

SWBAT to “do”:

Students will identify problems in our environment and brainstorm their causes. Based on one cause, students will research and design a model/way to address this issue. They will share their thoughts with other people to then evaluate and optimize a design. Once they have a solution, they will present their solutions through a presentation.

- Design Process
- Building and testing models
- Evaluating and optimizing a design
- Presenting solutions
- Problem Solving
  - Use a structured problem solving process to help address new problems
  - View challenges as solvable problems
  - Break down larger problems into smaller components
- Persistence
  - Expect and value mistakes as a natural and productive part of problem solving
  - Continue working towards solutions in spite of setbacks
  - Iterate and continue to improve partial solutions
- Creativity
  - Incorporate personal interests and ideas into activities and projects
  - Experiment with new ideas and consider multiple possible approaches
  - Extend or build upon the ideas and projects of others
- Collaboration
  - Work with others to develop solutions that incorporate all contributors
  - Mediate disagreements and help teammates agree on a common

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- solution
- Actively contribute to the success of group projects
- Communication
  - Structure work so that it can be easily understood by others
  - Consider the perspective and background of your audience when presenting your work
  - Provide and accept constructive feedback in order to improve your work

\* NJ Climate Change Education

### Assessments

#### **Formative:**

- Daily calendar with listed goals checked off/moved to the next day
- Summary notes in group folder of the documented design process

#### **Summative:**

- Group commercials with their STEAM Tank pitch recorded at Ocean View Studios shared during group presentations where they share the steps they engaged in the design process

#### **Benchmark:**

- Entry to the STEAM Tank competition

#### **Alternative:**

- Group share without entry to the competition

### Interdisciplinary Connections

#### **ELA**

W.WR.6.5 Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

W.IW.6.2 Write informative/explanatory texts (including the narration of historical events, scientific procedures/experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

### Career Readiness, Life Literacies, and Key Skills

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### Career Education

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.  
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity.  
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### Modifications (ELL, Special Education, At-Risk Students, Gifted & Talented, & 504 Plans)

#### **ELL:**

- Use visuals aids
- Provide peer support
- Use of Google Translate
- Guided notes and/or scaffold outline for written assignments

#### **Supports for Students With IEPs:**

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

#### **At-Risk Students:**

- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

#### **Gifted and Talented:**

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts

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*#spartanlegacy*





# Township of Ocean Schools

Assistant Superintendent  
Office of Teaching and Learning

## **SPARTAN MISSION:**

*Meeting the needs of all students with a proud tradition of academic excellence.*

DEPARTMENT: Applied Technology

COURSE: Design and Modeling, Grade 6

- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts

### ***Supports for Students With 504 Plans:***

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability

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