

**CODE/MOE/UOIT Makerspaces Project**

**Lesson Plan: Grades 1-3 Science: Understanding Structures, Mechanisms and Motion: Sphero Battle Bots**

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| **BIG IDEAS:****Grade 1** **An object is held together by its structure.****The materials and structure of an object have specific properties and determine its purpose.****Grade 2****Simple machines help objects to move.** **Mechanisms are made up of one or more simple machines.** **Grade 3****Structures have specific purposes and are affected by forces acting on them. They need to be strong and stable to be useful.****Critical aspects of technological problem solving are: careful planning; purposeful selection of tools and materials; testing, retesting, and modifications of a product or process; communicating about the solution; and recommending of changes or improvements.****Technology/ robots and simple machines can help humans.****Science and Technology Overall Curriculum Expectations****Grade 1****Investigate structures that are built for a specific purpose to see how their design and materials suit the purpose;****Demonstrate an understanding that objects and structures have observable characteristics and are made from materials with specific properties that determine how they are used.****Grade 2****Investigate mechanisms that include simple machines and enable movement.** **Demonstrate an understanding of movement and ways in which simple machines help to move objects.** **Grade 3****Investigate strong and stable structures to determine how their design and materials enable them to perform their load-bearing function;** **Demonstrate an understanding of the concepts of structure, strength, and stability and the factors that affect them.** |
| **Learning Goals:**“We are learning to make strong structures that will withstand loads and impact. Students will create Battle Bots using given materials, understand how the wheel and axle works. Structures and mechanisms will be attached to a sphero ball and students will battle in a designated area.” | **Success Criteria:** “We will be successful when we are able to explain how and why our structure/mechanism withstands impact from other Battle Bots” Students will make a plan, revise their plan and be able to describe the pros and cons of their design.”  |
| **Lesson Overview:****Students will be designing and testing structures they build to go over (attached to) a sphero ball. In order to build strong structures students will need to understand what shapes are in strong structures, and how they can use the materials given to create a structure that will allow the sphero ball to move freely, and remain intact when coming in contact with other Battle Bots.****Students will need to understand and construct simple machines, namely, the wheel and axle.****The structure will be attached to a sphero ball which will be able to move freely around in a designated area.****Students could also add various loads to their structure to test the Battle Bot’s performance.****Future applications:****Battle bots can be sent into areas that are dangerous for humans. They are able to retrieve, locate or destroy artifacts of interest.** |
| **Materials and Technology:** **Construction Materials:****cardboard, straws, balloons, tape, cups, popsicle sticks, Lego wheel and axle parts, Lego, CDs, scissors, ruler, pencil****Spero Balls, tablets****Teacher Resources****Books****“The Most Magnificent Thing” by Ashley Spires****Other suggested books to inspire Inventors and engineers:**

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| **Book Title** | **Author** |
| **Rosie Revere Engineer** | **Andrea Beaty** |
| **Iggy Peck Architect** | **Andrea Beaty** |
| **Ada Twist Scientist** | **Andrea Beaty** |
| **Awesome Dawson** | **Chris Gall** |
| **Papa’s Mechanical Fish** | **Candace Flemming** |
| **Violet the Pilot** | **Steve Breen** |
| **If I built a Car** | **Chris Van Dusen** |
| **Monkey with a Tool Belt** | **On “EPIC” app** |
| **The Most Magnificent Thing** | **On “EPIC” app** |
| **Incredible Inventions** | **Lee Bennett Hopkins** |
| **What would you do with an idea?** | **Kobi Yamada** |
| **Anything is Possible** | **Giulia Belloni** |

**Useful Websites**[**https://robotics.nasa.gov/edu/educators.php**](https://robotics.nasa.gov/edu/educators.php)**Chariot Challenge Lesson Plan -**[**https://sprk.sphero.com/cwists/63/preview**](https://sprk.sphero.com/cwists/63/preview)**The Strongest Shape**[**http://educ.queensu.ca/sites/webpublish.queensu.ca.educwww/files/files/Community/COC/Widgets/Grade%203%20(Structures%20&%20Mechanisms)%20Strong%20Shapes%20&%20Which%20is%20Strongest%20Lesson%20Plan.pdf**](http://educ.queensu.ca/sites/webpublish.queensu.ca.educwww/files/files/Community/COC/Widgets/Grade%203%20%28Structures%20%26%20Mechanisms%29%20Strong%20Shapes%20%26%20Which%20is%20Strongest%20Lesson%20Plan.pdf) |
| **Student Accommodations/Modifications:**  | **Lesson will be differentiated by:*** **Environment, specifically: a quiet working area**
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| **MINDS ON: Getting Started** |
| During this phase, the teacher may: • activate students’ prior knowledge; • engage students by posing thought-provoking questions; • gather diagnostic and/or formative assessment data through observation and questioning; • discuss and clarify the task(s).  | During this phase, students may: • participate in discussions; • propose strategies; • question the teacher and their classmates; • make connections to and reflect on prior learning.  |
| Describe how you will introduce the learning activity to your students. What key questions will you ask? How will you gather diagnostic or formative data about the students’ current levels of understanding? How will students be grouped? How will materials be distributed? **Minds On:****Read to the class “The Most Magnificent Thing” by Ashley Spires.** **This is a great story about a little girl who perseveres to make her idea. It is a great book to illustrate what builders and engineers do, make a plan, try the plan, modify the plan and try again. The students will soon find out that sometimes plans don’t work, and we must persevere in our problem solving efforts.****Discuss and observe structures and what makes them strong? What shapes do you observe in strong structures (arches and triangles)****watch**[**https://www.youtube.com/watch?v=pCI6LMWk2ik**](https://www.youtube.com/watch?v=pCI6LMWk2ik)**Brain Pop Jr. Simple Machines****For Grade 3****The video “Humans need not apply” provided insight into how robots can be used in the future. Ask the students to think of a useful task that a robot could perform. Some examples might include:** **A Rescue robot - can search for a lost person in any area, then sound an alarm or transmit a signal when it finds them.** **Driverless cars. - get from point a to point b without hitting anything****Battle Robots - can send robots to war other than people.****Recording Observations****https://www.teacherspayteachers.com/Product/STEM-Design-Challenge-My-Most-Magnificent-Thing-1375030****Students will work in pairs or groups of 3 or 4.** |
| **ACTION: Working on it** |
| During this phase, the teacher may: • ask probing questions; • clarify misconceptions, as needed, by redirecting students through questioning; • answer students’ questions (but avoid providing a solution to the problem); • observe and assess; • encourage students to represent their thinking concretely and/or pictorially; • encourage students to clarify ideas and to pose questions to other students. | During this phase, students may: • represent their thinking (using numbers, pictures, words, manipulatives, actions, etc.); • participate actively in whole group, small group, or independent settings; • explain their thinking to the teacher and their classmates; • explore and develop strategies and concepts.  |
| Describe the task(s) in which your students will be engaged. What misconceptions or difficulties do you think they might experience? How will they demonstrate their understanding of the concept? How will you gather your assessment data (e.g., checklist, anecdotal records)? What extension activities will you provide? **The Design Challenge****Using the construction materials provided and a sphero ball, students will design and build a Battle Bot using the engineering design process.****1. What is the task?****2. Brainstorm several ideas**  **(Students can fold their paper in four sections to draw four different designs)** **Encourage students to represent their thinking pictorially first. Clarify their ideas and pose**  **questions to others in the group.****3. Choose the best one to try first.****4. Make a plan on how to build it and gather the materials****5. Follow the plan and test it out.****6. Discuss what can work better and make the necessary changes.****(1 hour)****Anecdotal notes or a checklist may be used to record student work/evidence of learning.****How can you build a strong structure. What design considerations need to be made in order for the sphero ball to move freely over your structure?** **Assign a specified time period for all Battle Bots to come to the Battle area****Delineate a large area for Battle Bots to run and battle. Battle ends when one or two Bots are still intact or at the end of 20 min.****The Sphero ball can be maneuvered by hand on the tablet. Students could also learn to program sphero to take a designated path in the battle zone.**  |
| **CONSOLIDATION: Reflecting and Connecting** |
| During this phase, the teacher may: • bring students back together to share and analyse strategies; • encourage students to explain a variety of learning strategies; • ask students to defend their procedures and justify their answers; • clarify misunderstandings; • relate strategies and solutions to similar types of problems in order to help students generalize concepts; • summarize the discussion and emphasize key points or concepts.  | During this phase, students may: • share their findings; • use a variety of concrete, pictorial, and numerical representations to demonstrate their understandings; • justify and explain their thinking; • reflect on their learning. |
| How will you select the individual students or groups of students who are to share their work with the class (i.e., to demonstrate a variety of strategies, to show different types of representations, to illustrate a key concept)? What key questions will you ask during the debriefing? **After the competition, each group will present their Battle Bot to the class.****Why did you choose this particular design?****What worked and what didn’t?****What materials worked best?****What was the hardest part of building your Battle Bot?****How did it perform and did you anticipate any problems with your design?****How did the size of the wheels or other design characteristics impact the results?****What was the most challenging part of the activity?****How could your robot be used in the real world to assist humans?** |