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**CODE/MOE/UOIT Makerspaces Project**

**Lesson Plan--Grade 2 Science:**

**Understanding Structures and Mechanisms – Movement**

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| **BIG IDEAS:** Simple machines help objects to move.**Overall Science and Technology Curriculum Expectations:**1. Assess the impact on society and the environment of simple machines and mechanisms.
2. Investigate mechanisms that include simple machines and enable movement.
3. Demonstrate an understanding of movement and ways in which simple machines help to move objects.

**Specific Science and Technology Expectations:** 1.1 assess the impact on society and the environment of simple machines that allow movement.2.3 investigate the structure and function of simple machines. 2.4 use technological problem-solving skills, and knowledge and skills acquired from previous investigations, to design, build, and test a mechanism that includes one or more simple machines. |
| **Learning Goals:**“We are learning to…”* discover, observe and describe the qualities of different inclined planes.
* collaboratively work together .
 | **Success Criteria:** “We will be successful when…”* we move through the various stations and make observations of each of the different results of the Sphero on each ramp.
* create a video that details our understanding of inclined planes.
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| **Lesson Overview:** This is an introductory lesson that focuses on inclined planes. **During this lesson students will receive a brief definition of terms and through discussion they will begin to develop their understanding of what an inclined plane is.** An inclined plane is a sloping surface that allows us to move an object from one elevation to another with less effort. Pushing or pulling an object using an inclined plane is easier than lifting the object.  |
| **Materials and Technology:** * 1 Sphero robot per group
* 1 iPad per group with the Tickle app downloaded
* 3 boards (large enough to accommodate a Sphero robot)
* observation recording sheet
* green screen
* iPad with Do Ink app downloaded
* measuring tape
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| **Student Accommodations/Modifications:**  | **Lesson will be differentiated by:*** **Content, specifically:**
* **Process, specifically:**
* **Product, specifically:** during the recording of observations students are encouraged to draw or write their observations in a meaningful way
* **Environment, specifically:**
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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? **Lesson Introduction:*** Define the words ‘incline’ and ‘plane surface’. Inclined is when something is tilted, so that part of it is touching a lower point in space than the other. A plane is anything that is large and flat, like a piece of paper or wood.
* Now that students have those two definitions, ask them what an inclined plane is. An inclined plane is a large flat object that is tilted so that it goes from a lower point in space to a higher one (show an example using a flat piece of wood or cardboard).
* Ask students what might this tool be used for? Elicit students’ responses (i.e., skateboarders that are trying to get some air for their tricks will use ramps, roadways where there is another road in the way a ramp will enable cars to get to a different level gradually, wheelchair accessible entrances to buildings, moving trucks)
* Show the following video of an example of how people in ancient times used inclined planes. It is a little over a minute long and is a song that shows how the ancient Egyptians solved the problem of lifting large stones using an inclined plane in order to build the pyramids.
* [**https://www.youtube.com/watch?v=tvLDkNdDrqY**](https://www.youtube.com/watch?v=tvLDkNdDrqY)

**Key Questions:*** What is an inclined plane?
* How does changing the incline of a board affect the distance that a Sphero robot can travel up the inclined plane?

**Groupings:** * students will be put into groups of 3
* groups will rotate through 4 stations

**Materials Distributed to students:*** students at the Sphero station will receive a Sphero robot and an iPad that has already been programmed using the Tickle app to a set speed and time (i.e., 50% speed for 3 seconds).
* The Sphero robot will act as a constant in the exploration of degree of incline
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| **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? **Tasks:** * Students will travel between 4 different stations that already have the boards set up for the investigation. Three of the four stations will have a board set up like a ramp or inclined plane with a different length and pitch at each station.
* Students will make a prediction and then record their observations based on the things that they observe at each of the 3 stations that have the inclined plane and a Sphero robot.
* The Sphero robot’s speed will act as the constant in this investigation while the degree of incline will be the variable.
* Students need to ensure that the measuring tape is stretched out to measure the Sphero’s travel distance.
* The fourth station will be a chance for students to watch a couple of videos about inclined planes and then fill out the Inclined Plane Frayer-Model worksheet. Below are links to several videos
* [**https://www.youtube.com/watch?v=igrMlzHL-qg**](https://www.youtube.com/watch?v=igrMlzHL-qg)
* [**https://www.youtube.com/watch?v=fvOmaf2GfCY**](https://www.youtube.com/watch?v=fvOmaf2GfCY)
* [**https://www.youtube.com/watch?v=sTOWiDDgTIk&t=1s**](https://www.youtube.com/watch?v=sTOWiDDgTIk&t=1s)

**Demonstration of Understanding:*** Students will complete a worksheet where they will define an inclined plane, give examples of inclined planes, explain how an inclined plane works and how it is helpful.
* Students will take a picture of their Sphero robot on an inclined plane during the investigation that will become the backdrop of the video that they create.
* Using the green screen and the Do Ink app students will record a description of what they learned and observed during this investigation about inclined planes. Videos are intended to be about a minute in length.

**Extension Activities:*** After students have tried to run the Sphero up each of the 3 ramps at a constant speed they can then try changing the speed and make observations about the force required to travel up the inclined plane based on those changes.
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| 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? **Whose work is to be shared?*** Choose a video that focuses on the key points to share with the class that will encourage discussion as a group about their thinking about inclined planes.

**Key Questions during Debrief:*** What happened when the incline was at the highest setting compared to the lowest setting?
* During debrief with the whole class encourage students as they are explaining their thinking to refer back to their observations to help justify their thinking.
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