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| **Teacher Candidate:** Aria A.D. Atwell | **Date:** October 15, 2019 |
| **Lesson Title:** Re-Building “Wonder Park” (2-50 mins. periods, 2 - 35 mins. periods + 1 additional 40mins. period if needed)<br><br>**Grade Level:** 2 | **Unit of Study:** Understanding Structures & Mechanisms – Movement (S.T.E.M or S.T.E.A.M.)<br><br>**Subject:** Simple Machines |

**Lesson Overview:**

Students will create a single amusement park ride and incorporate at *least* 1 simple machine into their design. First a “blueprint” will be drafted (hand-drawn, done using computer software etc) and labelled. Then students will gather supplies (various materials will be provided in class but they may also bring materials from home) to create a 3D model of their mechanism featuring the simple machine(s) they’ve chosen (it should be functional). Finally, students will present their design (however they’d like to as long as the expectations for the presentation are met) to their classmates and then display them. Assessment will drive this lesson.

*This can also be done as a culminating task.

## *Part 1: Lesson Goals and Assessment*

**Ontario Curriculum Overall Expectations:**

<u>Science:</u>

Overall Expectation 2:  investigate mechanisms that include simple machines and enable movement

<u>Language:</u>

(Writing) Overall Expectation 3: use editing, proofreading, and publishing skills and strategies, and knowledge of language conventions, to correct errors, refine expression, and present their work effectively

**Ontario Curriculum Specific Expectations:**

Science:

2.1 follow established safety procedures during science and technology investigations (e.g., return tools to their designated area when they are done with them; carry tools and materials safely)

2.4 use technological problem-solving skills (see page 16), and knowledge and skills acquired from previous investigations, to design, build, and test a mechanism that includes one or more simple machines (e.g., a toy, a model vehicle)

2.5 use appropriate science and technology vocabulary, including push, pull, beside, above, wheel, axle, and inclined plane, in oral and written communication

2.6 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., orally explain to the class the process they followed in building a mechanism that includes one or more simple machines)

Language - Writing:
3.3 confirm spellings and word meanings or word choice using a few different types of resources

**Big Ideas/ Enduring Understandings:**

- Simple machines can be found all around us
- Simple machines help to make work easier
- Simple machines have few or no moving parts
- Simple machines don't use electricity or motors

**Essential/Key Critical Questions:**

- What makes your simple machine work?
- How does your simple machine make work easier for humans?
- What kind of movement does your simple machine demonstrate?

**Student Learning Goals:**

- We are learning to follow safety procedures.

- We are learning to communicate like scientists
- We are learning to solve problems like scientists

**Student Success Criteria:**

- We are learning to follow safety procedures.
    - We can put away our tools/materials
    - We can clean up our work area
    - We can move around the room safely when working
- We are learning to communicate like scientists
    - We can describe how a simple machine moves (i.e. push or pull)
    - We can name the parts of some simple machines (i.e. a pulley, lever, wheel, plane)
    - We can identify some simple machines and their parts
    - We can share our ideas with pictures & words
- We are learning to solve problems like scientists
    - We can test our simple machines
    - We can make changes to improve our simple machines
    - We can work listen to each other and share ideas

**Necessary Prior Knowledge, Skills, and/or Previous Lesson:**

Students should be familiar with and able to:

- Identify the 6 types of simple machines (wheel & axle, inclined plane, pulley, gear, lever, wedge), *independently or with some help/probing*
- Describe the parts of the simple machine and explain how they work, *independently or with some help/probing*
- Use some science/technology vocabulary appropriately (such as push, pull, move, wheel, axle, etc) and be able to use them to communicate their ideas, *independently or with some help/probing*
- Describe and explain cause and effect relationships (familiarity with the interconnectivity of animals, plants and people), *independently or with some help/probing*

**Instructional Strategies:**

Review & pre-assessment, scaffolding, collaborative learning, flexible/small groupings, hands-on/experiential learning, inquiry, the scientific method, moving gallery, graphic organizers, relationship mapping, group/class discussions, visuals/audio, read alouds

**Assessment:**
*Assessment as learning*:

- Students will have the learning goals and success criteria available to them on the SMART board (teacher's slides)
- Students will be given a checklist at each stage to make sure they have completed all the required steps
- Students will have their building "work cards" stamped by the teacher to serve as confirmation of completed tasks
- Students will create and submit their blueprint (design), materials list and graphic organizer and the teacher will check for all the required components and give descriptive and/or verbal feedback
- Students will design a co-created rubric with the teacher and go through the expectations of "Level 3" work using exemplars ("what does it look like" and "what I'm looking for")

*Assessment for learning:*

- Teacher will have a read aloud & follow-up with a review of simple machines and vocabulary (discussion & matching game)
- The teacher will be doing check-ins throughout the work periods (pose/prompt questions, probe, redirect etc and giving oral feedback. teacher observations during work periods the teacher will use these opportunities to analyze learners' comprehension and connection to learning; photo & anecdotal documentation (clipboard & success criteria) may be supplemented accordingly

*Assessment of learning:*

- Teacher will evaluate students' learning based on a the co-created rubric
- Teacher will assess students' final product; and their ability to communicate their ideas clearly, using subject-specific vocabulary, and the relevance of their ideas (according to a co-created rubric).
- Teacher observations, photographic/video documentation, anecdotal notes and student checklists will be used to help inform assessment

**Equity/Diversity/Indigenous Perspectives**

*Since this is a hands-on/inquiry learning experience, curiosity, wonder, and an environment of making mistakes will be encouraged - this is the role of a *true* scientist.

<u>Student Experiences & Background Knowledge</u>

Considerations will be made for students whose background knowledge/experiences may not include familiarity of an amusement park and/or rides. The option can be given for students to create something they would typically find from where they're from, a new playground at school, a fort, tree house, a get-away spot for them and special friends or other structure as long as it meets the criteria of a simple machine. Examples for inspiration will be taken from structures from various context and cultures(i.e. Indigenous and Environmental perspectives would offer a wonderful tie-in to the interconnectivity of animals, plants and people)

Accommodations & Modifications

Students that require modifications/accommodations (i.e. those with limited oral/written output) like ELLs (English Language Learners) or students with learning exceptionalities may find it easier to complete this task because all students are encouraged to use a variety of options (words, pictures/diagrams, technology etc) to design their mechanisms. They will be encouraged to use the scientific vocabulary but also have the following options: (1) to orally communicate their thinking and the teacher will scribe, (2) use pre-printed vocabulary cards and match them to their simple machine design, or (3) describe a simple machine in their Language 1 and use the pre-printed English vocabulary cards to label their diagram. For the presentation phase, ELLs may prefer to present their mechanism using a poster board or even Google slides (modifications may be made depending on the student designations)

- Students with IEPs (Individual Educational Plan) will have lessons accommodated accordingly (i.e. teaching strategies, access to AT/tools etc)
- Extra time will be allotted for students on a needs-basis
- ELL (English Language Learners) students may face challenges using subject-specific vocabulary so strategic pairings with students who share the same L1 will be used whenever possible; Otherwise, a trilingual student dictionary (or word wall) will serve as a reference from the beginning of the unit
- Tasks will be a combination of problem-based, inquiry and open-ended to allow students to engage at different levels and share responsibility for learning (i.e. a range of teacher and student-centered learning) wherever appropriate
- Students will benefit from UDL (Universal Design for Learning) with oral, and written/visual instructions for more complex tasks.
- Less proficient & highly proficient students will benefit from both flexible and strategic groupings at different times
- The 4 learning styles and Gardiner's Multiple Intelligences have also been considered in the planning of tasks that students will be responsible for completing throughout the activity
- Tasks will be scaffolded using guided lessons, shared tasks with explicit modelling by the teacher and group work
- Student choice will be offered at multiple instances when completing tasks and submitting work in this unit
- Assessment will drive this unit plan

Differentiated Instruction

- The teacher will provide a variety of materials for use in lessons to support students at various levels (this will be established via UDL)
- New or pertinent vocabulary will be provided and made visible to students during the lesson (via anchor charts built into lesson slides, on graphic organizers, science word wall on bulletin board etc)
- Students will have flexibility (where possible) in how they produce their work and show their learning.
- Learning goals and success criteria will be reviewed and made available to students for every session/class
- Students will have the choice on what they create and how they create
- Students will be given sufficient time to think and multiple opportunities to engage in tasks

- Lessons will be delivered in a variety of styles & using a variety of tools to suit students' learning styles, strengths/needs & multiple intelligences i.e. self-directed research & group work, videos, podcasts, books, hands-on learning, direct instruction, discussions, and explicitly making learning goals/success criteria available for student learning..
- Environmental considerations: proximity to teacher and/or board/screen (DHOH [Deaf/Hard of Hearing], visually-impaired students), flexible seating and accessible pathways for non-able bodied students or students with regulation/motor challenges (*be mindful of language i.e. moving gallery vs. walking gallery)

<u>Other/Miscellaneous</u>

To further support students in their learning, the following considerations can also be made and adjusted for depending on the group dynamic/demographic:

- Flexible groupings so students with different competencies, knowledge and backgrounds can share ideas, but strategic groupings (1 strong reader in each group to help support ELLs/struggling readers)
- Lots of text/visual/video/audio and various tasks/teaching strategies to support different learning styles
- Teacher instructions given orally and written to support different processing/learning styles
- Multiple perspectives will be explored to honour different ways of obtaining knowledge and understanding i.e. aside from traditional Western/Eurocentric ways of knowing (where applicable)

<u>Indigenous Perspectives:</u>

During this activity I would like students to focus on the Indigenous contribution to science and technology in terms of simple machines and movement. Considerations will be made for types of simple machines Indigenous communities used and ones that may have inspired ones we recognize and/or use. For example, in travel the (push/pull) movement of a toboggan/sled. Students will also be encouraged to look at the materials they used in building their simple machine and consider the following:

Understanding structures and mechanisms:

- *Materials, Objects and Everyday Structures* (Grade 1): Materials have specific properties; An object is held together by its structure; The materials and structure of an object determine its purpose (Overall expectations 1 and 2); Specific expectations 1.2 and 2.3. *What materials did the Indigenous use to build and create shelter? Utensils/tools? Clothing? Travel mechanisms? Simple machines for work? Games?*
- *Movement* (Grade 2): Movement is a change in position of an object (Overall expectations 2 and 3); Specific expectations 2.2, 3.1 and 3.2. *How did the Indigenous travel? Carry things from place to place? Do work?*

Further investigation can be done by considering the amount of space required to erect an amusement park and what happens to the land in order to do this. *How would this affect the people and animals that live* *there?* This would offer a perfect tie-in for Indigenous connections to place, land claims, and land acknowledgments. This perspective will also be closely linked to the environmental perspectives listed below.

Environmental Perspectives:

While students are planning, selecting their materials, and building they will be expected to consider the environmental impact of amusement parks. This can range from the energy utilised by the rides themselves, the materials used and even the clearing of land to erect an amusement park. Guideline questions will be provided by the teacher to be included in the “big ideas” such as: *what happens when humans bring outside species into a habitat? Does this affect ecosystems? How does it affect plants, animals and people? How much waste do you think visitors to an amusement ride create from food, wrappers etc? How would this affect the environment, and what could amusement parks do to prevent or limit this?* This will connect with the unit on Living things for Grades 1 and 2: *what do plants, animals and people need to live? How do the actions of humans affect (either negatively or positively) animals and their habitats, and vice versa?*

During the reflection/debriefing phase students will discuss how they may have (hypothetically or in actuality) planned for this in the consideration of their design and materials. If a student has opted to build something other than an amusement park ride, then they will be expected to share the environmental considerations for what they built (including but not limited to the energy source it requires, the energy source/machinery required to build their mechanism, the land that it was built on, the materials they used etc)

## ***Part 2: Lesson Preparation***

**New *or* Essential Vocabulary:**

Essential: pulley, inclined plane (ramp), screw, lever, wedge, wheel & axle, push, pull, movement

New (optional): work, force

*This list can be added to as learners continue to explore the world of simple machines

**Learning Environment/Safety Concerns and Precautions:**

- Since the focus on this task is around building, the classroom will reflect building zones (i.e. like a construction site) marked by signage/caution tape/pylons. This will be used to designate a space for tools/equipment, supplies and workspace.
- Safety rules for using/carrying/storing equipment will be reviewed before beginning each work session. To reinforce tool safety the handles of tools will be colour-coded with tape (green = students can take the tool safely to their work area and use it there until they are finished, yellow = students may use the tool only at the designated tool area, red = these tools may only be handled by the teacher). Each group/individual will have a “tool” box of basic green-coded tools for use (this will limit movement around the classroom with these tools).
- To give students’ ownership over this task and a sense of responsibility designated store-hands (1 for each group) will be picked each work session to ensure the amount of each tool is accounted for at the beginning and end of each building session; they will report to the teacher via a checklist; students will rotate each session.
- In the building phase we will require a lot of space, so table tops must be completely clear (no water bottles, lunch bags, books, other school materials/personal belongings etc) and even floor space will be required for students to build their mechanisms. To ensure clean up is done efficiently and students’ supplies are kept organized, each individual/group will have a tote for all of their work. A designated space will be occupied in the classroom storage area to host the projects while students are working on them.
- Safety goggles will be worn by ALL students during ALL times of the building phase. Students must tie their hair back (if applicable), rid themselves of any loose clothing (unzipped hoodies or strings from the hood, excessively long sleeves etc), and wear proper close-toed shoes to prevent stubbing their toes or dropping items on their feet.

**Materials/Resources/Classroom Arrangement/Necessary Preparation:**

Building materials (options may vary):

Lego, K'Nex, Clicformers, Magformers, snap cubes, wheels & straws, pipe cleaners, elastic bands, cardboard, glue, popsicle sticks, dowels, magnets, paper rolls, twine, cardboard, white glue, glue gun & sticks, pliers (for trimming dowels), tape, pipe cleaners, construction paper, poster board etc; and any materials brought from home

Group tool boxes & safety equipment:

totes/bins, safety goggles, aprons, scissors, rulers, pencils, erasers, chalk, simple machine reference cards (pictures/diagrams and vocabulary), markers

File folder:

task cards, instructions, templates/graphic organizers, success criteria/checklists, reflection cards

Safety Signage:

Reference posters/anchor charts (safety, reminders)

Books:

Read Aloud: Scribens, Sunny. *My Friend Robot*! Concord, MA, Barefoot Books Inc, 2017.

Media Texts:

"My Friend Robot" simple machine reference cards (optional)

*Wonder Park*. Directed by Dylan Brown, performances by Sofia Mali, Jennifer Garner, and Ken Hudson Campbell, Paramount Animation, 2019.

Movie clips:

- Discovering the Park: https://www.youtube.com/watch?v=ukZQlOwNWs0
- Re-building the Park: https://www.youtube.com/watch?v=NCi4QNKpVB8
- The Park is Fixed: https://www.youtube.com/watch?v=ANTOMowTXZU&t=8s

Teacher-specific:

Projector, screen/SMART board, laptop and "Wonder Park: Rebuilding the Park" scene movie clips, lesson slides

**References/Credits:**

N/A/ - Teacher designed activity

***Part 3: Lesson Design (3-Part Lesson)***

| **Length of Period: 50ms** | **Differentiated Instruction**<br><br>**Modifications**<br><br>**Accommodations**<br><br>**Ongoing Teacher Assessment** |
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| **Minds On (Before):** **Estimated Time: 15mins**<br><br>The teacher will be wearing a construction vest/hat and pretend to be on a frantic phone call. After hanging up the teacher will tell the students that it was her friend June and she has an emergency: she built an amusement park but now it's broken.<br><br>"June needs our help to fix it! She sent us this video of what's happening at Wonder Park. We've been talking a lot about simple machines lately so while you're watching the video I want you to see if you can identify some of the things that need to be fixed and any simple machines you may recognize."<br><br>Play video clip ("Wonder Park"- broken down amusement park) via the laptop/projector (2mins10s).<br><br>What are some things you noticed while watching the video?<br><br>Teacher will record oral responses on chart paper.<br><br>How might we use our prior knowledge and the new information we've learned about simple machines to help June rebuild her amusement park? Are you up for the challenge? | |

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| **Action (During):** **Estimated Time: 35mins**<br><br>**Teacher's instructions:** In groups of 4 you will pick one ride/feature of the park to rebuild. You can design it any way that you like but it must include at *least* one simple machine.<br><br>Teacher will have a list to ensure variety although multiple groups can do the same ride/feature.<br><br>*INTRODUCE/REVIEW SAFETY PROCEDURES AND COMPLETE A "MOVE-THROUGH" OF CLASSROOM DESIGNATIONS (see safety precautions above)<br><br>**Period 1 - First Phase (Plan & Design):** Each group will be given a sequencing graphic organizer & blank paper to design their simple machine. The teacher will give feedback to guide their final design (blueprint), process (graphic organizer) and materials list. Each group will have a "project folder" with the instructions written down in the form of a checklist to refer to. They will also have the student success criteria and reflection card. Students will brainstorm in their groups what materials they will construct their mechanism with. Materials will be provided in class. While students are not limited to the materials in class they will not be required to purchase materials for this task. They will come up with a materials list for the teacher. This is a good time to introduce safety tips/reminders for using materials, working and building etc.<br><br>**Periods 2 & 3 (4 will be for testing, or additional building time if needed) - Second Phase (Build):** Students will be given apx. 3 additional periods to work on their team tasks (this may be extended to an additional period if necessary). The teacher will document the project with photos and by visiting each group to prompt/probe them concerning what they're doing and how they're thinking. The teacher will also be available to provide aid if required. During the building phase the teacher will observe and also pose questions.<br><br>**Period 5 - Final Phase (Presentation):** This will serve as an opportunity for students to demonstrate their understanding and apply their learning, as experts on their mechanism. They will have various options to present/share their learning with the class i.e. oral performance, poster board display etc It will also allow students to consolidate their learning and connect to the big picture ideas and success criteria. | Teacher will give instructions orally (displayed on projector screen as well on written copy for students). This will help auditory, visual and sequential learners<br><br>Group selection process: Strategic/flexible groupings<br><br>Have exemplar available to show students during instructions<br><br>A suggested materials list will be up on a chart paper so students know what is available to them. This will also offer a math tie-in (i.e. quantities, measurement, estimating).<br><br>The teacher will continually refer to and encourage the groups to refer to their success criteria/tasks checklist/big idea card. This will keep them on task and remind them of W.I.L.F (what I'm looking for) and how they know they are on their way to success<br><br>**Intentional questions:** *What are you doing right now? Has everything gone according to your original plan or did it change as you went along? (Why?) What is the purpose of your mechanism? What simple machine(s) does it use? Explain how it does what it does. What kind of movement does it demonstrate? What tools did you find the most useful to build your mechanism?*<br><br>As part of their assessment students will be required to fill out a success criteria checklist throughout the process. The goal is to have them refer to it throughout the process and everything checked off by the end of their presentation, along with a reflection card. These will also be considered by the teacher in her assessment. |

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| **Debrief/Consolidation (After):** **Estimated Time: 15mins**<br><br><u>Periods 1-4 debrief:</u><br><br>Consolidation over these 4 periods will vary from class discussions, an exit ticket, and/or a reflection in students' science journals. They will centre around questions that pertain to the actual simple machines groups chose to make and the technological process. | *What kind of simple machine did your group choose to make? How did you come up with a plan on how to make it? How does the simple machine you've chosen to do relate to the ride/feature you've picked? What is the purpose of your mechanism? What simple machine(s) does it use? Explain how it does what it does. What kind of movement does it demonstrate? What tools did you find the most useful to build your mechanism?*<br><br>*Where is your group in the planning phase? Is everything going according to your original plan or is it changing as you go along? If not, what could you do to get back on track?* |
| <u>Period 5 consolidation:</u><br><br>Students will get to do a moving gallery of the mechanisms made by the peers and have a checklist (like site a foreman) to write their findings and they will bring these points back to the carpet.<br><br>The teacher will have a brief class discussion to close off this chapter of students' learning (i.e. *What were some of the challenges in designing and making your mechanism? Based on the tests you conducted, what might you change about your mechanism?)*. The success criteria will now be listed as "all the things we *now* know how to do" and will be added to the students' tool box (*When do you think you might use some of these skills outside of school? Can you think of jobs where people use these skills?*). During the "new tools" ceremony students will take ownership of what they learned and add it to their individual boxes and celebrate one another as they do it. The "Wonder Park" - the park is fixed! Video clip will be played to celebrate the completed task and their newly found skill-set! A final certificate as "Master Builders" or "Jr. Engineers" will be given to each student. | Moving gallery considerations: Can you tell what kind of mechanism is it and what kind of simple machine did it use? What made you think this? Can you think of another way this could have been done? What would you have done differently?<br><br>*This *tool box* initiative is something that would have been started at the beginning of the year. The "tool box" is a container of all the skills students have learned throughout the year. It will become a keepsake for them to see how much they've accomplished from Sept-June. |

**Lesson Extension/Homework/Future Responsibilities:**

Since this science lesson used building and knowledge of structures a cross-curricular connection to the math strands of measurement and geometry/spatial sense would segue easily into this.

**Sample Questions:** how they knew they had enough of a material? What strategies did they use to figure this out? (i.e. estimating, measuring). What shapes (2D & 3D) did they encounter when building?

Also, taking students' responses from their reflections (exit tickets, journals) and responses in the group discussion they can tally the responses and stem off into the data management strands.

**SAMPLE: A ferris wheel**

**Simple machine used: a wheel & axel**

**How does it move? What other information about your design do you want to share?: human power turns the axel and that makes the small wheel spin and the big wheel attached to it spins too. We used circles, hexagons and rectangular prisms in our design. We made our ferris wheel out of wood and glue, and added stickers to resemble the lights on a ferris wheel at night. We used egg cartons for the seats that hold the people.**


**Measurement:** measuring length using centimetres and metres; measuring perimeter, area

**Geometry and Spatial Sense:** classifying two-dimensional shapes by geometric properties (number of sides and vertices); classifying three-dimensional figures by geometric properties (number and shape of faces); locating a line of symmetry; composing and decomposing shapes; describing relative locations and paths of motion

**Data management:** organizing objects into categories using two attributes; collecting and organizing categorical and discrete data; reading and representing/displaying data using line plots and simple bar graphs