Understanding Structures and Mechanisms
Simple Machine: Levers

Specific Expectations

Grade 2 – Movement: **1.1** assess the impact on society and the environment of simple machines that allow movement; **2.2** investigate and describe different kinds of movement; **2.3** investigate the structure and function of simple machines; **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; **3.1** describe different ways in which objects move *(e.g., turning, spinning, swinging, bouncing, vibrating, rolling)*; **3.2** identify ways in which the position of an object can be changed *(e.g., by pushing, by pulling, by dropping)*; **3.3** identify the six basic types of simple machines – lever; inclined plane; pulley; wheel and axle, including gear; screw; and wedge – and give examples of ways in which each is used in daily life to make tasks easier; **3.4** describe how each type of simple machine allows humans to move objects with less force than otherwise would be needed; **3.5** identify simple machines used in devices that move people

Grade 3 – Strong and Stable Structures: 2.3 investigate, through experimentation, the effects of pushing, pulling, and other forces on the shape and stability of simple structures; **3.1** define a structure as a supporting framework, with a definite size, shape, and purpose, that holds a load

Potential Specific Expectations with minor extensions to the lesson:

Grade 5 – Forces Acting on Structures and Mechanisms: 2.2 measure and compare, quantitatively and/or qualitatively, the force required to move a load *(e.g., to lift a book, to open a drawer)* using different mechanical systems *(e.g., different pulley systems, a lever, a gear system)*, and describe the relationship between the force required and the distance over which the force moves; **2.5** use appropriate science and technology vocabulary, including *tension*, *compression*, *torque*, *system*, and *load*, in oral and written communication; **3.3** explain the advantages and disadvantages of different types of mechanical systems

Grade 8 – Systems in Action: 2.2 investigate the work done in a variety of everyday activities and record the findings quantitatively; **2.3** use scientific inquiry/experimentation skills (see page 12) to investigate mechanical advantage in a variety of mechanisms and simple machines; **2.6** use appropriate science and technology vocabulary, including *mechanical advantage, input, output, friction, gravity, forces,* and *efficiency*, in oral and written communication; **3.2** Identify the purpose, inputs, and outputs of various systems; **3.3** Identify the various processes and components of a system that allow it to perform its function efficiently and safely; **3.5** understand and use the formula work = force × distance ($W = F \times d$) to establish the relationship between work, force, and distance moved parallel to the force in simple systems; **3.6** calculate the mechanical advantage (MA = force needed without a simple machine divided by force needed with a simple machine) of various mechanical systems

Big Ideas (for lesson):

Students will understand why people create and use simple machines to make tasks easier to perform (*mechanical advantage*)

Students will learn how levers function and how they are used to move heavy objects

Students will see how levers are used effectively in everyday life

Accommodations:	**Differentiated Instruction:**
☒ Increase time ☒ Visual Aids ☒ Manipulatives ☒ Chunking ☒ Step-by-Step ☒ Scaffolding ☒ Copy of Notes ☒ Student Grouping	☒ Content: Use demonstrations throughout verbal instruction to help visual learners. ☒ Process: Students will work in pairs or groups to support each other if limitations or impediments exist. ☒ Product: Students may demonstrate their learning verbally, visually, or by written means. ☐ Other: _____
	Multiple Intelligence:

Bloom's Taxonomy:	☒ Verbal/Linguistic
☒ Knowledge	☒ Logical/Mathematical
☒ Comprehension	☒ Visual/Spatial
☒ Application	☒ Bodily/Kinesthetic
☒ Analysis	☐ Naturalist
☒ Synthesis	☐ Musical/Rhythmic
☒ Evaluation	☒ Interpersonal
	☒ Intrapersonal

Teachers Notes:

- This lesson is accompanied by a supplementary PowerPoint, "*Levers (powerpoint)*", and a worksheet, *"Levers (worksheet)*"
- The use of simple machine kits can be found throughout the lesson – it is recommended that these manipulatives be used to increase the experience and understanding of the students
    - your school might have access to a set of levers you can use for this lesson
    - if this is not available, you can purchase simple machines sets here:
        - http://www.pitsco.com/Grades_3-5/Kits/Simple_Machines_Set
        - http://www.learningresources.com/product/simple+machines+set.do
    - if this is still not an option, you can build your own simple machines
    - see below for examples:
        - http://www.ehow.com/info_7969543_homemade-simple-machines-kids.html
- Extensions to the lesson should be done if it is to be used at the grade 5 or 8 levels
    - The material covered by these lessons is strongly emphasized at the Grade 2 level – the more complex concepts that arise at later grade levels can be situated within the lesson
        - **i.e.** calculating force and mechanical advantage can be added into the lesson
- Resources for teaching and learning about simple machines can be found here:
    - Brainpop, http://educators.brainpop.com/bp-jr-topic/simple-machines/
    - Bill Nye The Science Guy: Simple Machines https://www.youtube.com/watch?v=rRjCQGa_HCE
- The font used for the handout is called Dyslexie. It is designed to help dyslexics read, but it is a very easy to comprehend font which will aid all readers.

Delivering the Lesson

Portion & Timing	Grouping:			Introduction:	Materials
Minds On: **5 minutes**	W ☒	S ☐	I ☐	Teacher introduces **levers** to students - (ppt slides 1-3) Perform demonstration for class by lifting various weights; Gizmos simulation can be used as well - Discuss the Mocomi video	- Lever set to provide example to students - projector technology
Action: **30 minutes**	W ☒	S ☒	I ☒	Proceed through "*Levers (powerpoint)*" - "*Levers (worksheet)"* can be followed along and filled in by students - Answer questions about the simple machine as the lesson proceeds - Students should highlight/underline important vocabulary words Activity: - Separate students into groups or pairs - Allow students to build and operate different lever systems (different classes and lengths of beam) - Have them record their observations by drawing and labelling diagrams of all the different levers they can create - See which group can create the most efficient and effective levers (can lift the most weight easily)	- Lever sets to allow students to explore the use and function of levers
Consolidate: **5 minutes**	W ☒	S ☒	I ☐	Conclude lesson by taking up worksheet – ensure each student has filled in all the appropriate information - Answer any remaining questions on levers	

References:
Mocomi; http://mocomi.com/
Teach Engineering; https://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_simple/cub_simple_lesson01.xml
ExploreLearning Gizmos; https://www.explorelearning.com/index.cfm?method=cResource.dspResourcesForCourse&CourseID=361
Wikipedia; https://en.wikipedia.org/?title=Simple_machine

All images from Google image search, Educational websites, and stock photos
All videos found on YouTube for educational purposes