

**CODE/MOE/UOIT Makerspaces Project--Lesson Planning Template**

**School Board: Lakehead Public Schools**

**Grade(s): 7/8**

**Subject(s): Science & Mathematics: Reconditioning Bikes**

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| **BIG IDEAS:** **Grade 8 Science - Systems are designed to accomplish tasks.** **Grade 7 Science - Structures have a purpose. (Overall expectation 1) The form of a structure is dependent on its function. (Overall expectations 1, 2, and 3)****Grade 8 Math - Developing, selecting, applying, and comparing a variety of problem-solving strategies to pose and solve problems and conduct investigations, to help deepen mathematical understanding.****Grade 7 Math: - Developing, selecting, applying, and comparing a variety of problem-solving strategies to pose and solve problems and conduct investigations, to help deepen mathematical understanding.****Curriculum Expectations:****OVERALL:****Science:** **- investigate a working system and the ways in which components of the system contribute to its desired function;** **-demonstrate an understanding of different types of systems and the factors that contribute to their safe and efficient operation.****Math Grade 8:****determine the relationships among units and measurable attributes, including the area of a circle.****Math Grade 7****-demonstrate an understanding of proportional relationships using percent, ratio and rate.****SPECIFIC:** **Science Grade 8:****2.1 follow established safety procedures for working with apparatus, tools, materials, and electrical systems;****2.3 use scientific inquiry/experimentation skills (see page 12) to investigate mechanical advantage in a variety of mechanisms and simple machines;****2.4 use technological problem-solving skills (see page 16) to investigate a system (e.g., an optical system, a mechanical system, an electrical system) that performs a function or meets a need;****3.4 compare, using examples, the scientific definition with the everyday use of the terms work, force, energy, and efficiency.****Science Grade 7:****3.6 identify and describe factors that can cause a structure to fail (e.g., bad design, faulty construction, foundation failure, extraordinary loads;****2.1 follow established safety procedures for using tools and handling materials (e.g., wear safety glasses when cutting or drilling);****2.3 investigate the factors that determine the ability of a structure to support a load;****2.2 design, construct, and use physical models to investigate the effects of various forces on structures;****3.1 classify structures as solid structures (e.g., dams), frame structures (e.g., goal posts), or shell structures (e.g., airplane wings) 3.2 describe ways in which the centre of gravity of a structure (e.g., a child’s high chair, a tower) affects the structure’s stability 3.3 identify the magnitude, direction, point of application, and plane of application of the forces applied to a structure 3.4 distinguish between external forces (e.g., wind, gravity, earthquakes) and internal forces (tension, compression, shear, and torsion) acting on a structure.****Math Grade 8:****solve problems involving the estimation and calculation of the circumference and the area of a circle.****Math Grade 7:****– determine, through investigation, the relationships among fractions, decimals, percents, and ratios.** |
| **Learning Goals:**“We are learning to…” repair bicycles to deepen students’ understanding of how to apply math and science curriculum to practise a hands-on learning experience. | **Success Criteria:** “We will be successful when…” students show how to use mathematical concepts to explain the gear ratio, the structural stability and the measurement of adequate air pressure when reviewing bike safety* students can take their bike apart using a variety of tools (wrenches, chain breaks, sockets, screwdrivers, hammers etc.)
* to be able to identify the required parts that need to be replaced after taking apart the bike down to the frame
* students re-design the bike (picking paint colours, creating stickers etc)
* students can put the new parts on the bike and have it operational again to send up to a Northern Community
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| **Lesson Overview**: This is a multiple lesson plan that will help students to use mathematical and science concepts to investigate how a bike works and understand the engineering that is involved in the design and building of a bike. Students will calculate the circumference and area of bike tires to see the largest wheel that will be used for the bike. Students will observe the structure of the bike and see how the shapes that are used in the frame create stability and balance. Students will then look at gear ratios to see the length of the chain required to fit all gears. Students will then receive a lesson about the different types of tools and what they are used for and the safety requirements when using each type of tool. Students will then take the bike apart until it is down the frame. Students will create a video journal using a device to see how the bike goes back together (while they are taking it apart) and then use the journal to figure out what parts they need to purchase. The bike will then be powder coated (painted) and the bike will be put back together. |
| **Materials and Technology:** Hammer, screwdrivers, wrenches (metric and imperial), drill, chain break, bike, sockets and drivers, bike stand, bike parts, IPAD or phone, measuring tape, pencil, paper and paper towel and Orange hand cleaner. |
| **Student Accommodations/Modifications:**  | **Lesson will be differentiated by:*** **Content, specifically:**
* **Process, specifically:**
* **Product, specifically:**
* **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.** The students will be introduced by a video that shows the importance of bikes (https://www.ted.com/talks/shimon\_schocken\_s\_rides\_of\_hope) and how there are more bikes in the world than vehicles (<http://www.worldometers.info/>). Then the students will be told to find a bike that needs repair, that is free and that they will need to raise money to buy parts. Students will be asked to get into groups and plan where to get a bike to fix. Groups will then figure out who will be the mechanic, the designer, the fundraiser, and the leader or person keeping group organized. **What key questions will you ask?** What type of bike will you recondition? What concepts in Math can we use to analyze the bike (ie. Circumference, gear ratio, stability of the bike)? What concepts in Science can we use to analyze the bike (ie. Structures, stability, gear ratio, friction and Mechanical Advantage)?How can your group fundraise money to buy parts for the bike?**How will you gather diagnostic or formative data about the students’ current levels of understanding?**Data will be collected by evaluating the video journal, evaluating the math and science worksheets and making sure that all parts are on the bike and that bike is ready to be used.  **How will students be grouped? How will materials be distributed?** Students will pick their own groups of 4 and oversee finding ways to fundraise money in the school. Groups will have to bring some tools; a lot of tools are in the Maker Space. |
| **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 m • 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.** One student from each group will be trained as a mechanic, by a group called Bike X. After two all day sessions the groups will take their bike apart and decide what parts they will need to replace on their bikes. A video journal will be created to help reconstruct the bikes. Students will then calculate circumference of tires, gear ratio to figure out chain length, and the stability of the frame. The groups will then start to fundraise in the school (dances, bake sales etc.) to make money to buy parts to reconstruct their bikes. Frames, handle bars and forks will be sent to Pelletier’s Autobody to be powder coated. After raising money, students will be taking bikes to Churchill High School to reconstruct them over a two-day period in their auto shop. Bikes will then be returned to the school to be decaled and decorated. Bikes will be sent to a Northern Reserve in the Spring.**What misconceptions or difficulties do you think they might experience?** How to use tools? What tools to use for the appropriate part to take off? To order the right parts for the appropriate bike? Knowledge of fixing bikes. **How will they demonstrate their understanding of the concept?**They will demonstrate their understanding by reconstructing the bike and insuring that all working parts (brakes, chain, bearings, gears and derailleurs) are successfully working. **How will you gather your assessment data (e.g., checklist, anecdotal records)?**Assessment data will be collected from the calculations for Math and Science, as well as, the video journal that the student has created. The bike also needs to be fully operational and safe.**What extension activities will you provide?** The extension activity would be to investigate the cost of fixing the bike and compare it to the cost of purchasing a new bike. |
| **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)?** Not really a sharing component with the class as a group. All students will see the bikes when they are reconstructed and sent to a northern reserve.**What key questions will you ask during the debriefing?** Questions that will be asked during the debriefing:1. How do bicycles impact the world?
2. What is the impact that they have in 1st, 2nd and 3rd world countries?
3. How does the use of the bicycles impact the environment? What would happen if there were as many vehicles as there are bicycles in the world?
4. Did the deconstructing and reconstructing of bikes help to improve your knowledge of using basic tools?
5. Would you take the time to fix a bike that is in disrepair or purchase a new bike? Why or why not?
6. Will this project impact your use of a bicycle? Will you ride a bike after this learning experience, why or why not?
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Create a design that you would like to see on your bike frame.

Remember that you are doing to have to paint on the design, so be careful with the amount of detail, sizing etc.



**BIKE REPAIR SHEET**

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| **BIKE GROUP MEMBERS:** |
| **BIKE BRAND/MAKE:** |
| **BIKE SERIAL NUMBER:** |
| **ABC ASSESSMENT** (What needs to be repaired):For each item, take a picture and include it with this paper. Ensure that each picture is correctly labelled and shows the specific part that is in need of repair. Be sure to double check that it is called the correct name. See the bike parts diagram for reference. For each part, research the approx. cost that would be required to do the repair. Website used for part prices: |
| **Name of Part In Need of Repair** | **What is required to repair it?** | **Cost of the part** |  **Picture****(take a picture with your device & insert here)** |
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T**OTAL COST OF YOUR PARTS (be sure to include tax and show all calculations):**

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**To cover the cost of the repairs, what ideas can your group create that would help fundraise the money? Be creative with your ideas, but realistic. Brainstorm in the space below.**

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**What do you think would be the most efficient idea that would have the lowest overhead cost to cover your expenses? Why?**

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**In the space below, develop a plan on how you would make this fundraiser happen. Include all the necessary details such as the date, job details, cost involved in putting this fundraiser on, anticipated amount of revenue you expect to make. What would guarantee its success and make it a worthwhile fundraiser for the amount of work required?**

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\*Depending on your bike, you may need to use a device to research your bike to find the specific name of each part. 