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ECE 4402/01
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Science Lesson Plan

Lesson Plan Title: Wheels in Motion!

Topic: Simple Machines- Wheel & Axle

Subject Area: Science, Language Arts, Math, Engineering and Technology

Grade Level: 4th

Time Frame: 90 minutes

Learner Description/Environment:

- The classroom is comprised of 12 males and 13 female students. It is a diverse classroom in which there are 2 children who are a mix of different backgrounds, 4 Hispanic students, 5 African American students, 13 Caucasian students, and 1 Asian student.
- The classroom environment is very inviting and comfortable for the students. Each student has their own desk and cubby to put their items away in.
- There is a Smartboard and doc-cam in the classroom, which allows the teacher to use different technologies to complete the teaching.

Enduring Understandings:

- Students will understand the concept of simple machines with the focus primarily on wheel and axles.
- Students will understand the importance of working together in a group to create their final product.

Essential Questions:

- What is the importance of the wheel and axle?

Scenario/Problem:

- We will give the students the following scenario in the form of a letter:
    - A young boy named Malawi who lives in Uganda has written a letter to us stating a problem his village in Uganda is having. He mentions in his letter how his village is suffering a severe drought and they have no money for food. In his letter, he requests our class to send him an organized list of ideas and examples of a simple machine that will help his village with the drought.
    - The teacher will break the class into four groups, two will create a windmill and two will create a waterwheel, and the students will work together to create their assigned project.

Common Core/GPS/NGSS:

GPS (Science):

- **S4P3.** Students will demonstrate the relationship between the application of a force and the resulting change in position and motion on an object.
  a. Identify simple machines and explain their uses (lever, pulley, wedge, inclined plane, screw, wheel and axle).

NGSS:

- **4-PS3-4.** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Common Core (Mathematics):

- **CCSS.Math.Content.4.MD.A.1** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec.

Common Core (Language Arts):

- **CCSS.ELA-Literacy.W.4.4** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

Objectives:

- Students will:
  - **Examine** the different examples of simple machines that the teacher will show them.
  - **Invent** a waterwheel or windmill from the materials and instructions that will be given to them.
  - **Define** vocabulary that the teacher will state during the lesson plan that relate to simple machines.
  - **Orally describe** the different types of simple machines and their contribution to our daily lives.

Materials & Resources:

- Teacher Materials & Resources:
  - Letter from Malawi
  - Book "Joey Becomes an Engineer" by Anbreen Babwani and Uzma Shah
  - Rubric for each group (all the rubrics are attach below)
    Letter Writing
    Final Product
    Oral Presentation
  - **Materials for Waterwheel:** plastic bottles, empty thread spool, index card (4x6 inch), straws, tapes, scissors, strings, paper clips, ruler, stopwatch
  - **Materials for Windmill:** scissors, rulers, white papers, large coin, hole punch, straws, modeling clay, sewing thread, paper clip, stopwatch

  - Video "Simple Machines" by Bill Nye http://www.youtube.com/watch?v=HEsH1iA20GM
  - Printer paper to write the letter
  - Concept Map on Simple Machines
  - Markers, Crayons and Color Pencils

- Students Materials & Resources:
  - Pencils
  - Science Journals

Flexible Grouping Strategy:

- This lesson plan with cater several multiple intelligences:
  - **Verbal/Linguistic:** Students writing a letter to Malawi about their solution to his problem and orally presenting their model to class for modification.
  - **Logical/Mathematical:** Students be constructing the model using correct measurements.
  - **Visual/Spatial:** Students are creating a waterwheel and windmill from the resources provided to them by the teacher.
  - **Musical/Rhythmic:** During the re-teaching the teacher will show video on simple machine to the students who need additional help understanding what simple machines are.
  - **Bodily/Kinesthetic:** Students will create the model of windmill and waterwheel model.
  - **Intrapersonal:** Students will brainstorms ideas at home to share later in their groups about how they would create their model of windmill and waterwheel with the resources given to them.
  - **Interpersonal:** Students will collaborate in small groups to work on their project of creating a windmill or waterwheel to help Malawi and his village overcome the problem of drought.
  - **Naturalist:** Students will be encouraged to use recyclable materials in building of their windmill or waterwheel.

Procedures:

- **Engage**:
  - The teacher will engage the students by reading the letter from Malawi requesting the help of the students to save his village.
  - The teacher will create an atmosphere for the students by asking them to become engineers for the day and help Malawi and his village.
  - The students will be told in the letter that they have to invent using simple machines.
  - The teacher will ask for the students to pay attention as they read a book about simple machines.

  - The book will be displayed on the doc-cam for the students to follow along. The book the teacher will read is titled, "*Joey Becomes an Engineer*".
- **Explore**:
  - The students will be given real-life examples of simple machines around their classroom.
  - After the teacher has read the book, "*Joey Becomes an Engineer*", the students will be familiar with the concept and examples of simple machines.
  - The students will be given instructions to go on the computer to research on simple machines and how they solve problems in our daily lives.
  - The teacher will ask the students to focus on the following question while they are completing their research online: What are some examples of simple machines that we see in our daily lives? **(HOTQ)**
  - The teacher will break the students into their appropriate groups and assign the project.
  - Two groups will create a windmill and two groups will create a waterwheel.
  - The students will be given materials to create their final product. While creating the product students will make notes in their science journal.
- **Explain**:
  - The students will explain why their final product is beneficial for Malawi and his village.
  - The students will write a letter replying to Malawi using appropriate vocabulary that they will learn that day.
  - The students will state the steps they took to create their project, and will also include a photo of their final product in the letter.
  - The teacher will grade the group letter based on the rubric (See Attachment Below).
    - <u>Materials for Waterwheel:</u>
      - ✓ For the waterwheel the students will be given a plastic bottle, scissors, empty thread spool, index cards (4x6 inch), aluminum foil, straw, tape, string, ruler, stopwatch and paper clip.
      - ✓ Students will be working towards the sink area, so they can you the water to see if their waterwheel works or not.
      - ✓ Students will use correct measurements in inches and will record for how many minutes or seconds their waterwheel machine run in their science journal.
    - <u>Materials for Windmill:</u>
      - ✓ For the windmill the students will be given scissors, rulers, sheets of typing paper, pencil, large coin, hole punch, straw, modeling clay, sewing thread, stopwatch and paper clip.
      - ✓ Students will use correct measurements in inches and will record for how many minutes or seconds their windmill run in their science journals.
- **Elaborate**:

- The teacher will assign two days for the students to complete their projects in their groups.
- Whilst the students are working on their windmill and waterwheel projects, the students will focus on the following two questions: In what ways will you test your waterwheel or windmill for durability? **(HOTQ)**. How will your windmill or waterwheel solve the problem that Malawi and his village are facing? **(HOTQ)**.
- The students will present their windmill or waterwheel to the class. They will explain why their product is beneficial.
- The class will do a comparison of both the windmills and waterwheels and apply their understanding of simple machines.
- The class will vote for the best example and send it to Malawi.
- As the students are casting their votes, the teacher will ask them to focus on the following question: Out of the four models, which model is best for Malawi and his village? **(HOTQ)**.

- **Evaluate**:
  - The teacher will assess the students on their performance in the groups. This will be done with the teacher walking around as the students work on their project to see which students are participating and which students are lacking focus. This will be a way for the teacher to assess the students based on the formative method.
  - The teacher can administer a summative assessment based on the final outcome of the projects the student will create. The summative assessment will judge the final product of each group, the letter that they will write to Malawi, and their classroom presentation orally describing the benefits of their windmill or waterwheel.
  - The teacher can also evaluate the students based on the feedback that they will give to the other groups on their showcase.
  - As the students critique their peers, the teacher will have them focus on the following question: What are some modifications that the group can make? **(HOTQ).**
- **E-Learning**:
  - The students are working together to create their model for the windmill and waterwheel.
  - The students will conduct their research on the computer by going on websites that are children-friendly to enhance their knowledge on simple machines prior to creating their model.
  - The teacher will use the doc-cam to read the storybook to the class.

Higher Order Thinking Question:

1. What are some examples of simple machines that we see in our daily lives? (Analysis)
2. In what ways will you test your waterwheel or windmill for durability? (Synthesis)
3. Out of the four models, which model is best for Malawi and his village? (Evaluation)

4. How will your windmill or waterwheel solve the problem that Malawi and his village are facing? (Synthesis)
5. What are some modifications that the group can make? (Evaluation)

Accommodations/Differentiated Instructions:

- **LD:** A co-teacher will help the students with disabilities so they may complete their model. The co-teacher will answer any questions that the student will have but not necessarily give them all the answers.
- **ELL:** The students will be given instruction in English and in their native language. Instead of writing an in-depth letter, the students can draw their model and label the part of their model. The students can follow the illustration with three bullet points talking about their model.
- **Gifted:** For gifted students, they will be asked to go beyond the required assignment and come up with a blueprint of an additional model using simple machines that will help Malawi and his village.

Re-teaching:

- For the students who may need additional help in learning the concept of simple machines, we will show them the following video: *Bill Nye Simple Machines*.
- The teacher can pause the video frequently to ask the students questions about what they have watched so that way the teacher can reinforce what the students are viewing.

Extension:

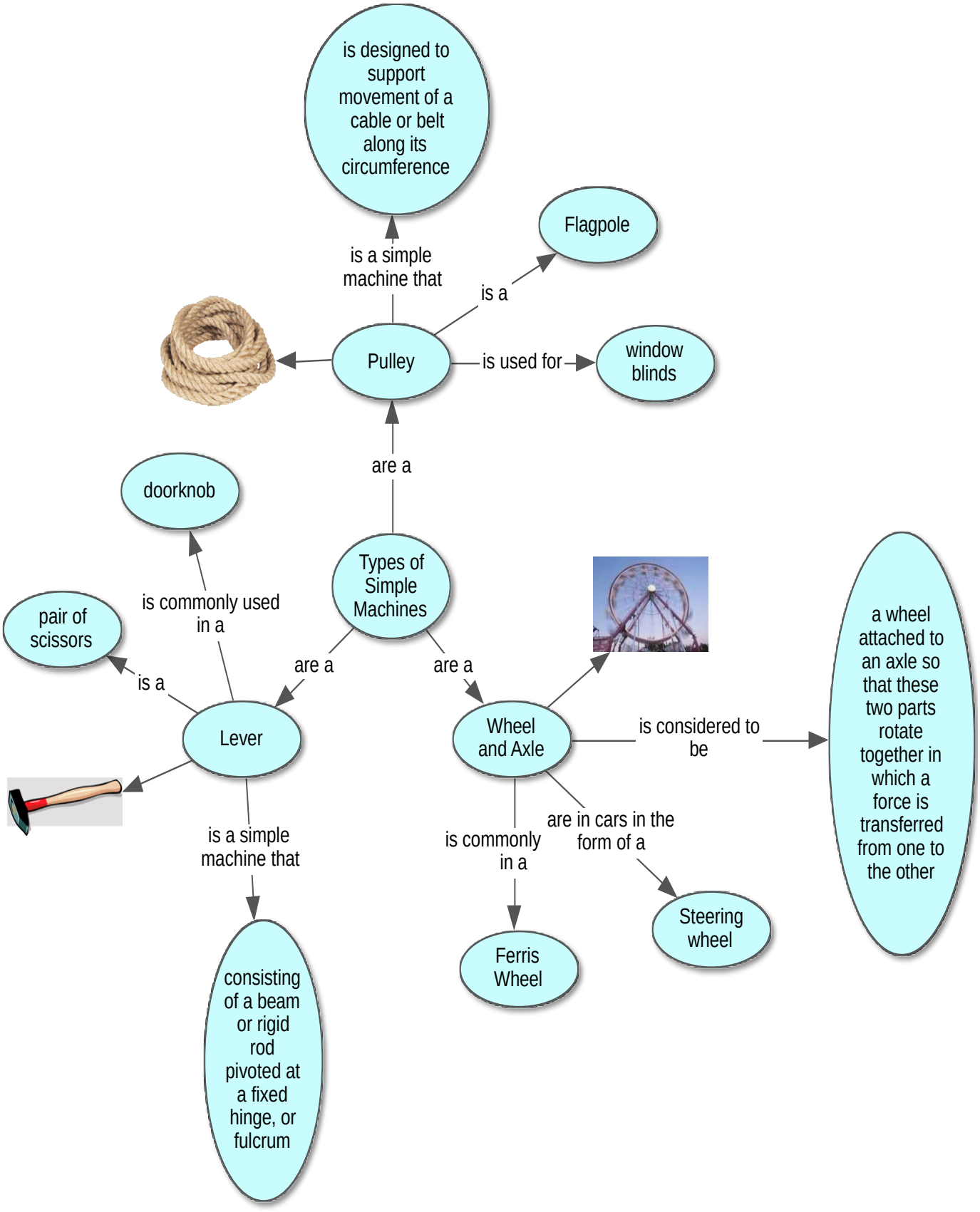
- To challenge the students who successfully met the standards for the assignment, we will ask them to create a blueprint in which they can propose another model that will help Malawi and his village.
- The blueprint must clearly show the appropriate use of simple machines and the students will support their blueprint with a one-page explanation as to why it will be beneficial for Malawi.

Culturally Responsive/Relevant Connection:

- Students will understand the importance of helping one another, this will be their first step towards being a global citizen.
- Students will learn about Malawi and his problem and see the problems that third world countries are facing and as global citizen students will understand that it is their responsibility to help their friends around the world.
- Teacher will talk about using simple things around us to create big dreams that can help many people to overcome poverty and hunger.

Concept Map: (See Attachment Below).

Concept Map - Simple Machines



Work Cited

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Nye, B. (2010, April 26). *Bill Nye Simple Machines*. Retrieved from www.youtube.com: http://www.youtube.com/watch?feature=player_embedded&v=HEsH1iA20GM#t=44

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Letter from Malawi

Dear Ms. Uzi, Ms. Anbreen, & your wonderful classroom,

My name is Malawi and I am from a small village in Kenya. I am 10 years old and I the oldest of two brothers and one sister. My parents are farmers but my father and I do most of the work on our land since my mother has to look after my siblings. Recently my village has been hit by a severe drought, which has caused our crops to become dry.

In our village, we do not have many residents that our educated. Majority of them cannot read or write which makes communication very difficult. My father made sure that my siblings and I receive proper education so we may become successful in the future and do things for the village, which may benefit all of the villagers.

I am using my knowledge of reading and writing English to communicate with you all because my village and I need your help. We would like for you to help us survive the drought that we are all facing. I would like to request you all to come with a plan for us to create a windmill or waterwheel. Please send us your plan so we are able to make one for our village.

Thank you so much for helping my village and I, we hope that with your help, our village can overcome this dreadful drought so we can farm again!

From your Friend,
Malawi

Building A Model : Wheels in Motion

Group Member Names: _____

CATEGORY	4	3	2	1
Modification/ Testing	Clear evidence of troubleshooting, testing, and refinements based on data or scientific principles.	Clear evidence of troubleshooting, testing and refinements.	Some evidence of troubleshooting , testing and refinements.	Little evidence of troubleshooting, testing or refinement.
Function	Structure functions extraordinarily well, holding up under atypical stresses.	Structure functions well, holding up under typical stresses.	Structure functions pretty well, but deteriorates under typical stresses.	Fatal flaws in function with complete failure under typical stresses.
Plan	Plan is neat with clear measurements and labeling for all components.	Plan is neat with clear measurements and labeling for most components.	Plan provides clear measurements and labeling for most components.	Plan does not show measurements clearly or is otherwise inadequately labeled.
Data Collection	Data taken several times in a careful, reliable manner.	Data taken twice in a careful, reliable manner.	Data taken once in a careful, reliable manner.	Data not taken carefully OR not taken in a reliable manner.
Construction - Materials	Appropriate materials were selected and creatively modified in ways that made them even better.	Appropriate materials were selected and there was an attempt at creative modification to make them even better.	Appropriate materials were selected.	Inappropriate materials were selected and contributed to a product that performed poorly.
Construction - Care Taken	Great care taken in construction process so that the structure is neat, attractive and follows plans accurately.	Construction was careful and accurate for the most part, but 1-2 details could have been refined for a more attractive product.	Construction accurately followed the plans, but 3-4 details could have been refined for a more attractive product.	Construction appears careless or haphazard. Many details need refinement for a strong or attractive product.
Journal/Log - Appearance	Several entries made and all are dated and neatly.	Several entries are made and most of the entries are dated and neatly entered.	Several entries are made and most of the entries are dated and legible.	Few entries are made AND/OR many entries are not dated or very difficult to read.

Letter-Writing : Wheels in Motion

Group Members Names: _____

CATEGORY	4	3	2	1
Format	Complies with all the requirements for a friendly letter.	Complies with almost all the requirements for a friendly letter.	Complies with several of the requirements for a friendly letter.	Complies with less than 75% of the requirements for a friendly letter.
Ideas	Ideas were expressed in a clear and organized fashion. It was easy to figure out what the letter was about.	Ideas were expressed in a pretty clear manner, but the organization could have been better.	Ideas were somewhat organized, but were not very clear. It took more than one reading to figure out what the letter was about.	The letter seemed to be a collection of unrelated sentences. It was very difficult to figure out what the letter was about.
Sentences & Paragraphs	Sentences and paragraphs are complete, well-constructed and of varied structure.	All sentences are complete and well-constructed (no fragments, no run-ons). Paragraphing is generally done well.	Most sentences are complete and well-constructed. Paragraphing needs some work.	Many sentence fragments or run-on sentences OR paragraphing needs lots of work.
Grammar & spelling (conventions)	Writer makes no errors in grammar or spelling.	Writer makes 1-2 errors in grammar and/or spelling.	Writer makes 3-4 errors in grammar and/or spelling	Writer makes more than 4 errors in grammar and/or spelling.
Capitalization and Punctuation	Writer makes no errors in capitalization and punctuation.	Writer makes 1-2 errors in capitalization and punctuation.	Writer makes 3-4 errors in capitalization and punctuation.	Writer makes more than 4 errors in capitalization and punctuation.
Salutation and Closing	Salutation and closing have no errors in capitalization and punctuation.	Salutation and closing have 1-2 errors in capitalization and punctuation.	Salutation and closing have 3 or more errors in capitalization and punctuation.	Salutation and/or closing are missing.
Neatness	Letter is typed, clean, not wrinkled, and is easy to read with no distracting error corrections. It was done with pride.	Letter is neatly hand-written, clean, not wrinkled, and is easy to read with no distracting error corrections. It was done with care.	Letter is typed and is crumpled or slightly stained. It may have 1-2 distracting error corrections. It was done with some care.	Letter is typed and looks like it had been shoved in a pocket or locker. It may have several distracting error corrections. It looks like it was done in a hurry or stored improperly.

Oral Presentation Rubric : Wheels in Motion

Group Member Names: _____

CATEGORY	4	3	2	1
Content	Shows a full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.
Preparedness	Student is completely prepared and has obviously rehearsed.	Student seems pretty prepared but might have needed a couple more rehearsals.	The student is somewhat prepared, but it is clear that rehearsal was lacking.	Student does not seem at all prepared to present.
Stays on Topic	Stays on topic all (100%) of the time.	Stays on topic most (99-90%) of the time.	Stays on topic some (89%-75%) of the time.	It was hard to tell what the topic was.
Collaboration with Peers	Almost always listens to, shares with, and supports the efforts of others in the group. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others in the group. Does not cause \"waves\" in the group.	Often listens to, shares with, and supports the efforts of others in the group but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others in the group. Often is not a good team member.
Speaks Clearly	Speaks clearly and distinctly all (100-95%) the time, and mispronounces no words.	Speaks clearly and distinctly all (100-95%) the time, but mispronounces one word.	Speaks clearly and distinctly most (94-85%) of the time. Mispronounces no more than one word.	Often mumbles or cannot be understood OR mispronounces more than one word.