**STEM Stories: Galimoto**

**Lesson Plan**

**STEM** **Career** **Connections:** Health Sciences, Mechanical Engineering

**STEM Disciplines:** Science, Technology, Engineering, & Mathematics

**Non-STEM Disciplines:** English Language Arts

**Academic Content Standards**

**English Language Arts Standards:**

* RL.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
* RL.3.3 Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events.
* W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons
* SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.
* SL.3.6 Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

**Mathematics Standards:**

Given a set of data or a graph, describe the distribution of the data using median, range, or mode.

**Mathematical Practices:**

1. Make sense of of problems and persevere in solving them.

6. Attend to precision

**Science Standards:**

Science Inquiry and Applications, Technological and Engineering Design

During the years of PreK to grade 4, all students must develop the ability to:

• Plan and conduct simple investigations

• Employ simple equipment and tools to gather data and extend the senses

• Communicate about observations, investigations and explanations

• Review and ask questions about the observations and explanations of others

• Identify problems and potential technological/engineering solutions

• Understand the design process, role of troubleshooting

**Design** **Challenge** **Problem/Scenario**

In *Galimoto*, Kondi made a galimoto from bits and pieces of scrap wire that he found at various places in his village in Malawi.

**Engineering** **Design** **Challenge**

Your team will be responsible for designing a game/toy from recycled items and writing step-by-step directions to go along with the game/toy.

**Essential** **Question Students Investigate:**

What recycled items can you use to invent a new game/toy? Are there any recycled objects that are similar to objects you may buy from a store and use in a game/toy?

**Enduring** **Understandings**

● Using the engineering design process when approaching problems results in unique solutions and creativity.

**Prerequisite** **Knowledge** **(as** **connected** **to** **academic** **content** **standards):**

Range, Mode, Median

**Material** **List**

1. Recycled items (brought in from students and teachers). Remind students to bring in recycled items.
2. Tape
3. Glue
4. Scissors
5. Play Money

**Day 1**

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| **Introduction: 15 minutes**   * Sit in a chair and gather the students on the floor around you so they can all see the book. * Remind the students of the full scope of the Engineering Challenge (Day 1, Day 2, Day 3, and Day 4). * Introduce *Galimoto* by Karen Lynn Williams. Show them the cover of the book and ask them what they think the book might be about. Take a picture walk through the book to identify the main events at the beginning, middle, and end of the story. * Slide 2: Ask student to complete the journal entry for day 1. |
| **Read Aloud: 20 minutes**  Read the book aloud to the class, making sure to share the illustrations on each page.  Throughout the read-aloud, you can use the following strategies to monitor the students’ comprehension of the story:   * Ask students a question about the story, then ask them to “turn and talk” to their neighbor to answer the question. Be sure to set a signal for when students should stop their conversation and come back to the large group (hand clapping, snapping, etc.). Questions you might ask include:   + What is the setting of the story?   + Who is main character?   + What are some ways you might have helped Kondi? (this question is a preview to the Engineering Design Challenge). |
| **Quick Write: 15 minutes**   * Ask the students to open their STEM notebooks and title a new entry (Entry #X, Galimoto). * Present the students with the sensory box filled with recycled materials. Invite them to place their hands in the box, and without looking in the box, identify what items they feel in the box. * After they have had time to feel the items, ask them to make a list in their notebook of the items they think they felt in the box. * While the students wait for others to engage with the box, ask them to write one to five sentences about what they could make with the items they think are in the box. You can provide some students with sentence stems if needed. Students can also draw a picture to go with their writing. Use your imagination, like Kondi did! * Once everyone has had a turn to make a list of the items they felt, reveal the actual items to the class by showing them one by one. The students can keep track of the items that were really in the box next to the list they made in their notebooks. * Have a discussion about what the students felt and thought, versus what was really in the box. Invite all students to share, to take turns, and to listen to the contributions of their classmates. This is a good time to remind students about respectful conversation and accepting everyone’s responses. |
| **Application: 20 minutes**   * Display slide one of the PowerPoint: * Slides 3 & 4: Ask the students to share some ideas about what engineers do for their jobs. * Slide 5: Review the classroom rules with students. Set a goal together. * Slide 6: Create questions to ask visitor coming to talk about making toys in their childhood. * Slides 7, 8, 9: Present the “Engineering Design Problem”.   + **Design Challenge Scenario:** In *Galimoto*, Kondi made a galimoto from bits and pieces of scrap wire that he found at various places in his village in Malawi.   + **Engineering Design Challenge:** Your team will be responsible for designing a game/toy from recycled items just like Kondi did! * Slide 10: Explain or share the “Design Goals”.   + Your goal will be to create a creative game/toy from the recycled materials in the store. Your team will have $5.00 to buy tools needed to make your game/toy. You will also be responsible for writing step-by-step directions to go along with your toy/game so others may play with. * Slide 11: Introduce the resources/materials available.  |  |  | | --- | --- | | **Materials:** | Any recycled items the students bring in, masking tape, glue, and scissors. |  * Slide 12: Explain the design testing procedures.   + Procedures: Instead of testing the design against an outside source, your team will be testing your design with other students in the classroom. You will be responsible for rating each other’s design. * Slide 13: Explain the “Engineering Design Process”   + To differentiate instruction, the “Engineering Design Process” is on the handout. Therefore, more proficient readers may want a copy of the handout. * Slide 13: Have the students complete the “Ask” step of the Engineering Design Process.   + Ask the students to notice that the word Ask is in one of the circles of the “Engineering Design Process”.   + Students should Ask themselves what materials they would like to use to make their toy/game.   + Students should write these materials on their STEM Challenge handout.   + Walk around as the students complete the Ask step of the Engineering Design Process. * Slide 13: Explain to the students that the next time they meet, they will spend time on the Imagine step in the Engineering Design Process. In fact, you can ask students to start imagining what their game/toy will look like when they are at home, and they can share their ideas with their families. |
| **Wrap Up: 10 minutes**  Review what was learned during today’s session.   * Invite a retelling of the book by asking students to share what happened first, second, third, and so on in the story. * Review the inventors and inventions discussed. * Remind the students of the Engineering Design Challenge. * Preview the next session by explaining to students that they will continue the Engineering Design Process so that they can imagine and plan ideas to create their own game/toy made from recycled items from home. |

**Day 2**

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| **Introduction: 5 minutes**   * Remind the students that during the previous session they read and discussed the book *Galimoto* by Karen Lynn Williams and were presented with a Design Challenge Scenario and Engineering Design Challenge. Generate a discussion about the Design Challenge Scenario and Engineering Design Challenge. Do a “picture walk” through the book to remind students of the main idea. |
| **Engineering Design Process: Imagine and Plan, 20 minutes**   * Distribute the “STEM Challenge” handout. * Display slide 13 of the PowerPoint:   + Ask the students to notice that the word Imagine is in one of the circles of the “Engineering Design Process”.   + Students should Imagine what their game/toy will look like and how it will be played. Let the students go to the store and look at the items that are available to be purchased. Remind them they may purchase $5.00 worth of items.   + Students should draw a picture or write a description of their game/toy on their STEM Challenge handout.   + Walk around as the students complete the Imagine step of the Engineering Design Process. * Slide 13:   + Ask the students to share their ideas with their team.   + Walk around as the students share their ideas with their teammates. Make sure that each student is given ample time to share his or her ideas. Students get excited about wanting to create their toy/game and often rush through the sharing process. Remind students that the sharing process is extremely important as engineers often alter their designs based on ideas shared during the brainstorming process. * Slide 13:   + Ask the students to notice that the word Plan is in one of the circles of the “Engineering Design Process”.   + Students should Plan as a team what their game/toy will look like.   + Students can use a teammates’ ideas or a combination of the teams’ ideas, but remind them that they must create one game/toy together as a team!   + Students should draw a picture or write a description of their game/toy on their STEM Challenge handout.   + Walk around as the students complete the Plan step of the Engineering Design Process.   + Make sure all students are contributing to the planning process. Often the dominant students expect the other students to use his or her ideas. Remind students that coming to a team consensus is important as engineers are often expected to plan with a group of people.   + Ask the students probing questions about their game/toy     - How did you combine your individual design ideas?     - Why did you choose that design?     - How did you create the idea for this design?     - What are your reasons for selecting the material for your game/toy.     - Suppose a company decided to use your team’s ideas for an actual game/toy they plan to produce. How sturdy is your toy?   + Before allowing teams to build their game/toy, require them to gain approval of their sketch of the team’s prototype design idea. You can write “Approved” beside the sketch on a student’s paper or hand them a notecard with “approved” written on it. A colored note card works nicely as you can easily see if a team has the notecard on their desk or table before they begin to work with the materials. * Once the objects are chosen, the students will be responsible for buying their objects from the store. They will have $5.00 of play money, and the objects will be bought on a first come first basis. Once the item is gone, the students will need to readjust their idea with the items left (an added challenge). * Next, the students will begin the building of their game/toy with their partner/ group. |
| **Wrap Up: 10 minutes**   * Ask students to place their handouts and materials in a safe location and to clean up their area whether they are finished or not. Remind the students they will have extra time to finish during the next session. |

**Day 3**

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| **Introduction: 10 minutes**   * Show the students the book, *Galimoto*, and ask them to raise their hands and offer a one-sentence summary of the book. Invite as many one-sentence summaries as time allows. Alternatively, ask the students to turn to a partner and tell a one-sentence summary of the book. * Remind students that they are working on a game/toy made from recycled items. * Help teams of students locate their handouts and materials. * Remind the students that during the previous session they planned and bought items that would help make their game/toy. * Today, students are going to finish putting the items together to create their game/toy, then begin writing the directions on how to use the game/toy. |
| **Teams Build their game/toy: 30 minutes**   * Slide 13: Ask the students to notice that the word Create is in one of the circles of the “Engineering Design Process”. * Instruct students to continue working on their game/toy. * As the students are building their prototypes, walk around the room and ask them probing questions about their design. For example:   + What are your reasons for selecting that material?   + What are your reasons for using that material for ...?   + What are your reasons for using that material for ...? |
| **Direction Writing: 30 minutes**   * Once the students are finished with their game/toy, allow them to start writing their step-by-step directions. If technology/time permits, allow them to type their directions on the computer.   + EXPLAIN HOW THE PROTOTYPE WILL BE TESTED.     - Students will be using the next session time to test each other’s game/toy and grading their toy/game based on various categories. |
| **Reflection: 10 minutes**   * Slide 14: Design reflection * Ask students to discuss with their team:   + What do you like best about your game/toy?   + How does your game/toy compare to other game/toys in the class? * If time permits, ask some students to share their ideas with the entire class. * Ask the students if they have any ideas as to what type of engineer might make games/toys.   + If a teacher or student assistant has made a game/toy or done something similar, possibly through co-op or a class project, share the experiences (in simple terms) with the students. |
| **Wrap Up: 5 minutes**   * Ask students to place their game/toy in a safe location and clean up their area. |

**Day 4**

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| **Introduction: 5 minutes**   * Help teams of students locate their handouts and materials. * Remind the students that during the previous session they created a game/toy and direction for the game/toy. * Today, students are going to grade each other’s game/toy. |
| **Testing: 30 min**   * Have the students place their game/toy on their table. * Pass out the “grading” worksheet to each student. Explain they will be responsible for grading each others’ groups game/toy based on various categories. * The students will have 5 min at each game/toy and will rate the game/toy based on the categories on the paper.   **Median, Mode, Range: 25 min**   * Once all have been tested/rated, allow the students to review their own scores for their toy/game. * As a class, talk about mode, median, and range. As a class, go through the summary section on their worksheet, and go through question 1 together with a sample response sheet. * Then, allow the students to work with their partner/small group to determine the range, median, and mode for the remaining 3 questions and answer the conclusion questions on the bottom of their paper. Provide extra guidance and support for students by walking around the room and answering questions. |
| **Engineering Design Process: Improve, 5 minutes**   * Slide 13: Ask the students to notice that the word Improve is in one of the circles of the “Engineering Design Process”. * Students should discuss how they can Improve their game/toy according to their peers’ suggestions. * Students should draw a picture or write a description of their improved game/toy on their STEM Challenge handout. * Have a small class discussion how the input of other students helped with the improvement of a groups individual game/toy. |
| **Reflection: 10 minutes**   * Slide 14: Ask students to discuss with their team:   + What aspects of other team designs stood out to you?   + How did the materials affect your ability to make the game/toy the way you wanted it to be?   + What idea from another group did you like best? |
| **Wrap Up: 10 minutes**   * Slide 15: Conclude by discussing the following questions as post-activity surveys are distributed.   + What ideas do you have for engineering a better world?   + How can you turn ideas into reality? * Allow time for students to complete their post-activity survey. |

**Overview:**

*Day 1: Literacy*

*Day 2: Buy objects/start building*

*Day 3: Finish building/write directions*

*Day 4: Move around the classroom and grade each others/ talk about mean, median, and mode*