Week 1- Roller Coaster PBL

Facilitation Guide

Welcome to Week 1! This week’s purpose is establishing the foundation for the rest of the unit in basic skills and standards. This guide will describe the daily activities and just-in-time lessons that have been included in the Student Activities and Timeline page of the PBL unit.

Week 1

Day 1

1. Starting Activity:
   1. This activity includes working together on a BrainPop software program to create a virtual roller coaster. This gives the teacher an opportunity to gauge the excitement and interest of the students in the project as well as introduce speed and Newton’s laws of nature in a fun and exciting way.
   2. The class can do this together or in several groups. If done in groups, it would give the students and teacher a bigger idea of how to work in groups to be effective. Students can reflect later on what could have made the groupwork more effective and voila! Effective teamwork discussion (see #4)
   3. After the starting activity- you can help students think about creating a roller coaster of their own.
   4. This leads into the driving question of the unit, which should be posted in clear view of the students so that it can be a constant driving force for the unit activities.
2. The project overview:
   1. This is a syllabus of sorts, outlining the unit for the students. This should be passed out and gone over, reading it almost word for word, and offering opportunities for students to ask questions
   2. This should also be paired with the guidelines checklist
   3. Grouping strategy is also mentioned in the overview, as well as group roles. Use this to help students break into groups and students apply for roles within groups.
3. Group formation
   1. The teacher will select the group leader and the leaders will work with the other students to interview them for positions within the group.
   2. It should be obvious by now that group leaders, or “project managers” as the role calls it, should be the compassionate leaders of your classroom, those who have great interpersonal skills. It may not be the smartest student, but these are the students who work well with others and who can bring out the talents of others.
4. Effective Teamwork
   1. There is a facilitation handout that lists the effective teamwork attitudes needed to be productive. This may be a great way to introduce teamwork and help students reflect on the attitudes it takes to help this project be successful.
   2. This is also helpful to pull out as a just-in-time lesson if you notice students are struggling to collaborate and communicate
5. Effort Log and Rubric
   1. This effort log and rubric are meant to help students see the connection between effort and achievement, as well as help them see how their individual efforts matter to the group success.
   2. This log should be filled out on almost a daily basis, or it can be filled out whenever there are larger projects or workdays. Either way, it should be used by the students to self-report on their effort.
   3. Teachers should also conference with the students about their effort after the first week. This gives students an opportunity for self-questioning and reflection, as well as conflict resolution and communication.
6. Group time- group time today should be to apply and interview, as well as have an initial meeting to talk about the goals checklist.

Day 2

1. This day should start with the powerpoint introducing students to the history of roller coasters. This can end with further discussion about the evolution of technology throughout the history to help students determine a better technology that their group may want to capitalize on.
2. Skype with an engineer-
   1. This activity is dependent on the teacher’s resources- there are some Knoxville area engineering firms contact information included in the materials and resources section of the PBL.
   2. The students should create a KWLQ (what I Know, Want to know, Learned, Questions) chart before the discussion and fill in the first two sections K and W. During the discussion with the engineer, they should work to fill in the other two sections, and after being given a couple of minutes to form questions, they should be expected to have at least 2 questions for the engineer, although they are given choice about asking them during the discussion. The engineer will hopefully leave an email address in which students who may be too shy to ask questions can have a better outlet to ask questions (teacher monitored of course)
3. Video and Poster
   1. After the discussion with the engineer, you can watch the short engineering process video and have a comparison and contrast discussion between the discussion and the steps presented in the video.
   2. CRITICAL THINKING- Have students work collaboratively to list the steps of the engineering process and write them on the board. Ask them if they think this process is cyclical or just a line that has a definite beginning and end. His encourages students to process the steps and think about the design process in a whole new way.
   3. After your discussion, you can post the engineering poster somewhere visible in the room for students to constantly reference during the unit.
   4. There is also a guide to the steps included if you need extra teaching with the content.
4. Group time- CRITICAL THINKING- groups should discuss the engineering process and do their individual reflections comparing what they will do to the engineering process
   1. They will also fill out the effort log

Day 3

1. Favorite Roller Coaster Facts-
   1. Groups will select a favorite roller coaster and use the handout to research important stats about that roller coaster. The groups will present their information to the class and also use this roller coaster as a basis for their own design as well as the next few day’s discussions of speed, time, and even Newton’s laws.
2. [**Simple machines**](http://weebly-file/2/1/6/0/21603648/simplemachinepowerpoint.ppt)- this is a just-in-time activity for students to learn more and review the six simple machines using this powerpoint. If you want the groups to do this together or all students individually that is up to you.
3. **ID simple machines- students are going to use their favorite roller coaster information to identify the six simple machines on the coaster and where and how they are used.** 
   1. **There is a simple machines review guide included to give to groups or individual students as a review of the simple machines**.
4. **Group work time:** 10 minutes- groups will begin to develop concrete ideas about the type of roller coaster, modifications desired, as well as design and size.

Day 4

1. **Speed, time, and distance formulas** (45 minutes)   (Unit rates, proportions, and  percent changes)- This is a just-in-time powerpoint that helps review speed, time, distance, unit rates and percent changes. I have a feeling that my students are going to need this extra boost of instruction to help them make modifications
2. [**Nasa Physics**](http://www.nasa.gov/topics/nasalife/features/defy_gravity.html)- this is a video that helps students make connections from roller coaster physics to the physics that are involved in roller coasters. This is a great way to initiate discussion about why these two different occupations may be connected (CRITICAL THINKING)
3. **Group work time:** 15 minutes- students will have 15 minutes to finalize their ideas (which are due the next day), or conference with the teacher for any conflict resolution or larger issues.
4. **Students must also fill in their effort log and do the exit ticket as a group for day 4**

Day 5

1. **Ideas due for rollercoaster- groups will turn in their ideas with desired specifications and modifications. These should be checked for accuracy and comprehension of the concepts.**
2. **Newton's laws review**(30 minutes)-
   1. [Leaky Water Bottle](http://exploration.grc.nasa.gov/outreach/appd/documents/LeakyWaterBottleEnhanced.pdf) **– this activity is a great way to start the discussion about Newton’s Laws**
   2. **Students can send a representative from the group (especially the engineers) to do the experiment and answer questions about the experiment**
   3. **This experiment requires a plastic tarp or cloth on the floor or table to help with the mess.**
   4. **After the experiment, students will have questions about the relevance of this experiment, and this is a gateway to more discussion about gravity and free fall, two huge components of roller coaster design.**
   5. **There is a handout about Newton’s laws which requires students to fill-in information that can come from just-in-time instruction or can come from student-directed research.**
3. **Rates and Ratios-**
   1. **This is an example of just-in-time instruction reviewing rates used in speed and formulas such as newton’s laws. This can be used at the teacher’s discretion and useful in reviewing important concepts if needed. This can also be given to the groups just as a resource if they only need some review.**
4. **Safety considerations** (20 minutes
   1. **Groups can send a representative- most likely the project manager or materials acquisition manager to research the safety regulations of roller coaster design. A link has been provided to help their search. They should take their information back to the group and they become the expert of safety, helping their team implement safety measures into the design ideas.**
5. **Group work time:** 10 minutes- the groups should work to finish up their design ideas, as well as individually fill in their effort logs.
   1. Students are also responsible for the CRITICAL THINKING reflection about the impact of Natural laws such as Newton’s laws on safety regulations.
   2. This is also a great time for teachers to conference with project managers or groups to understand where groups are and settle any conflict leading into the next week.