Buckhannon-Upshur Middle School

LESSON PLAN

Name of Teacher: Christina Sterck

Date: Days 1 & 2 Time: 47 Minutes Grade/Subject/Course: 7th Grade Science

1. Lesson Topic(s) Inca Engineering- Q’eswachaka Bridge

2. Length of Time 47 minutes

3. Lesson Material(s) and Special Equipment

   Rubber bands, string, roll of pennies, toothpicks, Popsicle sticks, cardstock, cardboard, paper clips, binder clips, computers, dry erase markers, whiteboards,

4. Adaptations for Special Needs

   - Students will have directions read to them and rephrased.
   - Students will be questioned for understanding of directions/procedures.

5. Objective(s) and Related Academic Standards Code(s)

   - S.6-8ETS.1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
   - S6-8ETS.2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
   - S6-8ETS.3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
   - S6-8ETS.4 Develop a model to generate data for iterative testing

6. Assessments and Checking for Understanding (match these to your objectives and include them in your procedures below)

   - Ability of groups to develop a bridge that can withstand a roll of pennies.
   - Evaluation of design by groups that shows ability to problem solve issues and modify design.
7. **Anticipatory Set and Motivation Activities/ Accessing Prior Knowledge**

Day 1  Bellringer- What plans need to be considered before building a house?

    Answer- Location of house, proximity to utilities, cell service in the area, etc.

    Teacher- Ask What steps do we need to make to build a bridge?

Day 2  Bellringer- Test your bridge to see if it will support the weight of the pennies.

    Answer- Students will evaluate their design.
    - Students will answer the following questions.
      - Describe if your bridge supported/did not support the full weight of the pennies.
      - What worked well in your planning and construction of your bridge?
      - What could be improved in your planning and construction?

8. **Procedures and Content Presentation** (*attach all handouts, presentation notes, etc.*)

Day 1- In pairs, students will design and build a bridge using specific materials.
- Students are to look at materials available.
- Students will decided what building materials will be used.
- Students will be given ten (10) minutes to plan their bridges.
- Groups will spend twenty-five (25) minutes building their bridges.
- Criteria
  - Bridges can only be made with provided materials.
  - Bridges must be able to support one unopened roll of pennies.
  - Everyone in the group must assist in building the bridge.
  - Bridges must be 6-12 inches long.
- Students will record what types of building materials were used and quantity of each material.

Day 2- Groups will walk around the room for ten (10) minutes and look at each other’s designs.
- For at least three different stations, students will evaluate each other’s designs.
  - Students will answer the following questions:
    - Did this bridge support the weight of the pennies?
    - What do you like about this group’s designs?
    - Compare three things and contrast three things between your bridge and this group’s bridge.
- Review the answers to the questions as a group. *** Ensure that evaluation of the work is done respectfully. ***
- ***Prior to class, collect the long grass from alongside of the soccer fields. ***
Teacher will ask the students “Can you make a bridge from grass?”
- Students will spend three (3) minutes talking with the individuals at their table to discuss their ideas. Students must defend their answers.
- Discuss the question “Can you make a bridge from grass?”
  - Yes/No
  - Explain your answer.
- On laptops and in pairs, students will research what materials are used to build bridges. Ten (10) minutes
  - Lists may include: stone, cement, metal, sand, bricks, tires, wood, plastic, rope
- On one of the wipe boards, Teacher and students will generate a list of materials used to build a bridge.
- If no primitive material are stated, guide students to specific websites.
  - Smithsonian- Museum of Native Americans
- Teacher will talk about the Inca Empire.

9. Summary and Closure

Day 1- Groups will mark their bridges and place them in a safe location.
- Teacher will review the activities of the day and expectations for the next class.

Day 2- Students will draw a picture of how they think the Inca people looked.

10. Assignments and Enrichment Activities
Buckhannon-Upshur Middle School

LESSON PLAN

Name of Teacher: Christina Sterck

Date: Days 3 & 4 Time: 47 Minutes Grade/Subject/Course: 7th Grade Science

1. **Lesson Topic(s)** Inca Engineering- Q’eswachaka Bridge

2. **Length of Time** 47 minutes

3. **Lesson Material(s) and Special Equipment**
   - Computer, whiteboards, dry erase markers, overhead projector, laptop, 45 lb kettlebell/weighted plate, video “Why are there so many different types of bridges?” By Sebastian Kalilikane (YouTube)

4. **Adaptations for Special Needs**
   - Students will have directions read to them and rephrased.
   - Students will be questioned for understanding of directions/procedures.
   - Partner with higher functioning peers in group

5. **Objective(s) and Related Academic Standards Code(s)**
   - S.6-8ETS.1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
   - S6-8ETS.2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
   - S6-8ETS.3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
   - S6-8ETS.4 Develop a model to generate data for iterative testing

6. **Assessments and Checking for Understanding** (match these to your objectives and include them in your procedures below)
   - Students will perform a fill-in-the-blank form for the video to gather notes on bridges,
   - Students will complete a video question guide on the Inca Empire.
7. **Anticipatory Set and Motivation Activities/ Accessing Prior Knowledge**

Day 3 Bellringer- In what countries was the Inca Empire?

Day 4 Bellringer- Define the word force.

Answer- a push or pull upon an object resulting from the objects interaction with another object.

8. **Procedures and Content Presentation** *(attach all handouts, presentation notes, etc.)*

Day 3- Inca Empire
- Students will watch a video about the Incan Empire and its achievements.
  - Students will complete a video question guide on the Inca Empire.
- After video, discuss with students.
  - At what elevations did these people live?
  - What were some engineering accomplishments?
    - Moving heavy objects without the use of the wheel or work animals.
    - Demo- Have a 45 lb kettlebell/weighted plate on the floor.
      - Ask a student to move the weight across the room.
      - Ask the student to return the weight to the original position in the room. **this time using a cart**
      - Ask the students which method of moving the weight was easier?
      - Which method took less time?
      - Teacher will have students imagine how much work it took to complete the Inca Road without help.
- Teacher will ask “what forces does the Inca Road have to withstand each day?”
  - Students will generate ideas such as wind, rain, cars, earthquakes, etc.
  - Define force.

Day 4- Demonstrate force
- Have the students grab hands with the students across from them (4-person tables) or beside them (2-person tables)
- Teacher will direct students to gently pull the person toward them.
- Teacher will direct students to gently push the other person away from them.
- Teacher will ask “what are some force interactions going on in the classroom at this moment?”
  - Ex: Books on desk, person on chair, ponytail holder in hair, stretchy fabric against skin, shoelaces on shoes, my stump/ cement block against the door, magnets holding the fire doors, etc.
- Teacher states “bridges are many types of bridges”.

- Show short introduction video “Why are there so many different types of bridges?” by Sebastian Kalilikane (YouTube)
  - Students will perform a fill-in –the-blank form for the video to gather notes on bridges,
- Definition- Arch bridge- a bridge with abutments at each end shaped as a curved arch
- Show images of arch bridges
- Definition- Suspension bridge- bridges with overhead cables supporting its roadway.
- Show images of suspension bridges
- Review bridge building materials list with class. Challenge the kids to answer the question “Can you make a bridge from grass?”

9. **Summary and Closure**

Day 3- Review bridge building materials list with class. Ask students to define the word “Force” for homework.

Day 4- Review bridge building materials list with class. Challenge the kids to answer the question “Can you make a bridge from grass?”

10. **Assignments and Enrichment Activities**
Buckhannon-Upshur Middle School

LESSON PLAN

Name of Teacher: Christina Sterck

Date: Days 5 & 6+ Time: 47 Minutes Grade/Subject/Course: 7th Grade Science

1. **Lesson Topic(s)**
   Inca Engineering- Q’eswachaka Bridge

2. **Length of Time**
   47 minutes

3. **Lesson Material(s) and Special Equipment**
   Computer, whiteboards, dry erase markers, overhead projector, laptop, Video titled “Grass-bridge” in Video folder on laptop, string/twine, grass from outside by the soccer field, Suspension Bridge Project guide

4. **Adaptations for Special Needs**
   - Students will have directions read to them and rephrased.
   - Students will be questioned for understanding of directions/procedures.
   - Partner with higher functioning peers in group

5. **Objective(s) and Related Academic Standards Code(s)**
   - S.6-8ETS.1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
   - S6-8ETS.2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
   - S6-8ETS.3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
   - S6-8ETS.4 Develop a model to generate data for iterative testing

6. **Assessments and Checking for Understanding** *(match these to your objectives and include them in your procedures below)*
   - Teacher will walk around and check progress sheets for students.
   - Teacher will question students and answer any questions posed by the students.
7. **Anticipatory Set and Motivation Activities/ Accessing Prior Knowledge**

Day 5  Bellringer- “Can you make a bridge from grass?”
Answer- bridges can be made from grass and many other materials such as cotton, hemp, metal cables, etc.

Day 6  Bellringer- List three steps that were accomplished while building your bridge the previous day.

Answer- cut supports, measured main ropes, tied ropes to supports, etc.

8. **Procedures and Content Presentation** *(attach all handouts, presentation notes, etc.)*

Day 5- Inca Road and Bridge building
- Students and teacher will review bridge types.
- Teacher will state that the Inca used suspension bridges to move materials.
- Students will watch the Video entitle “Grass-bridges” from the Video folder on the laptop.
- With the grass from the field, Students will emulate the way the grass was make in the video.
  - Lay some grass in your hands
  - Roll the grass between your hands
  - Add more grass and repeat
- Teacher and students will evaluate the progress of the rope making.
  - Good, Bad, indifferent
- Students will receive “Suspension Bridge Project” guide.
  - Students will work in pairs or groups of three
  - Each group is to construct a three (3) feet long suspension bridge using yarn, string or twine.
  - Each bridge must have supports on only the ends.
  - Bridges must suspend over a gap and be self-supporting.
  - Bridge must support the weight of a composition book without collapsing.
  - Grades for participation will be given daily. As well, an overall group score will be given for the project.
- Set expectations for what students should accomplish by the end of the class period.
- Students are to work on projects for remainder of the period.
  - Day 1- planning and gathering materials.

Day 6 and 7- Students are to work on projects for the period.
- Students are expected to begin construction by the end of the class period.
Students need to plan how they want their bridge to look, how many supports are needed, how many strands of twine need to be used, etc.

- Students can spread out in the room to fit the available space
- ***Projects must be left in the room overnight*** the projects must not be taken home. Work must be completed at school

Day 7- End of period- projects must be turned in for grading.

9. **Summary and Closure**

Day 5- Review project expectations. Review work that should have been accomplished by the end of the period.

Day 6- Review project expectations. Review work that should have been accomplished by the end of the period.

Day 7- Collect materials for grading.

10. **Assignments and Enrichment Activities**