David Crewes

CEP800

Technology Lesson Plan

Introduction - Content

- This lesson is designed for a High School Physics Course.
- Grade levels are usually from 10 to 12.
- Content area is Forces (HSCE Standard P3: Forces and Motion)
- **Rationale –** After unit discussions on Vectors, Forces and subsequent calculation thereof, students are asked to design a bridge that will hold an optimal amount of weight. Students will draw on prior knowledge and also utilize technology to test new theories and ideas.

Pedagogy

- Students will utilize a Constructivist model of learning where they will use prior knowledge to complete the unit requirements.
- This unit will have an Inquiry based lesson plan where students will investigate individual aspects of a bridge and its design, and then they will use technology to analyze their findings. The end game will be the building of a bridge utilizing their designs.

Content and Pedagogy

- Maximum student achievement and understanding can be utilized when they are the masters of their learning
- I can guide students as they determine the best designs for their bridges based on a few learning activities
- Content mastery will originate from original student thought and group collaboration based on student designs

Technology

- Depending on the stage of development, there will be videos to show on the classroom projector
- There are some rudimentary simple machines that a used to calculate forces of bridge members
- Excel is used to calculate the tension forces of each member tested
- The West Point bridge Building Software is also utilized at several different points in the lesson to help with content mastery

Technology and Pedagogy

- Simulations via the computer along with actual hands on experiments in the laboratory will enrich student experiences
- The technology itself is constructivist oriented wherein the conditions during each test can be modified then tested again after changing certain aspects

Technology and Content

- By using the Bridge Building Technology the individual forces of each member of a bridge can be calculated and investigated leading to greater understanding of the net forces on a bridge
- Tensile strengths are investigated as the program allows the user to change the materials the bridge is made from

Assessment

- Assessment will be in the form of a pile of sand
- Groups utilizing the software and heeding the concepts of forces will be rewarded with a bridge that will probably hold more weight than one that was not
- After the bridges are tested, each group will analyze their crushed bridge for flaws and offer any input on improving design for future use
- Bridge program will then be used to test those ideas

Bridge Building 101 (Classroom lesson Plans)

Anticipatory Set:

- Teacher led discussions on forces, vectors and free body diagrams
- Previous bridges displayed to class and passed around
- Timelines, requirements, restrictions and schedules discussed

Discussions and Adventures

1) Differences/similarities discussed between bridges (Student led/teacher moderated)
   - Compression and tension members are the topic of the end discussion
   - Different lengths and sizes of file folder members constructed and tested using simple machines that crush or compress
   - Excel spreadsheet used to calculate tensile strength of each member. Students then write an informal summary of member strengths
2) Analysis of forces
   - Forces on several members calculated from the design of an average bridge
   - Compression or tension calculated in Newtons
   - Sample calculation Quiz
3) West Point Bridge Building Program
   - Computer lab: Using data collected from previous adventures, groups start to design their own bridges
   - Different shapes, sizes, and members are explored as students decide on an overall plan using the program
4) Design and Drawing
   - Students draw out plans of bridges (usually two sides is sufficient)
   - Instructor input on design and drawing to help with construction
5) Fabrication
   - Bridge members are cut glued and placed together
   - Instructor input on clean cuts and sloppiness
6) Testing
   - A board is placed on the deck of each completed bridge and sand is added to a suspended bucket until bridge fails
   - Group and class discussions on event and design flaws/improvements