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| Lesson 7: Re-Design |

Problem Statement:

The city of Bothell needs help! In the event of a natural disaster (e.g., earthquake, fire, flood, land/mudslides, and storms), power goes out, methods of communication and transportation are often lost or damaged, medical care is needed, and basic survival resources need to be maintained and distributed to those in the disaster area. Often, resources are low or have been damaged/contaminated. Your goal is to aid the community in the event of a disaster, with each group in charge of an area within the city affected by the disaster. Groups will identify two problems that can occur within a city grid, then develop a physical solution (build/repair) or a conceptual solution to a problem in future lessons.

Learning Objectives: Students will…

* Redesign - For physical solutions, students will redesign in order to increase the effectiveness of their solution.
* For conceptual solutions, this will be analyzing the effectiveness of their solution using PUGH chart analysis and using the Conceptual plan evaluation form filled out my class members based on their presentation.

Lesson Standards (NGSS, CCSS, CTE):

* MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
* MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions already in place, to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
* MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Materials:

Google Powerpoint - Disaster Strikes Lesson 7/8

Have all materials available for re-design and re-testing (same as lesson 6)

Physical Models: Materials needed to build physical models of proposed student solutions..

* Example Road/Bridge Model Materials: popsicle sticks, toothpicks, index cards, wooden dowels, clay, cotton balls, soil, straws, spoons, yarn, rocks, sand, legos, rubber band, sponges, small wooden planks, cardstock, small plastic cups~ and any additional items for design students bring from home
* Student Worksheet to record and document plan.

* Conceptual Models:
  + For conceptual solutions, this will be analyzing the effectiveness of their solution using PUGH chart analysis
  + Copies of class evaluation tool “Disasters Strikes” - Conceptual Plan Evaluation that was filled out by all class members.

Lesson Preparation:

* Student Worksheet PBL Disaster Strikes Step 7 to record and document plan.
* Materials listed above for physical models - preparing access to these materials for student evaluation/collection before building model.
* Copies of class evaluation tool “Disasters Strikes” - Conceptual Plan Evaluation that have been filled out by class members from the previous days lesson.

Time Required:

40-80 Minutes ( 1 - 2 class periods)

Grouping of students for instruction:

* Students will be in their “anchor groups” which is their assigned seating. These groups are based on prior performance in order to scaffold each group to have a strong leader, strong academic performer, and a social individual. Each group should have 3-4 students.

(TEACHER SPECIFIC) Brainstorm What Students Know/Need to Know from prior lessons

* Physical solution groups need to evaluate what part of their physical model was unsuccessful and implement new ideas for improvement. Teacher will facilitate with this process by asking questions which prompt their thinking to focus on the area of concern in their solution and brainstorm new ideas.
* Conceptual solution students need to evaluate the effectiveness of their plan based on their conceptual plan evaluation ranking and re-design to improve on criteria and adjust constraints.

LESSON PROCEDURE:

* Teacher will facilitate physical solution re-design teams with evaluation (stamp) of their new design solutions. Teacher will ask specific questions as to how the re-design step(s) will fix the prior problem from their original testing solution. Teacher will model safety guidelines in pouring water on models, collection of water, and clean-up. Students will re-test their improved design model and record data.
* Teacher will facilitate conceptual solution teams with evaluating their team evaluation scores based on their team’s solution presentation. Teacher will model how to tally up scores to determine if overall their scores represent a 75% passing for approval. If the team has meet the 75% approval rating a stamp is given to the completion of STEP 6 and STEP 7 Test and Re-Design Sections of the PBL Disaster Strikes student worksheet.
* If the team did not meet the 75% approval rate the team will develop adjustments to their plan, self-evaluate by developing another PUGH chart based on their adjustment.
* Conceptual students will re-evaluate their solution using the Disaster Strikes - Conceptual Plan Evaluation.

Accommodations:

* Accommodations based on individual student/group needs. For example, physical model teams may need additional materials for testing their re-design. Conceptual teams may need accommodations based on math skills in determining a 75% approval rating for their solution. In addition, support in brainstorming for new ideas in making adjustments on their plan may also be needed. Checking in with each group and verifying what their next steps are ensures they are on track and accommodations can be provided for as they come up.