Inquiry Activity: Study of Trusses

Chances are that your school building uses trusses in its design. If you look at bridges, bicycle frames, or at roofs, you will also see trusses at work. Have you ever wondered about the purpose of a truss? Why are they made the way they are?

If you are designing a roof, why not just use a beam? Is there something about that triangular shape that provides some benefit? Could it be that a truss can carry more weight than a beam with the same amount of wood? Your goal is to investigate the basic truss shape to understand what factors affect its strength and stability. After some investigation you will use your new knowledge and design your own truss to be tested.

MATERIALS

Vernier data-collection interface (e.g., LabQuest or LabQuest Mini)

Vernier data-collection software (e.g., LabQuest app or Logger *Pro*)

computer (only necessary if using Logger *Pro*)

Vernier Structures and Materials Tester (VSMT)

VSMT Truss Tester Accessory

wood (as supplied by the instructor)

other materials: glue, corner brackets, measuring and cutting tools (as supplied by the instructor)

Part 1

1. Brainstorm with your class or your group about why trusses are used and what factors of a simple triangular truss affect its strength or effectiveness. Record the results of your brainstorm session and explain your ideas.

2. Design an investigation to test your ideas about truss. Your investigation should identify several factors you think will affect the function of a truss and how to specifically test each factor. The trusses you will build for your test should be between 20 and 30 cm long and be able to fit into the Truss Testing Accessory for the VSMT. Present your test plan to your instructor for review and approval.

3. Build the trusses and conduct the tests you designed. Depending on the building supplies your instructor provides you may need to allow a day or more for the glue to cure. Make careful notes of your observations regarding how the trusses failed, including the nature of the failure and the maximum force withstood. Compile this data in a meaningful way and present the data to your instructor.

Part 2

In this activity, your goal is to design a truss that holds the most weight per weight of the truss. For example, if your truss weighs 0.05 N and you can support 50 N of force applied, you will divide 50 N by 0.05 N to calculate an efficiency of 1000.

1. The span of this truss must support itself over a gap of 24 cm.

2. The truss must fit into the Truss Tester Accessory.

3. The maximum force applied will be 700 N. The efficiency of a truss that supports more than 700 N will be calculated by dividing 700 N by the weight of the truss.

4. Using the data and observations from Part 1, design a truss that will maximize the efficiency of your truss. Your group will collaborate on the design; and you are able to create three advanced trusses. These can be built and tested sequentially or simultaneously.

5. Test your design and document your results. Include an introduction that explains your trusses' design features.