

Phase 1 Design: Graphics and Layout

QuickView

The students review car designs that they like and draw multiple thumbnail sketches to generate ideas for their own cars. After creating at least three designs, the students select one and do a more detailed multiview drawing.

Time Required

45-135 minutes

Content Areas

Primary: Engineering

Secondary: Math

Vocabulary

- brainstorming
- scale
- thumbnail

Materials

"Thumbnail Drawing Sheet"

"Multiview Design Sheet"

Engineering Design Process

1. Determine the problem or the opportunity.
2. Determine the specifications.

The Design Loop

- A. Research.
- B. Brainstorm possible solutions.
- C. Formulate a solution to implement.

Procedure

Before this activity, encourage students to bring photos of cars they like to class. These can include concept cars, race cars, drag racers, or any car with a design the student admires. You may also choose to provide a set of your own photos for students to peruse. Also provide several photos of CO₂ dragster cars to show students the typical form of these vehicles. The images will stimulate imagination and dialogue.

It is recommended that students do their sketching and drawing by hand, at least at first. If you have the resources, you may have students each create a CAD version of their multiview design after they have settled on a design. They could then make adjustments to the CAD file and save each updated draft with a new name.

Teacher Instruction

1. Look through the collection of vehicle photos, both the real-world cars and the CO₂ dragsters. You will notice that many CO₂ cars are inspired by features of real cars but that they have a form all their own. Pick out several photos of cars that you like.
2. Sketch at least three car designs on your "Thumbnail Drawing Sheet." You can sketch more than three if you like. Each design should have a top, side, and isometric drawing. The designs you make do not need to look exactly like the cars in your chosen photos. In fact, they do not need to look like them at all. The photos are only for inspiration and ideas. The drawings you are making are only quick sketches. The point is to capture an idea, not to make a polished, perfect drawing (Figure 1).

This is one of those times when extreme attention to detail is not desired. If students are being too perfectionistic about their drawings, you may urge them to speed their sketching process a little. Consider doing some preliminary sketches with a very short time limit, such as one or two minutes, to get students used to the idea that these are quick sketches, not detailed sketches.

3. After you have drawn three thumbnail sketches, decide whether you like any of these well enough to use it as a final design. If not, keep making more sketches. If one is close to being satisfactory but not quite where you want it to be, make another sketch of that design but with modifications that make it to your liking. Do not just erase sketches you have already made. Instead, create new sketches. Stop when you have at least three sketches and one that you really like.

Watch students as they sketch to ensure they are not just continually erasing their vehicles and redrawing them. A little bit of erasing is fine, but it is good for them to have a record of the way their ideas have changed. Emphasize that this is an important part of the design process.

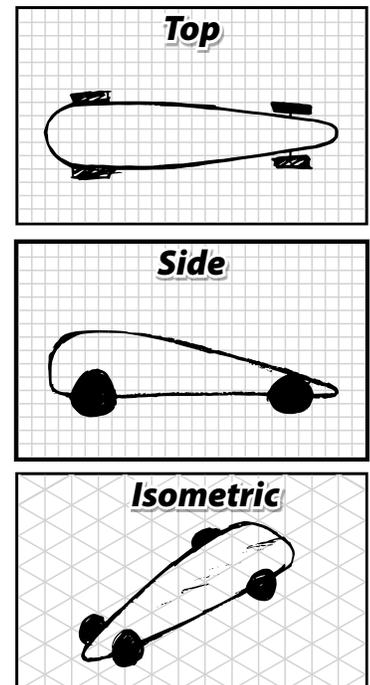
4. When you have created all your thumbnail sketches, choose the one that you like the most. Study it and imagine how it will look from the side, from the top, from the front, and from the back.

The "Multiview Design Sheet" has outlines of the body blank that should help students understand the concept of multiple views. However, it might take a little more explanation to convey the concept. One technique is to use blocks as manipulatives. These can be arranged in ways that clearly and comprehensibly demonstrate the difference between the different views. An Ortho-Box™, available from Hearlihy, is a product that can help explain the concept in a powerful way.

5. You will now transform your sketch into a series of detailed full-size drawings. Fill out the information at the top of the "Multiview Design Sheet." For Design Number, write the numeral 1. If you do another detailed drawing later, you will redraw it on another sheet with your changes and keep track of the number of designs you've made.

Some teachers might still wish to use blank sheets of 11" x 17" graph paper instead of the "Multiview Design Sheet" for more advanced students. If you take this route, it is doubly important to emphasize sticking to the specifications.

6. You will do a side-view, a top-view, and a rear-view drawing. Before you begin drawing, however, look at the specifications indicated on the "Multiview Design Sheet." These tell you such things as how long or short the car may be and how far apart the wheels may be. When you make your drawings, make sure that you follow



(Figure 1)

Teacher Instruction

these specifications.

In the next activity, students will be assessing their vehicle drawings to make sure they are within the specified ranges. It is not necessary that they get everything right at this point because they will have time to make corrections.

7. Make a detailed side-view drawing of this sketch on the “Multiview Design Sheet.” You will make your drawing full scale, which means that your drawing will be the same size that you want your car to be. If your car will be 220 millimeters from front to back, so will your drawing. When making a side-view drawing, show only the side. You should not show any of the top, bottom, back, or front. Include the placement of the screw eyes on this drawing. (These should not be placed below the axles.)

Providing the available dragster wheels for your students to trace and instructing them to place the center of the wheel where they imagine the axle to be might help them visualize their designs and save time during the measurement and redesign stage.

8. Make a top-view drawing on the “Multiview Design Sheet.” Just as before, the drawing will be at full scale. Show only the top of the vehicle. To do this, imagine that you are standing directly over your vehicle and looking down at it. Use the graph lines to make sure that the two drawings are aligned.
9. If time remains, you may also draw a front-view drawing and a back-view drawing. You may also add details to your car such as decals and painting ideas.

If there is time, a rear-view drawing in particular is helpful. It prompts students to think about the safe space around the cartridge hole. Students will also have an easier time with the rear view. The front view is considerably more difficult technically.

10. Save all your work in your portfolio.