Dynamic Design: The Cleanroom

Working Together

TEACHER GUIDE

BACKGROUND INFORMATION

Johnson Space Center

In the Student Activity, "Working Together" students complete a task by working in teams. Often the best products are a result of many people working on the same task in harmony. The following information is provided for the teacher here and also located in the Student Text, "Scientific Symphony," which accompanies this activity.

Contamination Control Lead Scientist Eileen Stansbery describes the orchestration of putting the array together in this way. " To install this [array frame] vertically it takes about three people. One person to hold the wafer in place, one person to hold the retaining rings in place and one person to mount the screws and screw the screws in."

NATIONAL SCIENCE STANDARDS ADDRESSED

Grades 5-8

Science and Technology

Abilities of technological design

Understandings about science and technology

History and Nature of Science

Science as a human endeavor

Grades 9-12

Science and Technology

Abilities of technological design

Understandings about science and technology

History and Nature of Science

Science as a human endeavor

(View a full text of the National Science Education Standards.)

MATERIALS

For each group of three students:

- Paper cut-outs of wafers. See "Teaching Tools"
- Scissors
- Large sheets of paper
- Color coding labels (19 mm diameter)
- Color coding labels (6.25 mm diameter)
- Forceps
- Overhead projector and transparency of the array frame
- Student Activity, "Working Together"
- Student Text, "Scientific Symphony"

PROCEDURE

1. Before class, make a transparency of the array frame. Using an overhead project the array frame onto a large sheet of paper such that the diameter is about 75 cm that is taped to the wall. Trace the frame onto the paper and then darken with a marker. Make copies of the student texts, student activity sheets, and the wafers. If you are going to demonstrate the procedure before the students complete the assignment, have about 5-6 wafers on hand. Have the top row of three wafers and the first wafer on the second row on the array prior to class.

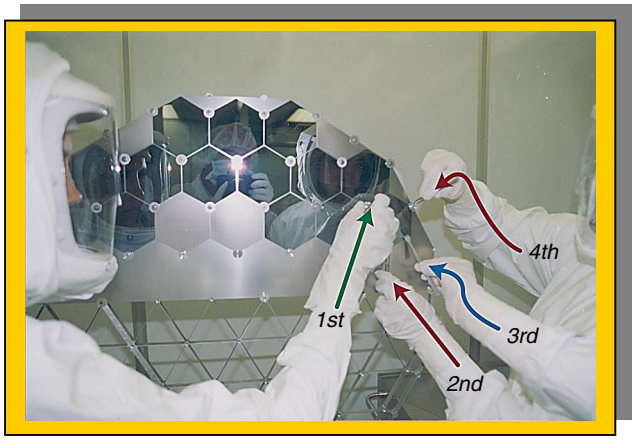
Alternate Strategy Tip

If students are going to listen to this online they will need to be at computers with a headset. It might be easier if you had a recording available so that you can have them listen to the parts mentioned in the text as a class.

2. Distribute Student Text, "Scientific Symphony" to each student. They should read this text prior to completing the activity. Once students have had a chance to read this article, ask questions similar to the following:

   a.) What is the common theme of this text? (Students may suggest that both examples include people working together in order to complete a task.)
   b.) What are some other examples of tasks that require several people in order to complete? (Student answers will vary)
   c.) Why did Sousa compose "Stars" with the three themes? What if he had not done this? (Students may suggest that the song would not be as interesting)
   d.) Describe some of the tools that were created for a specific job in the Genesis array assembly.
   e.) What are some tools and parts that are commonly used by people?

3. Explain to students that today they will model the process that they saw in the video. They will put together paper wafers on an array frame using a similar technique as the scientists in the cleanroom. Read the second paragraph of the teacher background to students. Distribute the Student Activity, "Working Together"



McREL

4. Have the top row of three wafers and the first wafer on the second row on the array prior to the demonstration. Demonstrate the procedure by asking for two volunteers. The instructor should use the forceps to hold the wafer in place as the first volunteer uses the forceps to hold one large round sticker (representing bottom retainers) at the bottom of the previous wafer and one large round sticker at the bottom of the new wafer. The second student puts a large sticker (representing the top retainers) at the top left of the new and previous wafer and then the small sticker (representing the screw) in the middle of the large sticker. The small sticker (screw) cannot be done until the surrounding wafers are in place. Once the second student has placed the small sticker in the middle, the other two can let go. Repeat a second time so that everyone can get a look at this. The use of the video mentioned in the Student Text, "Scientific Symphony" would be a good review as well. The graphic here illustrates the procedure. The blue/3rd from left arrow represents the person holding the wafer. The red/2nd and 4th from left arrow is the person holding the retainers (large stickers) in place. The green/left represents the person screwing in the screws (placing the large and small sticker over the wafer and securing it in place.

5. Students should now talk within their groups and write a detailed procedure for assembling the wafers onto the array frame. You should check this prior to allowing the students to assemble the array.

6. Students should then begin by cutting out one wafer per student, about 5 wafers. They should assemble the wafers on the array frame in a manner similar to the demonstration. Encourage the students to complete each of the jobs during the assembly of the row. Each student should complete a different job on their wafers: holding the wafer,

holding the retainers, or screwing in the screws. Walk around the room offering assistance to those groups who have questions. Also complete a check of each group to make sure they are completing the task appropriately.

7. Once the groups have assembled the second row, make sure they put their name on the chart paper and keep them in a safe place. They will be using this again for the assessment.

8. Students should then answer the four questions on the student activity sheet. Student answers will vary.

   - What was the most difficult part of this procedure? Why?
   - How was working as a team critical for completing this task?
   - After viewing the video clip of the scientist completing this procedure in the cleanroom, what are some similarities and differences with this simulation?

9. If time still remains in the class period you may encourage students to try the wafer assembly activity in the assembly lab of the *Genesis Cleanroom Interactive Field Trip*. This would be a good time for students to use the interactive field trip to review what they have learned prior to the assessment activity.

TEACHER RESOURCE

Hurd, (November, 1998). *A Science Educator's Answer to the Middle Level Curricular Question: "What About Us?"*