

Adapting the Modules

The Materials World Modules are designed to be used by different teachers in different ways. This section addresses some of the ways in which these module can be adapted and gives suggestions for supporting students using the modules.

Integrating Your Own Activities

You may already have activities that relate well to the module's theme. We encourage you to incorporate your own activities into your module lesson plan. For example, some teachers have taken students on field trips to factories or to construction sites to observe how materials are produced or used. Other teachers have modified existing Design Projects if they think their students will enjoy a different project more. You can integrate your own ideas while adapting the Materials World Modules for your use.

Open-ended Projects

The Materials World Modules offer many opportunities for students to work on open-ended experiments and projects. Most modules offer two Design Projects: the first assigns students to come up with a specific product or device; the second gives students free rein in deciding on the kind of product, device, or material they will make. You can select the Design Project that matches your students' abilities with open-ended tasks.

Many of the Activities can also be as specific or as open-ended as you choose. To make an Activity more open-ended, you might have your students formulate their own goals or come up with procedures on their own. Tips for adapting an Activity to be more open-ended also appear in some of the Planning Guides or margin notes.

Students vary in how well they handle the independence of open-ended projects. This is not a function of students' academic achievement. Many lower-level students do quite well at open-ended Design Projects because the hands-on nature of the work allows them to apply their experiences in a scientific context. With the Materials World Modules, you can provide the amount of structure that works best with your students.

Using Qualitative or Quantitative Procedures

Qualitative tests provide a quick way to evaluate a material's properties. Such tests help improve students' skills at observing because they are required to give clear, precise descriptions of their

observations. Quantitative procedures are often more time-consuming, but help give math a context: hard numbers are evidence for observable or subtle effects. Many of the Activities in the Materials World Modules are flexible so that you can incorporate qualitative tests, quantitative procedures, or both. Feel free to modify the modules to emphasize the types of procedures that best fit your goals or time constraints.

If you emphasize quantitative procedures, you may wish to have students practice specific mathematical techniques they will be using before they do the Activity in which they apply the techniques. This will reinforce the math skills and ensure that data collection or interpretation goes more smoothly. Specific suggestions for reinforcing math skills can be found in the Math Connections and are sometimes incorporated into Cross-Curricular Teaching tips.

Promoting Active Discussions

For many students, key insights come quickly through discussion. Discussions give students a chance to find out what they have

Act. 1: Evading Motion Detection Students experiment with evading the sensor. (30 min.) Act. 2: Taking a Tour of Some Sensors Students explore sensors. (20 min.)	Day 1	Act. 2: Class discussion. (20 min.) Act. 3: Making a Microphone Students make and test microphones with flexible and rigid PVDF film. (30 min.)	Day 2	Act. 5: Measuring Piezoelectric Response Students set up and conduct experiments. (50 min.)	Day 3	Act. 5: Discuss results. (10 min.) Act. 4: Exploring the Piezo Effect: The Inside Story, Part B Assemble polymers and discuss structure-function; relate to Act. 5. (40 min.)	Day 4
Act. 4: Discuss results. (10 min.) Design Project 1 Coin Counter Plan coin counters and predict performance. (40 min.)	Day 5	Design Project 1 Build and test coin counters; present in small groups if time allows. (50 min.)	Day 6	Design Project 1 Redesign coin counters; begin building them. (50 min.)	Day 7	Design Project 1 Finish building redesigned coin counters; test them and present final results. (50 min.)	Day 8

With this sample lesson plan, the teacher took a week and a half to run the module. Teachers have adapted the modules for use from three days to three weeks.

Fostering Collaboration

Collaboration can play an important role in helping students learn key science concepts presented in the Materials World Modules.

When working together in a small group, students have many opportunities to articulate their ideas. The very process of talking and working with others can help students increase their comprehension of science. For example, when working in small groups, students may feel more comfortable discussing ideas they do not completely understand. Group members may present opposing ideas and try to defend them, citing evidence from the Activities or Design Projects or from their own experience. They may work together to test different ideas. Such collaboration can enhance your students' comprehension of science.

learned by talking about it. You can use small-group or whole-class discussions in the following ways: as a motivational tool at the beginning of an Activity or Design Project; to stimulate students to make predictions before the main part of an Activity; as a checkpoint during a complex procedure; or to spur students to integrate what they learned at the end of an Activity. Through thorough, thoughtful discussion, you can help students improve their communication skills and consolidate their understanding of science concepts presented in the modules.

Keeping Science Logs

Inspiring students to keep clear, complete records of their work is

an important goal of the Materials World Modules. Students can keep such records in a science log. Science logs can come in many different forms—folders, lab books, binders, spiral notebooks, or even as computer files. In their logs, students can record all of their ideas, predictions, observations, data, and reflections. Such documentation can help students consolidate their learning as they work on the modules.

Copies of the black-line masters that come with each of the Materials World Modules can be included in students' science logs. The black-line masters provide charts for recording data and suggest guiding questions for the Activities and Design Projects.

Not only do we encourage you to modify Activities and Design Projects to suit your individual classes, we'd like to know how your changes have worked. If you would like to share your ideas with the Materials World Modules team and with other teachers using the modules, please contact us by phone at (847) 467-2489 or by e-mail at mwm@nwu.edu.