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LESSON BACKGROUND AND CONCEPTS FOR TEACHERS

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Annotation: this article identified elements of problem-solving activities that were frequently used by a sample of technology education teachers recognized for their teaching excellence. The inferential qualities of the data are limited due to the sample size, but the cluster analysis does establish norms for describing the characteristics of technology education problem-solving activities.

Key words: strategies, tests, reasons, challenges

When faced with a new problem, brainstorming our understanding of the problem or project and the progress we need to make on the project is usually a good starting point. This type of research provides the foundation and relevance, and can be used in other sectors of energy science and technology. In this unit, the common problem to solve is the fact that Americans consume a lot of energy, the consequence is that our supply of fossil fuels is reduced and we are emitting a lot of carbon dioxide and other air pollutants. Specific projects assigned to students are one aspect of the problem, forcing them to determine what actions they can take to reduce overall energy (or fossil fuel) consumption.

1. Identify the problem

Clearly state the problem. (Short, sweet and to the point. This is the "big picture" problem, not the specific project you have been assigned.)

2. Establish what you want to achieve

- Completion of a specific project that will help to solve the overall problem.
- In one sentence answer the following question: How will I know I've completed this project?
- List criteria and constraints: Criteria are things you want the solution to have. Constraints are limitations, sometimes called specifications, or restrictions that should be part of the solution. They could be the type of materials, the size or weight the solution must meet, the specific tools or machines you have available, time you have to complete the task and cost of construction or materials.

3. Gather information and research

- Research is sometimes needed both to better understand the problem itself as well as possible solutions.
- Don't reinvent the wheel – looking at other solutions can lead to better solutions.
- Use past experiences.

4. Brainstorm possible solutions

List and/or sketch (as appropriate) as many solutions as you can think of.

5. Choose the best solution

Evaluate solution by: 1) Comparing possible solution against constraints and criteria 2) Making trade-offs to identify "best."

6. Implement the solution

- Develop plans that include (as required): drawings with measurements, details of construction, construction procedure.
- Define tasks and resources necessary for implementation.
- Implement actual plan as appropriate for your particular project.

7. Test and evaluate the solution

- Compare the solution against the criteria and constraints.
- Define how you might modify the solution for different or better results.

Students with math problems will find solutions to math problems, especially vocabulary problems, challenging for a number of reasons, as discussed in Babbitt and Miller (1996) in their literature review. These challenges include misunderstandings of the problem, difficulty in detecting relevant and irrelevant information, ignorance of the appropriate mathematical operations, generation of calculation errors, lack of steps necessary to solve the problem, and difficulty in organizing the information in the problem (Babbit and Miller, nineteen ninety six). . . These challenges can be classified into questions of declarative, procedural, and conceptual knowledge.

Students need all three types of knowledge to solve problems. Problem solving requires students to understand their basic mathematical facts, implement the strategies and procedures necessary to solve the problem, and understand conceptually how to apply these facts and procedures. Without this conceptual understanding, there is no guarantee that students will be able to use this knowledge in a meaningful way when encountering problems.

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