Problem Solving—A Part of Everyday Thinking

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Lesson Plan for Grades 4–12

Overview

Many students view problem solving, its process and necessary skills as a task assigned by the teacher Monday between 9:15 and 10:15 am that must be completed within a set time or else they will suffer the consequences----gradewise. These students have not acquired the habit of critically reviewing every recommendation and decision they make before acting on it. Therefore, the process of critically thinking through every significant idea that comes to mind is viewed as playing a very minor role in their daily lives.

Purpose

As a course introduction or an introduction to any unit of study, this activity helps students master the process of applying critical thinking to each and every problem or task that confronts them. Further, this activity can serve as a base reference and model for every problem or task assigned or any problem that students bring up.

Objectives

As a result of this activity, each student will

1. demonstrate knowledge of six basic steps to problem solving by listing them or reciting them orally;
2. demonstrate mastery of the six basic steps to problem solving by actively applying them in problem solving when the task lends itself to such a process; and
3. demonstrate ability to apply these basic steps to problem solving by guiding other students in the solution of a given problem or set of problems.

This activity works well as an introduction to a course and its objectives, requirements and expectations. The activity can also help students achieve the following secondary learning objectives, given that the necessary follow-through is provided during the school year:

1. Demonstrate a high awareness of the need for the application of critical thinking skills to everyday problem solving.
2. Demonstrate an observable and measurable improvement on problem-solving skills by way of constantly and consistently applying this modeled process.
3. Show understanding and mastery of the problem-solving process by way of written or oral explanation of the critical steps in problem solving learned through this mode.
4. Show a marked improvement in the quality and completeness of written and oral responses to other assigned, as well as, routine personal problems.

Resources/Materials

No resources other than pencils and paper are required if solution to the problem is assigned individually. Chart paper may be used for group work if the problem is assigned to small groups. Overhead transparencies may be used for easy viewing if the teacher works the solution through with the whole class.

Activities and Procedures

Set the stage by explaining the purpose of the following story problem. Orient students to the explanations. Review with students the basic strengths of a "good" problem solver. Emphasize a student's ability to think critically; to identify, group and classify information in an order and form that make it relevant and applicable to a given solution. Alert students to the fact that one's ability to solve daily problems, simulated or real, depends on the ability to separate useful from useless information and necessary from unnecessary information and then apply the pertinent information to the problem or task at hand. Remind them that their success in the course or unit of study depends on their attention and critical thinking skills/habits. Tune-in, tune-out habits will result in low-quality solutions to assigned tasks,

while critical listening, critical thinking and assertive problem-solving processes will result in high-quality solutions to any problem students solve. The story problem you are about to share contains many fabricated distractors, together with the pertinent and necessary information for solving the problem that the story poses.

The Story: The Shepherd and the Harvard Boys

A few years ago, not counting those that came later, two Harvard sophomore students decided that they would spend their summer break traveling across the United States, the same country that they had studied in for years. In preparation for this long journey, they were careful to pack the necessary credit cards, which their generous parents provided, maps, some light casual traveling clothes and the friendliest Harvard smiles they could muster. They were to travel in an old 1961 Chevy panel truck that one boy had gotten as a high school graduation gift from an uncle. The vehicle had made many trips between their hometown Newport, Maine, and the Harvard campus in Cambridge, Massachusetts. Therefore, the two agreed that the panel truck would make it to the west coast and back. All due caution was taken in preparing the vehicle for the trip.

Traveling through the midwestern and southeastern states provided much entertainment and challenge for their trained minds. The real fun began, however, when they reached California. They spent four weeks in Hollywood, two weeks at the San Diego Zoo, a few days in San Francisco and many days in Disneyland. All too soon, it appeared, their summer had come to an end and it was time for them to start back to more familiar territory. After picking up some supplies in Sacramento, they headed east on Interstate 80. On the second day, the panel truck made only 150 miles during a 10-hour day. Repairs had taken up most of that day. On the third day, after six stops for repairs over a 60-mile stretch, the two abandoned the vehicle and hitched a ride home on I-80.

The hour was marching on to four o'clock in the afternoon when they bade their panel truck good-bye. Both boys were silent for the first hour of walking but each was thinking of the night ahead and having to round up a meal or go without. The more timid of the two was re-experiencing fears that he had thought he left behind at age 12 when he was in Grade 7. He began envisioning attacks by wild lions, tigers, panthers and the like. When he spoke up, his first question was, "Where are we going to sleep tonight and what are we going to eat?" "Fear not, my good friend," responded his partner, "I shall teach you how the pioneers of the frontier survived in these desolate plains long before there was even a highway through here. Just keep your eyes alert for sheep. When you see some and their shepherd, let me do the talking. For I fear that in your condition you might jeopardize our chances for an evening meal and perhaps even a bed to sleep in."

Our timid friend did not speak up, but he did not fancy the idea of chasing and wrestling a sheep down for their dinner, not to mention having to butcher and prepare it over an open fire. He was deep in his thoughts when his traveling companion's shout of glee brought him back to reality. "There, there, by those trees on that other slope!" he shouted as he pointed with excitement at some white spots that, in Mr. Timid's eyes, looked like rocks. "Those are nothing but rocks," he returned with the air of certainty that he often used on the Harvard campus. Nonetheless, he was happy to accept his error when they approached the white spots, which turned out to be sheep.

No sooner had they arrived at the herd's northernmost edge when out of the scrub oak thicket came two Australian sheep dogs. The young men stopped and searched the valley for the whereabouts of the shepherd and, sure enough, from under the tallest pine tree, there emerged what looked like a person. As they got closer, they saw that he had needed a shave, a haircut and probably a bath for several weeks. But they left all that aside and decided that there was a good opportunity to cash in on that evening meal they so badly needed and perhaps even a place to spend the night, if they applied their best manners and savvy.

While still about a dozen or so yards from the shepherd, Mr. Timid's partner took a quick glance over the entire herd and mentally made the best estimate of the number of sheep in the herd that his bright mind could compute. He greeted the shepherd, saying "A very good afternoon to you, Mr. Shepherd of 2,000 sheep," not knowing his name. "Your greetings are kindly accepted, my traveling friends, but you err, Mr. Bright Boy. I am not the shepherd of 2,000 sheep. If I had that many sheep out there plus another herd as large as that, then again half as many as I have out there, I should be the shepherd of 2,000 sheep."

Mr. Timid immediately set his mathematical mind to the problem and, by the time they had arrived at the shepherd's tent a few hundred yards away, he had figured out how many sheep the shepherd actually had in that herd.

Problem and Solution

Question to students

How many sheep were in this shepherd's herd?

1. Direct the students to apply the six basic steps of problem solving. To do so, students must list each step, and next to it or immediately following, they must list the information from this story that applies and is pertinent to that particular step. Remind students that you began by explaining that the point of the story was to see how well they can separate useful information from useless information given a particular task or problem to solve.
2. You may wish to accept a solution that is arrived at by guess-and-test (trial-and-error) method, or you may direct the students to apply their algebra skills and produce an algebraic formula/equation: for example, $1x + \frac{1}{2}x = 2,000$ sheep.
3. You may wish to have students attempt the solution to this problem individually or in small groups. If you feel the group is very unfamiliar with the six basic steps to problem solving, you may want to use this story problem to establish familiarity with these steps and do a whole-group problem solving exercise. This problem lends itself well to any of these approaches.
4. A reward may be offered to the person or group that produces the most complete and well-formulated solution.

Tying It Together

1. Review by having students re-state and review the purpose (objective) associated with this story problem.
2. Be sure to review the best solution (problem-solving process) with the students before this story problem is set aside for the day or the week.
3. Remind students that constant reference will be made to the components of this problem and especially the steps followed in solving it, as problems of a similar nature come up during the year or unit.
4. Encourage students to share the results of this activity with their parents or guardians.
5. Use this story problem to introduce or review the problem-solving process with any lesson unit or course. Remember, you can vary it for different grade levels; for example, the number of sheep may be 20, 200 or any other number.

Divisibility of Numbers
The number $3^{105} + 4^{105}$ is divisible by 13, 49, 181 and 379, but not by 5 and 11. How can you prove this?

Equation
Find the solution of the following equation: $(x^2 + x + 1)(2x^2 + 2x - 3) = -3(1 - x - x^2)$