The Olympics – A Problem-Solving Plot

by

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Problem solving involves critical thinking. Although new programs for the gifted and talented focus on critical thinking skills, there is little attention given to these skills in today's schools. Simply telling learners that something is important is not very effective. Rather, we must help them discover for themselves that critical thinking is important for societies in general, and for each of them in particular. Students should be encouraged to examine their own experiences, both direct and vicarious, to find out how critical thinking, or a lack of it, has affected their lives and the lives of others.

An interdisciplinary or thematic approach to teaching provides many opportunities for structuring and analyzing problems which extend far beyond a computational exercise. In reality, it places learning in its natural setting. In its Recommendations for School Mathematics of the 80's, the National Council of Teachers of Mathematics (1980) strongly supported this position:

> As new technology makes it possible, problems should be presented in more natural settings or in simulations of realistic conditions . . . Mathematics teachers should create classroom environments in which problem solving can flourish. Students should be encouraged to question, experiment, estimate, explore, and suggest explanations. Problem solving, which is essentially a creative activity, cannot be built exclusively on routines, recipes, and formulas. (p. 3)

The daily newspaper can serve as an excellent means for applying mathematics to local, state, national and international problems such as environmental, cultural, social and technological issues. For example, environmental and energy-related issues could be studied in terms of their mathematical problem-solving implications related to production, distribution and use of energy. The problem-solving skills of describing, comparing, contrasting, analyzing and evaluating could be reinforced by debating controversial dilemmas, such as nuclear energy versus nuclear waste disposal; strip mining of coal versus preservation of our natural landscape; school levy taxes versus quality education; local taxes versus state taxation for schools and so forth.

Numerous problem-solving skills related to mathematics could be utilized in publishing a students' newspaper or magazine. Examples of areas that might be included are: mathematics crossword puzzles; a "Dear Math Challenger" column in which students respond to problem questions submitted by other students; the new invention of the month; a scientific breakthrough; classified advertisements and problems related to these; editorials on the value of math; a science experiment corner. In addition to seeing the relevance of math to everyday problems and situations, publishing a newspaper would itself be a problem-solving situation requiring problem-solving skills. Such factors as costs, timing, communications, production, distribution, and labor are all integral to a publication and create natural problem-solving experiences.

The focus of problem solving should be on a specific problem felt to be relevant by the problem solver; it is, in fact, his or her involvement in the problem that makes it a problem. While the teacher's role as questioner is integral to the inquiry process, so too, the role of the children as questioners and problem "creators" is important. This requires a classroom environment in which children feel free to question, to take risks, to hypothesize, and to make mistakes.

Recording data, keeping track of resources, establishing assumptions and considering viable alternatives, describing a given situation, and using insight on the basis of observed patterns are desirable skills for people in all walks of life. Numerous everyday activities can be used to reinforce the development of these skills. Shields (1980) reports on how one fourth-grade class tried to solve a continuing logistics problem in the school cafeteria. The students worked on the various aspects of the problem for six weeks. The culmination of these experiences was a set of proposals which could improve service in the cafeteria. As a result of their work, several changes were implemented and the students became anxious to attack other problems they found around the school.

Another important problem-solving technique is the "open sentence." The children write open sentences about pictures or story problems before they begin to solve a given problem. Writing the open sentence beforehand requires the children to stop and think about the problem situation: What do they know? What don't they know? What is happening in the problem? How are the things they know and do not know related? When the children actually write the open sentence, they are showing how they interpret the problem. The sentence serves as a summary of the information and relationships in the situation. When children solve a problem using the open sentence as a guideline, they validate the solution and also put the solution back into the context of the problem to be sure it makes sense. This is in contrast to children who see two numbers in a story problem and immediately add or subtract without thinking about the problem.

The classroom environment can be designed to facilitate problem solving. Instead of a "problem-free," sterile environment, a more naturalistic setting with situational and simulated problems can provide opportunities which demand problem solving, decision-making, and research. A strategy used effectively with both pre-service and in-service teachers was described by Heck and Cobes (1977) in a book entitled The Creative Classroom Environment. In this strategy

the classroom is perceived and compared loosely to a regular theatrical setting. For example, when the curtain opens for a play, the audience becomes aware of the time, place, and setting of the play through action, stage scenery, and property. Similarly, simple representations constructed out of cardboard can be used in the classroom at all grade levels to create an illusion of time and place, creating a more naturalistic setting for simulated problems. The ultimate development of the classroom as a stage-set design is, of course, in the classroom where bulletin boards, chalkboards, instructional centres and arrangement of furniture can reflect the time, place, or concept being studied. For example, the Olympic symbol of unity, posters of Olympic events, international flags and the symbolic torch are sufficient to set the stage for an Olympic theme. Like the scenographic elements which support the actor in his or her efforts on the stage, the stage-set design provides additional stimulus to the children in researching and role playing many of their learning experiences -- thus applying problem solving to many unstructured and unexpected situations.

Teachers need not be artistic to design the creative classroom environment. They can manipulate the classroom environment with free or inexpensive materials to make a specific unit of study come alive. A first step might be to locate illustrations that depict the era or setting of the unit being studied. Good resource materials for this activity could include encyclopedias, basic histories, brochures from travel agencies, picture files in the public library, and books or slides. A second step in drafting the design might be to visualize pieces or cutouts from the original illustrations so that when seen in isolation and out of context they will cause the learner to think about the original illustration. For example, Big Ben evokes thoughts of London, or a skyline evokes the image of a large city. Three simple ways of creating such illustrations include: (1) using an overhead projector to make a line drawing; (2) using an opaque projector to make a silhouette drawing on any type of materials including cardboard, paper or wood; and (3) using a slide projector to project pictures which depict the desired image. Using any of these three techniques, one could eliminate the precise scaling process used in theatrical stagecraft. For younger children, the teacher might provide much of this environment; older children could be given the problem of developing their own setting unique to a specific area of study. The problem solving and mathematical skills that could be developed through such an assignment are significant.

One example of a stage-set design developed with children in grades 4 to 6 was a unit pertaining to the 1980 Winter Olympics. First, the classroom teachers identified the areas of children's needs (i.e., geometry, measurement, decimals, and monetary skills). Since the winter Olympics were in process and were of great interest to the students, this theme was selected and incorporated into the instructional areas of mathematics identified by the teachers. The selection of a relevant theme and one which was of interest to the students was critical to having a positive effect on children's thought processes and enhancing confidence in their problem-solving ability. Integrating the various subjects into a high-interest theme provided a meaningful opportunity for these children to realize the necessity of considering, testing, and re-evaluating problems - a process which is an integral part of their lives.

A creative classroom environment does not necessarily teach a child what to think, but rather assists him or her in how to think. A stimulating environment provides the motivation for a child to become a miniature researcher through the processes of reading, living, and recalling. Through discoveries and explorations children can develop a more complex frame of reference from which generalizations can be derived and applied to the present and future.

An interdisciplinary unit on the Olympics can promote critical thinking in students. The teacher needs to consider involving higher level objectives. Learner tasks such as identifying the cities in which the Olympics were held, researching the history of the Olympics and reporting this on a timeline that includes national and international events represent the lowest level of information; conversely, activities which require more problem-solving skills correspond with the higher level thought processes of application, analysis, synthesis and evaluation. Examples of activities which require these higher level problem-solving skills might include simulating a trip to the Olympics with $1,000.00 per person where numerous decisions need to be made regarding lodging, transportation, food and events; forming an Olympic Committee to decide how to raise funds through advertising; inventing a more aerodynamic model of a bobsled; producing a scale model of an Olympic Village which includes the sports and housing areas and the costs involved in constructing the village; and evaluating the media coverage of the Olympic Games.

Within the stage-set design numerous research activities that promote problem-solving skills can be formulated to include areas of study such as sociology, anthropology, geography, history, economics, and political science. For example, an activity in which the students identify the cities where Olympics were held and the reason for selecting specific cities is applicable to the study of geography. In studying sociology, anthropology, or political science, a debate on the pros and cons of boycotting the 1980 Olympic Games would be an excellent activity. Role playing also becomes very natural within the stage-set design environment. Imagine the problem-solving and decision-making skills involved in role-playing the Olympic boycott decision from the viewpoint of the Canadian and Russian athletes, the parents of the athletes, the Prime Minister of Canada, the Russian and Afghanistan people, the Russian business community, the T.V. networks, the Olympic Committee, etc.

As a culminating activity to the Olympics Unit described earlier, the children were asked to develop a set of problems related to mathematics. Developing a problem is a problem itself. It serves as an excellent strategy for developing the skills of describing, observing, classifying data, and analyzing situations. While the children were given no guidelines in terms of specific problems, it was extremely interesting to observe that the problems they created were related to the areas of need identified by the teachers prior to the implementation of the unit. In addition, the children developed various levels of questioning. The problems ranged from very simple one-step processes to more complex processes.

Examples of students' problems related to measurement included the following:

If the Olympic track was 400 metres, how many times would a runner have to run it for a 5000 metre race?

Leah Mueller skated the 5000 metre race in 7 minutes and 56 seconds. The first 1000 metres took 1 minute 28 seconds. Her last 1000 metres took 1 minute 37 seconds. How long did it take Leah to skate the middle 3000 metres?

The high jumper made 3 jumps. His first jump was 2 metres 37 centimetres. His last jump was 2 metres 43 centimetres. His 3 jumps totaled 7 metres 21 centimetres. How high was his second jump?

If an Olympic swimmer swam an average of 25 metres in 38 seconds, how long would it take her to swim 100 metres? 500 metres?

The Swedish ski jumper's first jump on the 70 metre ski jump was 87 metres. His second jump was 89 metres 58 centimetres. How much shorter was his first jump? How long were his jumps when added together?

Through activities the children learned the value of a well-balanced diet for the athlete and what exercises an athlete might do in a day's training. The students also studied the effects of drugs, alcohol and tobacco on the body. Mathematical problems related to body exercise and practice became natural to the situation. These were reflected in the problems designed by the elementary school children.

For example:

Eric Heiden, the speed skater, trained an average of 6 hours a day, 5 days a week for the last 3 years to prepare for the 1980 Olympics. How many hours has he trained for the Olympics?

Design a week's nutritious menu for the 10 American hockey players. Include a daily snack for after "work-out" time. Using Safeway's newspaper ad, figure out the cost of the week's menu for the team.

Examples of monetary problems by the students included the following:

Linda Fratianne has 3 costumes she could wear for her performances. The total cost of the costumes was $261. What was the average cost per costume?

The Gold Medals are made out of gold and silver. There is about $126.00 worth of gold, and $332.00 worth of silver in each Gold Medal. Eric Heiden won 5 Gold Medals. How much are his medals worth altogether?

One meal (supper) for a hockey player cost $6.25. How much would the meal cost for the whole Canadian team if all 20 players ate?

Mary Wilson bought dinner for her 3 friends at a good restaurant at Lake Placid. Mary's lobster dinner cost $18.00 for everything. Together, all 4 meals cost $75.87. What was the average cost for one of Mary's friend's meals?

You used 400 litres of gasoline to drive to Lake Placid and back to your home. The gasoline cost $148.00. How much did the gasoline cost per litre?

An Olympic visitor bought 8 tickets for 3 events. 2 tickets cost $8.50 each, 3 cost $15.25 each, and 3 cost $9.00 each. How much did the visitor pay for all 8 tickets?

The problems created by the students often included irrelevant data, as illustrated in the following examples:

John Smith drove to Lake Placid for the Olympics. It took him 8 hours to get there. He used 250 litres of gasoline, and traveled 548 kilometres. How much did John average in speed per hour?

The four men in the 4-man bobsled totaled 780 lbs. The weight of the men and the bobsled totaled 1985 lbs. What was the average weight of the men?

Juri Svenson of Norway is a ski jumper. He is 23 years old and has trained 36 hours a week for the last 3 years. His two jumps at the 90 metre jump totaled 245 metres. His first jump was 122 metres. How long was his second jump?

All children should have the chance to develop their problem-solving abilities, and in turn, develop their minds in order that they might enjoy a fuller life. An interdisciplinary unit of instruction with diversified problem-solving activities allows children to utilize their particular learning styles. Whether they learn best through concrete experiences or more abstract presentations, this approach provides for meaningful experiences.

References

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