Issues In the Mathematics Curriculum

Marlow Ediger

Marlow Ediger is a professor of education at Northeast Missouri State University in Missouri.

Some salient issues in the mathematics curriculum must be discussed and resolved. Each teacher and supervisor must take a position on vital issues, but what issues are relevant?

Inductive Versus Deductive Teaching

Pupils may attain significant concepts and generalizations through induction. Thus, with teacher guidance, students use discovery techniques to learn mathematics. Problems and questions are then identified by pupils. Pupils individually and in committees, using a variety of reference sources, secure necessary facts, concepts and generalizations to solve problematic situations. Pupils develop broad ideas or generalizations from specific understandings. The generalizations, supported by facts, are used to answer questions and solve problems.

Deductive teaching procedures are the opposite of inductive teaching strategies. With inductive teaching, the teacher explains a new process to pupils in a meaningful manner. Students then apply the knowledge. Communication exists as a one-way street from teacher to student. However, the pupil must attach meaning to what has been acquired in order to use this knowledge in individual situations.

Active Involvement Versus Passive Recipient

Educators who emphasize active student involvement in lessons and units believe individuals learn by doing. Thus, with teacher guidance, pupils identify and solve lifelike problems in mathematics. To become proficient in problem solving, a student needs to practice specific skills. Subskills in problem selection include, gathering data or information to answer the problem, developing a hypothesis or answer to the problem, testing the hypothesis and revising the hypothesis if necessary. The sequential steps in problem solving are flexible, not rigid.

The passive receiver may secure information (facts, concepts and generalizations) from the sender. The sender is usually the classroom teacher. Thus, content moves from the teacher to the student in explanation/lecture form. Individual differences among students must be taken into account. It is hoped that students will be able to apply what is received from the sender. In contrast, in active pupil involvement, the whole person (intellectual, emotional, social and physical) is involved in projects and activities to solve problems relevant to society. Thus, school and society become integrated entities in the mathematics curriculum.

Advocates of active pupil involvement in learning believe that

1. students are capable and interested in making curricular decisions,
2. students should arrange their own course content rather than follow a logical curriculum offered by adults, and
3. students must be involved in self-appraisal for evaluation techniques to be effective. Otherwise, adult means of appraising learning performance may not affect the student.

Measurably-Stated Versus General Objectives

How precisely should objectives for pupils be stated? The teacher may select learning activities that help students attain chosen objectives. Then, the

teacher may measure if a pupil has achieved the stated goal. Successful students may then attempt to attain the next sequential objective. Unsuccessful students may require a new teaching strategy to achieve the previously unattained objective.

Instructional Management Systems (IMS), mastery learning, criterion referenced testing (CRT) and exit objectives are mathematical teaching procedures that are related to measurable objectives. In each of these plans of instruction, precise measurable objectives are used in teaching and learning situations. Advocates of measurable ends believe that teachers should possess a clear intent when teaching. Thus, teacher and pupils have clear and specific ideas about what students will learn.

The teacher can more effectively select learning activities if measurable rather than general objectives are used. Each experience is chosen on the basis of one criterion: Do the activities guide students to specific objectives? If the activity is too complex or not challenging enough, it should be omitted. The teacher may measure personal success in teaching by obtaining objective data to determine if pupils have or have not achieved the desired objectives. Furthermore, student progress may be communicated clearly and precisely to parents. Teachers should also obtain evidence to show that pupils are not achieving measurable objectives.

If pupils are not attaining measurable goals, the teacher receives feedback. The teacher may then need to select a different teaching strategy to help students attain their objectives.

The opposite of measurably stated objectives are

1. broad, general goals that provide some kind of direction in determining the kinds of students a teacher wishes to develop, and
2. evaluation procedures that lack precision in determining if pupils have or have not attained the desired ends.

Student-Centred Versus Society-Centred Curriculum

Should most of the objectives in teaching and learning be set by the pupils themselves, or should attainable goals for pupils be selected on the basis of what society needs and deems to be significant?

How might goals be chosen that reflect the personal interests and purposes of the pupil? First, students can decide which tasks to pursue and which to omit when interacting with learning centres in the school/classroom setting. An adequate number of tasks must be available at learning centres so that pupils may select, as well as omit, sequential experiences. Thus, students might select interesting tasks to pursue. Students may also perceive reasons for participating in ongoing activities.

The following teaching strategies also emphasize the personal interests and purposes of the students:

1. Individualized reading. Students select and read a library book about mathematics. The book must be interesting and suited to the students' reading level. Students may also choose to be evaluated in terms of word recognition techniques and comprehension skills. Thus, students may read a selection orally to the teacher. The teacher might then assist the student in appraising word recognition techniques. To indicate their comprehension, students may develop a mural, diorama, model or creative dramatic presentation to demonstrate what they have learned from the book.
2. The contract system. With teacher guidance, students may specify which mathematics activities they will complete within a particular period of time. The contractual agreement must be reasonable in terms of number of activities students must complete. The contract should also reflect students' enthusiasm and reasons for choosing specific mathematic activities.

To emphasize practical skills in the mathematics curriculum, teachers and supervisors must ascertain what life skills are necessary for students. Teachers might include the following suggestions:

1. Computing the total cost of goods and services purchased in any given situation.
2. Ascertaining the amount of change due in any transaction.
3. Writing cheques and keeping a balanced chequebook.
4. Knowing how to obtain loans to make satisfactory investments.
5. Possessing applicable concepts involving interest rates.
6. Realizing specific abilities involved in ordering materials from mail order companies.
7. Shopping intelligently for necessary goods and services used in the home setting.
8. Buying insurance for property and health in an effective manner.
9. Learning to live within budget requirements.
10. Completing job application forms and gaining knowledge about taxation forms.

Selected References

Billstein, Rick, Shlomo Libeskind and Johnny W. Lott. *A Problem Solving Approach to Mathematics for Elementary Teachers.* 2d ed. Menlo Park, Calif.: The Benjamin/Cummings Publishing Company, 1984.

Bingham, Alma. *Improving Children's Facility in Problem Solving.* New York, N.Y.: Bureau of Publications, 1958.

Bitter, Gary G., Mary M. Hatfield and Nancy Tanner Edwards. *Mathematics Methods for the Elementary and Middle School: A Comprehensive Approach.* Boston, Mass.: Allyn and Bacon, 1989.

Bruner, Jerome S. *Toward a Theory of Instruction.* New York: N.Y.: W. W. Norton and Company, 1966.

Burrowes, Sharon et al. *Exploring IBM LOGO: A Guide for Adults.* New York, N.Y.: Holt, Rinehart and Winston, 1985.

Commission on Standards for School Mathematics. *Curriculum and Evaluation Standards for School Mathematics.* Reston, Va.: National Council of Teachers of Mathematics, 1989.

Coxford, Arthur F., ed. "The Ideas of Algebra, K-12." Reston, Va.: The 1988 Yearbook of the National Council of Teachers of Mathematics, 1988.

Crosswhite, F. Joe. "Organizing for Mathematics Instruction." Reston, Va.: The 1977 Yearbook of the National Council of Teachers of Mathematics, 1977.

Curio, Frances R. "Teaching and Learning: A Problem Solving Focus." Reston, Va.: The National Council of Teachers of Mathematics, 1987.

Kennedy, Leonard M., and Steve Tipps. *Guiding Children's Learning of Mathematics.* 5th ed. Belmont, Calif.: Wadsworth Publishing Company, 1988.

Krause, Eugene F. *Mathematics for Elementary Teachers: A Balanced Approach.* Lexington, Mass.: D. C. Heath and Company, 1987.

Lindquist, Mary Montgomery, ed. *Learning and Teaching Geometry, K-12.* Reston, Va.: The 1987 Yearbook of the National Council of Teachers of Mathematics, 1987.

Missouri Department of Elementary and Secondary Education. *Core Competencies and Key Skills for Missouri Schools. (For Grades 2 Through 10.)* September, 1986.

Moore, Kenneth D. *Classroom Teaching Skills.* New York, N.Y.: Random House, 1989.