Mathematics and the Affective Domain

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Cognitive objectives are important to emphasize in the mathematics curriculum. Thus being able to apply what has been learned is salient. Thinking critically and creatively is necessary when determining answers to problems in mathematics. The cognitive domain tends to receive major attention when students attain objectives in mathematics.

Another dimension of teaching stresses students achieving affective goals. Affective or attitudinal goals complement the cognitive dimension. Students then who have positive attitudes toward mathematics should achieve at a more optimal rate in that curriculum area. Positive attitudes influence the self-concept as well as feelings toward others in ongoing lessons and units in the mathematics curriculum.

How might the mathematics teacher assist students to develop quality attitudes in the affective domain?

Quality Attitudes in Mathematics

Teachers are the major decision makers in selecting objectives, learning opportunities and appraisal procedures. They must be highly cognizant of students' attitudes. Perhaps students should increasingly share with mathematics teachers decisions made in ongoing lessons and units. Students' input is vital to guide each to attain more optimally. The role of mathematics teachers might then shift to becoming guides, facilitators and helpers to assist each learner to learn as much as possible. Students need to experience continual success in the mathematics curriculum. The concept of success can be implemented in numerous ways.

Mathematics Textbooks

Using a reputable series of mathematics textbooks, students may achieve optimally on an individual basis. Sequential content in acquiring basic facts, concepts and problem-solving skills might well come from ordered pages in the basal textbook. Students work at their own optimal rate of speed. Mathematics teachers monitor individual progress of each student. Because students progress individually, teachers need to provide background information for each learner prior to beginning a new process. If learners cannot succeed in a given sequence, teachers must guide and direct them. Success at each step of achievement is vital for students on an individual basis. Positive attitudes might then be in the offing for each student. The teacher may emphasize intrinsic or extrinsic motivational approaches to assist optimal mathematics achievement. Branching out from textbook use, students might experience a multimedia approach. Thus software and computers, lifelike experiences as well as audiovisual materials provide enrichment experiences for students.

Students pace their own progress when moving forward sequentially using the basal mathematics textbook as the core of the curriculum. Teachers must provide readiness as needed for each student to understand new facts, concepts and generalizations. Continuous progress in learning is paramount. Quality attitudes toward mathematics should result.

Programmed Learning

Programmed learning (software or books) in mathematics follows models of teaching emphasized by the late B.F. Skinner (1904–1990). Skinner emphasized students learning in small sequential steps. Thus mathematics subject matter is broken down into small segments of knowledge. Students then read from programmed books or from monitors, a small amount of content, after which the learners respond to a multiple-choice item. After responding, the students check their answers with that provided by the teacher. With quality field-tested programs, students individually should respond correctly approximately 90 percent of the time. Programmed materials generally stress the same sequence with read, respond and check. With a high success rate in responding, students should develop quality attitudes. For each sequential step of learning, reinforcement is evident. Each sequential item provides readiness for the next ordered task in ascending complexity.

With programmed learning, students may achieve at their own optimal learning rate. Students should not compare themselves with others in rate of speed and achievement. Each needs to learn as much as possible with feelings of attainment in evidence. Affective goals are then achieved by students individually.

Computer literacy in mathematics is important for all students. Flake, McClintock and Turner (1990, 29) wrote the following:

> Of all the uses of computers, which ones should all students learn to do comfortably and successfully? These questions have stimulated controversy among educators. Some people equate computer literacy with the ability to select and use commercial software. Their argument is that the average person does not need to know how a computer works, what RAM is, or how to write a computer program. They compare using a computer to driving a car—in order to drive, one does not need to know how a car works, what a manifold is, or how to do a tune-up.
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> On the other hand, some people equate computer literacy with knowledge of programming. Their argument is that in order for a person to use the computer to solve problems, that person needs to have the flexibility and control that a knowledge of programming provides. In short, knowledge is power.

Integration of School and Society

A third philosophy emphasizing the affective dimension in mathematics is the integration of school and society. Life-like endeavors then need to be evident. Separation of the mathematics curriculum from the societal arena is frowned on. That which has utilitarian values in mathematics is emphasized. The practical rather than the abstract becomes paramount. Useful content is acquired by students and applied in the real world of mathematics.

Topics that provide the practical include buying goods and services, balancing a chequebook, budgeting and spending an allowance, comparing prices of items to be purchased, developing a budget, ordering from a sales catalog, shopping wisely, buying items at discount, keeping and maintaining an inventory as well as using credit cards.

Too frequently, students learn abstractions in mathematics that cannot be applied. There is separation then in the abstract from the concrete or the theoretical from the utilitarian. These separations represent dualisms in the mathematics curriculum. Rather, the dual situations need to become one whereby abstractions in mathematics can be used in the real world. The theoretical also is not separated from the practical. Number theory provides guidance and direction on the level of application for each student. The real world and the school curriculum become one in a mathematics curriculum stressing the affective dimension. When students perceive that what has been learned can be used, improved attitudes might well be in the offing.

Pertaining to problem solving, Grossnickle et al. (1983, 177) wrote the following:

> Problem solving is a process by which the choice of an appropriate strategy enables a pupil to proceed from what is given in a problem to its solution. Often the answer is the least important part of the problem-solving process; few of the answers children obtain in school mathematics will have much value in their lives. The ideas used in the process are much more valuable than the answer. Thus, it is important for teachers to determine whether an incorrect answer is due to an error in process or in computation. Do not, however, infer in this discussion that errors in computation are acceptable; rather, keep in mind that overemphasis on answers may impede the pupil's understanding of the process. A pupil with poor computational ability who understands the process can use a calculator to get the answer. A pupil who can compute rapidly and accurately but does not understand the process is lost.

Mastery System of Learning

In a mastery system of learning, mathematics educators select carefully chosen precise objectives prior to instruction. These objectives might be selected several years prior to their implementation in teaching-learning situations if they are chosen on the state or district levels with instructional management systems (IMS).

Prior to instructing a lesson, the teacher announces clearly and concisely what students are expected to learn as a result of teaching and learning. Students then understand what is to be acquired within a given time, such as the implemented lesson plan. The objectives are stated in measurable terms. Either a student does or does not attain what is contained in the objective announced to students prior to instruction. If an objective is not achieved, a different teaching strategy needs emphasis. If an individual student achieved one or more sequential objectives, he or she can move on to the next objective in sequence or order. Students with teacher guidance might then pace their own individual achievement. Each will be at a different place on a continuum in achieving the predetermined measurably stated objectives. Quality attitudes might well be evident when students individually have the opportunity to learn as much as possible.

Contract System

The contract system may become the total mathematics curriculum or emphasize enrichment opportunities to the learner. With adequate background information pertaining to an ongoing unit of study in mathematics, students with teacher guidance plan what to achieve. Each item in the plan is clear and can involve pages to be completed from a single or multiple series of textbooks, construction work in which model geometric figures are constructed and mathematics library books to read and summarize. In the contract, students have numerous vital tasks to record and complete. The due dates are written in the contract.

The contract system emphasizes student selection of content to learn, student sequence of his or her own activities, student purposes in learning and student interest in the mathematics curriculum.

The mathematics teachers' role in the contract system is to encourage, motivate and stimulate student learning. They are guides, monitors and evaluators. No longer are teachers the sole people in determining objectives, learning opportunities and appraisal procedures. Because learners are heavily involved in determining the curriculum, they should become increasingly positive in the affective dimension.

Conclusion

In providing for individual differences and to guide optimal affective achievement, mathematics teachers need to guide students to achieve an adequate self-concept. Adequate self-concept development comes about when teachers assist students to

1. achieve meaningful knowledge so that understanding of acquired subject matter is evident,
2. develop readiness for learning to have learners experience sequence in ongoing activities,
3. increase interest in the mathematics curriculum to attain attention to achieve worthwhile objectives,
4. perceive purpose in achievement to understand reasons for attaining in ongoing lessons, and
5. enjoy mathematics and thus develop quality attitudes in the affective dimension.

Students need to experience procedures in teaching-learning situations which aid optimal achievement in critical and creative thinking, as well as problem solving. Mathematics teachers need to emphasize methodology of instruction that harmonizes with their own unique style of learning. Quality attitudes assist students to achieve vital knowledge and skills.

Software should encourage positive student attitudes in a modern curriculum. Abelson (1992, ix) wrote the following on student control over computers/software:

> Logo is the name for a philosophy of education and for a continually evolving family of computer languages that aid its realization. Its learning environments articulate the principle that giving people personal control over powerful computational resources can enable them to establish intimate contact with profound ideas from science, from mathematics, and from the art of intellectual model building. Its computer languages are designed to transform computers into flexible tools to aid in learning, in playing, and in exploring.
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> We try to make it possible for even young children to control the computer in self-directed ways, even at their very first exposure to Logo. At the same, we believe Logo should be a general purpose programming system of considerable power and wealth of expression. . . . More than 10 years of experience at MIT and elsewhere have demonstrated that people across the whole range of "mathematical aptitude" enjoy using Logo to create original and sophisticated programs. Logo has been successfully and productively used by preschool, elementary junior high, senior high, and college students, and by their instructors.

References

Abelson, H. *Logo for the Apple II*. Peterborough, N.H.: BYTE/McGraw Hill, 1992.

Flake, J., C. McClintock and S. Turner. *Fundamentals of Computer Education*. 2d ed. Belmont, Calif.: Wadsworth, 1990.

Grossnickle, F., et al. *Discovering Meanings in Elementary School Mathematics*. 7th ed. Chicago: Holt, Rinehart & Winston, 1983.