```
Procedure Getdata;
Begin

     Write ('Input beginning amount - ');
     Readln (start);
     Writeln;
     Write ('Input annual rate of interest - ');
     Readln (annualrate);
     Writeln;
     Write ('Input years - ');
     Readln (years);
     Writeln;
     Write ('Input days - ');
     Readln (days);
End;


Begin     Main Program

     Getdata;
     Earned := Interest (start,annualrate,years,days);
     Writeln;
     Writeln ('Initial investment : $', start:10:2);
     Writeln ('Annual rate        :  ', annualrate:5:3);
     Writeln ('Duration of note   :  ',years,' years and ',days,'
days.');
     Writeln;
     Writeln (' Interest earned    " $',earned:10:2);

End. {of Investment}
```

OBJECTIVES IN THE MATHEMATICS CURRICULUM

Marla Ediger
Northeast Missouri State University
Kirksville, Missouri

The mathematics curriculum is indeed experiencing rapid changes. The hand held calculator is no longer an innovative method in teaching-learning situations. Just a few years ago numerous educational journal articles contained content pertaining to the introduction and utilization of the calculator. As a whole, it is accepted that the hand held calculator is a must in the curriculum area of mathematics. New or modified uses of the calculator may, of course, be continuously implemented.

Microcomputers and their uses are coming in rather rapidly in teaching and learning situations in mathematics. Thus, change is a key concept to emphasize. The mathematics curriculum must not only reflect, but also take the lead in bringing in vital changes in society.

Each learner needs to experience relevancy in ongoing units of study. Teachers, administrators, and supervisors must select and implement vital goals for student attainment. The goals selected need to be modified and revised as needs and interests of learners indicate. Also, as trends in society change, the mathematics curriculum must adopt and determine relevant innovations.

Problem Solving

Learners individually need to become proficient in identifying and solving problems. Why? Each person faces perplexing situations in life. Thus, a variety of paths exist from which to choose solutions. Generally, numerous solutions to a problem can be noticed and the consequences of each must be evaluated. If one path of action compared to a different one is emphasized, how might the outcome differ? Certainly, the mathematics curriculum can and should stress problem solving experiences.

The problems may come from real life situations of learners involving the use of mathematics. The chosen problem might emphasize practical uses of arithmetic in school (such as buying school lunches) or in society (spending an allowance). Word problems from basal textbooks, workbooks, and worksheets might also provide problem solving experiences for learners. Students need to be guided to perceive reasons for engaging in the identification and solving of problems.

Learners must be guided in determining with clarity the problem involved in real life situations, in school, and in society. Vivid perceptions in problem identification are also significant involving the use of textbook, workbook, and worksheet materials. Salient information must be sought to solve the problem. Thus, an answer (or answers) become available directly relating to the problem. The choices are tentative and tested within the framework of the involved situation. Revisions may need to be made as the hypothesis is being tested.

Pertaining to learning activities in problem solving, Morris and Pai[1] wrote:

> There is only one general qualification we must lay upon this principle, says the Experimentalist, and that is that the problematic character of the situation must be recognized by the learners as individuals. They must see the situation as their situation, the problem as their problem. They can, of course, be placed in other people's situations and handed other people's problems--in school, for instance, the teacher can prepare problems for them--but to that degree their growth becomes artificial, linked to motivations and promptings that are generically external to their own being.
>
> At the very base, then, of Experimentalist pedagogical theory is the identification by the learners of their interests, the sectors of the world seen from where they stand to be most problematic. If this identification can be made honestly, if the teacher can elicit some genuine curiosities in the learners, then learning is truly under way.

Problem solving does <u>not</u> involve:

1. Rote learning and memorization of subject matter. Rather, content is utilized to solve problems.
2. Teachers alone determining the mathematics curriculum. The learner is also actively involved in choosing and solving problems.
3. Students being passive recipients in the school and class setting. Rather, each learner is involved in decision-making situations.
4. Heavy utilization of textbooks, workbooks, and worksheets in the mathematics curriculum.

---

[1]Van Cleve Morris and Young Pai. <u>Philosophy and the American School</u>. Boston: Houghton Mifflin Co., 1976, pg. 185.

A Laboratory Approach

Laboratory methods in teaching mathematics emphasize utilizing concrete materials. Thus, learners may measure length and width of regions to determine perimeters and areas. Weighing real objects and recording the weights also can be stressed in a laboratory setting. Finding the volume of diverse containers may be fascinating to involved learners.

Pertaining to laboratory approaches, Grossnickle and Reckzah[2] wrote:

> Instruments of measurement are particularly well adapted for laboratory purposes in a mathematics classroom. A pupil learns to use an instrument, such as a ruler, by making measurements. Similarly, he learns to read a scale, such as that on a thermometer, by observing and recording temperatures. Because of the great variety of measuring instruments, the teacher is faced with the problem of choosing those most appropriate for the classroom. The self-contained classroom should have many different measuring instruments that are used for a given grade level. This list indicates measuring instruments that should be in a mathematics laboratory:
>
> 1. Quantity: abacus, adding machine, number charts, tallying devices, street numbers, fact finders, counting blocks.
> 2. Lengths: ruler, yardstick, tape measure, meter stick, standards for measuring height, micrometer, protractor, speedometer, odometer.
> 3. Time: calendar, clock, watch, stopwatch, sundial, shadow stick, candle clock, hourglass, timetable, standard time chart.
> 4. Value: coins, bills, checks, wampum, tax tokens, stamps, price tags.
> 5. Weight: postal scales, balances, spring scales, pressure gauges, height-weight charts, pictures of scales for weighing large amounts, labels showing weights of things.
> 6. Area: square-inch cards, square-foot cards, maps.
> 7. Volume: pint, quart, gallon measures; cup, teaspoon, tablespoon, cooking measures; peck and bushel measures; rainfall gauge; cubic-inch blocks.
> 8. Temperature: thermometer, clinical thermometer, cooling thermometer.

---

[2]Foster E. Grossnickle and John Reckzah, <u>Discovering Meanings in Elementary School Mathematics</u>. Sixth edition, New York: Holt, Rinehart and Winston, Inc., 1973, pp. 33 and 34.

The laboratory method does not emphasize:

1. Heavy stress upon abstract subject matter to be acquired by learners.
2. Repetition and drill in teaching-learning situations. Rather learners choosing and selecting what (the objectives) to learn as well as the means (activities and experiences) of achievement.
3. Teachers selecting objectives, learning activities, and appraisal procedures in ongoing units of instruction.
4. Learners passively receiving content through reception methods of teaching. Rather, students select, from among options, learning activities in the mathematics curriculum.

Management Systems of Instruction

Management instructional approaches emphasize the utilization of behaviorally stated objectives. The precise ends have been selected by teachers, administrators, and supervisors prior to teaching students. The objectives need to be ordered in ascending order of complexity. Thus, learners move in the direction of achieving from the simple to the complex. With quality sequence in objectives attainment, pupils may certainly be guided to attain optimally.

Students individually are directed to achieve the first end before working to attain the second sequential objective. It is measurable if a learner has/has not achieved objective one before moving on to objective two and other sequential objectives. Ediger[3] wrote:

> Objectives which pupils are to achieve should be selected carefully since there is much to learn due to the tremendous amount of information available with the explosion of knowledge as a societal trend. General objectives pertain to long-range goals which pupils should achieve, whereas precise, specific objectives can be achieved by pupils in a short period of time such as in one lesson, or in lessons covering several days. Objectives can be classified in terms of understandings, skills, and attitudes, or in terms of cognitive, psychomotor, and affective domains. One category of objectives

---

[3]Marlow Ediger, Relevancy in the Elementary Curriculum. Kirksville, MO: Simpson Publishing Co., 1975, pg. 27.

affects the other categories, such as guiding pupils to develop more positive attitudes should assist learners to achieve at a more optimum rate in understandings and skills.

Management systems of teaching do not:

1. Advocate the use of open-ended general goals in teaching students.
2. Emphasize utilizing student-teacher planning in developing the mathematics curriculum.
3. Stress students making decisions in terms of activities and experiences.
4. Permit learners to choose which objectives to attain.

A Subject-Centered Curriculum

Much emphasis is being placed upon the three R's in the curriculum (reading, writing, and arithmetic). The three R's then are essential learnings for all students. General education is stressed in an essentialist curriculum.

Arithmetic being one of the three R's needs to have a carefully developed scope and sequence. Each student must attain optimally. Effective sequential objectives assist students individually to achieve as much as possible. Equally significant is scope. Vital learnings must be selected to emphasize scope, that is what is to be taught.

An essentialist mathematics curriculum tends to stress subject matter to be learned by students. Subject matter, rather than an activity centered curriculum, becomes salient. Content, essential for all students, may well come from reputable textbooks (single or multiple series) and workbooks. Sequential subject matter to be learned by students then is inherent in the textbooks and workbooks. A well developed manual provides the teacher with vital objectives, quality learning activities, and evaluation procedures.

Pertaining to an essentialist curriculum, Morris and Pai[4] wrote:

> To a Realist the humanities seem vague and indefinite. In their worst form they border on mysticism, a kind of transcendental set of generalities that, because they are so general, cannot even be "right" or "wrong"--merely "interesting." We can never come directly to grips with them, and so, the Realist is likely to say, perhaps we had better leave them to the theologians and philosophers to reflect on. For educational purposes they are too indefinite.
>
> In their best form the basic ideas of the cosmos are represented by the laws of nature. If this is what we are talking about, says the Realist, then perhaps we can get somewhere. But the laws of nature are not learned in literature and history. They are learned by the direct study of nature, which we have come to associate with the subject matters of science: biology, zoology, botany, geology, chemistry, physics, astronomy, and their many subdivisions. These subject matters are definite and specific. One doesn't have to guess about things or speculate on the meaning of the material. It is either right or wrong.
>
> Mathematics, as the language of quantity, is the symbol system we use in studying the physical world of nature. So it will be necessary for the child to master mathematics in order to grow into a mature understanding of the world. Mathematics, moreover, is the very epitome of order and precision, two of the basic features of the "world-as-machine" metaphysics. Mathematics may be abstract, but it certainly is not vague. Vague and abstract are not synonyms. What mathematics does is to render symbolic the absolute precision and regularity of the cosmos in which we live. As symbology it should be attractive to Idealists as well, but as the medium of discourse for work in the sciences it is an essential in the Realist curriculum.

Essentialism or general education <u>does</u> <u>not</u> emphasize:

1. Pupil-teacher planning as to objectives, learning experiences, and appraisal procedures.
2. Humanism, as a psychology of learning. Thus, learner choice is not advocated in decision-making situations.

---

[4]Van Cleve Morris and Young Pai, <u>Philosophy and the American School</u>. Boston: Houghton Mifflin Co., 1976, pg. 84.

3. An elective system whereby choices may be made by learners in terms of course work to be pursued.
4. Frills and fads in teaching-learning situations.

In Conclusion

There are numerous philosophies inherent in selecting objectives, activities, and experiences, as well as appraisal procedures in the mathematics curriculum.

1. Problem solving procedures emphasize learners, with teacher guidance, identifying and solving relevant problematic situations.
2. A laboratory approach stresses using concrete materials for student usage. Thus, the learner may measure length and width, determine area and perimeter, find volume, and weigh diverse materials.
3. A subject centered mathematics curriculum emphasizes students acquiring essential content for all to master. Vital facts, concepts, and generalizations need to be achieved utilizing content from reputable textbooks, workbooks, and worksheets.

A mathematics curriculum needs to be developed which guides each student to attain optimal sequential progress.

DATES TO REMEMBER

February 28, 1987	OCTM Annual Mathematics Contest
March 19 - 21, 1987	OCTM Annual Meeting Cincinnati, Ohio
April 8 - 11, 1987	NCTM 65th Annual Meeting Anaheim, California
April 6 - 9, 1988	NCTM 66th Annual Meeting Chicago, Illinois