THE ALBERTA TEACHERS' ASSOCIATION MATHEMATICS COUNCIL

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The Theology of Individualization

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The teacher seeking individualization is not unlike the Christian seeking Salvation. The Believer is buffeted on all sides by the prescribers who preach of the True Path which must be followed to Everlasting Glory.

Thus, the teacher, whose every step is fraught with the dangers of temptation, contemplates the various efforts to reform the educational process. The Promised Land is described in glowing terms, where the perdition of unrealized Salvation will come to those who persist in maintaining within their repertoire of educational techniques such superannuated procedures as Large-Group Instruction-Ability Grouping-Tracking-Lectures....

Instead, the teacher is exhorted to Reform her efforts, to Individualize ... to Task Group ... to ....

From Penn.C.T.M. Newsletter, Nov/'76:

ELECTRONIC THEORY WITH HAND CALCULATORS

The July, 1976 issue of "Popular Electronics" begins a three-part series by Edward M. Noll, titled "Learning Electronic Theory with Hand Calculators." This course requires a great deal of computational work and frequently proves boring or even repellent to many students because of this. Powers and roots are encountered, angles and vectors are used, and both very large and very small numbers are a part of it all. The hand calculator offers a quick and easy approach to avoid the drudgery of long, laborious calculations.

This first lesson discusses series and parallel resistances, Ohm's Law, and formulas for reasonance and power and voltage gain. The next installment will discuss impedance and ac formulas.

Certainly this series of lessons offers an excellent opportunity to see interrelationships between science and mathematics. Also, although some of it is quite elementary mathematics and science, opportunities will be afforded for some extremely advanced work in both areas.

See editor's report on calculator questionnaire, p.24.

IN THIS ISSUE

One Evangelic recently described the scene as she entered the Promised Land through the Pearly Gates: Let us swing open the door so that you can see what is going on in this second-grade classroom. The children are sitting in groups of four at each of eight tables. In each group, a child who easily grasps mathematics concepts has been appointed as monitor for two average achievers and one is having trouble with mathematics at the moment. This arrangement provides for peer learning and interaction among the children - they learn from one another.

The youngsters are playing with mathematics games. At one table near the front of the room the children are working with equivalent sets as they construct Indian villages and compare the number of members in each. To one side, the students drill subtraction with five as they line up their rockets and blast them off as the monitor directs the countdown. Another group practices counting by odd numbers, and a group nearby compares and contrasts larger and smaller sets as cardboard animals are manipulated. These children are achieving through a systematic skill development program. Each group of four works through each skill. Notes are made by the teacher as to each child's performance. Periodically new grouping takes place: the children work in groups of two members, then they are directed in individualized program. *(Arithmetic Teacher,* January 1972, p.35)

Individualization is taking place here, there can be no dispute of that. All of the properly prescribed components appear to be present - regrouping, task groups, peer teaching, etc. What does not appear in this article, and what is rarely dealt with, is the path by which this Promised Land is reached.

Thus, it is easy for the teacher to begin to doubt and question her own efforts as she compares the scene within her own classroom with the scenes described by writers such as this. As these comparisons are made, it becomes very easy to develop guilt feelings, for as the practitioners of the True Belief are extrolled, the doubts increase. Yet there is no enlightenment as to how the Promised Land is to be reached, so the teacher is rarely given more than vague prescriptions and descriptions of what that classroom should be like.

Rather than reinforcing and improving upon what is being done well now, teachers are encouraged to believe that Individualization of a Mathematics Program will require a complete revamping of their educational efforts. Rarely do these descriptions refer to the role of large-group instruction; instead it is ignored, and implications are made that its use is to be cast out. The textbook's role is generally ignored, the Reformers implying that the mathematics curriculum is somehow made anew by each teacher, that the teacher who relies on the textbook is Sinful and should be consigned to the Purgatory of Unrepentant Traditionalists.

Admittedly, most Reformers will deny these implications, but these impressions are what is being transmitted to classroom teachers. This being the case, where do we go from here? The answer does not lie in rejecting these visions of Glory; rather, they should be accepted for what they are - an endpoint, and Ultimate Goal. We should strive for them; but we must accept them for what they are, we must begin to build on what we have, realizing that Salvation is individualized, both for the student and for the teachers. We must accept the fact that what worked best for one teacher and for her students will not necessarily be right for other individuals.

If a program of individualizing is to be viable, we must begin with the fact that both teachers and students are individuals, that they differ, and any successful program must meet the needs of all. From this point it becomes the task of the teacher to provide teaching strategies which meet the needs of her students as they arise. The form these strategies take are, therefore, dependent upon the context in which they are used.

But before these strategies may be devised, a basic course of study must be outlined; without this the mathematics program would have no direction, no continuity, and it is quite likely that the program would shortly flounder. The best source for this outline is the textbook. It can serve as the guide, the basic resource from which the teacher may then chart a course of Individualization for her students. Although their place may not be prominent, or even apparent within programs such as that described earlier in this paper, most teachers who have developed programs of their own began with a basic textbook series. Because textbooks have been used improperly does not mean that they have no role in an Individualized Mathematics Program. Their role is to aid in providing objectives, sequencing objectives, and formulating strategies for attaining these objectives. Thus, if you dig far enough, you will find that in all programs similar to that which was described earlier, there is a basic underlying course of study and its most likely source is a basic textbook series.

The teacher's task is to devise strategies other than those which appear in the textbook, in order that the individual needs of the students are met. It is also her task to alter the sequencing, to vary the amount and the difficulty of the objectives, as she perceives the needs of her students.

The excerpt from the article describes *a* version of the Ultimate Goal, not *the* version. Each teacher must work out her own version, and there are many paths for attaining this end; but for the individual teacher, there is a unique path, and it is one which she must find for herself. As long as the teacher has a goal which accounts for the individual needs of her students, and she is wisely choosing those activities and characteristics which will aid her in attaining that goal, she need not be overly concerned about the preachings and phrophesies of the oracles of educational change. Indeed, if her program is soundly based, it will accomplish that which it is intended to do, even though it might not have a form outwardly consistent with current educational theology.

Thus, it is incumbent upon each teacher to determine what her goals are, and to outline and implement strategies which will enable her to attain these goals. She will reach the Promised Land as long as these goals consider the individual need of her students, as long as these goals are implemented through a program which is approached in a rational manner and which allows each student to advance in a manner best suited to himself.

Reprinted from *The Ohio Council of Teachers of Mathematics Newsletter*, Vol. XXIII, No 1, November 1974.

The Computer,
A Facilitator of Learning

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Computers and computer methods are beginning to play a significant role in today's education. Despite the spectacular achievements of computer application, such as the control of air and space travel, it is the educational role which will be the main reason for having to become familiar with the use of computers. Anyone living in the latter half of the twentieth century needs to know something about the technological advances, their uses and misuses. This is also true of computers. As computers and computer concepts can augment our thinking, it is desirable for everyone to have some understanding of them. To achieve this end, it behooves us to make computer education available to all people, especially our youth. This can be justified by the contributions which computers are bringing and will continue to bring to education.

What, then, are the objectives of education which can be used to develop the body, mind and personality so that one may have a broad and clear view of the world around, may live a full and satisfying life, and may make as valuable a personal contribution to society as possible? Some of the objectives are:

1. the development of perception and knowledge;
2. the ability to apply knowledge through skills;
3. the ability to analyze and form judgments, to develop a sense of values and make decisions;
4. the ability to explore, to adapt, to ask questions, to recognize and face problems;
5. the ability to express oneself creatively.[1]

How can the computer be used to facilitate learning and in the process aid the fulfillment of these objectives?

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[1] *Computer Education for Teachers in Secondary Schools - An Outline Guide* (revised edition, September 1971), Photospeed, London, and *Computer Education for Teachers in Secondary Schools - Aims and Objectives in Teacher Training* (October 1972), Photospeed, London.

The computer is capable of storing a vast amount of information, retrieving it quickly, and of sorting and ordering with extremely great speed. Consequently, it can help us to perceive pattern and structure of knowledge more exactly and meaningfully than ever before. Without the computer, the sorting and ordering by man would be, in many instances, an impossible task.

The ability to analyze and form judgments can be aided by a sophisticated use of the computer known as simulation. To illustrate, let us consider the question of population explosion. A student can enter various parameters which affect the human population. Some of these are life expectancy, sex ratio, and fertility. Not only can the student see the results of his parameters on population, but through his own initiative he can also ask questions, analyze the responses and form judgments.

To further illustrate, the Canadian government recently used a computer to predict the developments in Canada during the next 25 years. The predictions were formulated on assumptions that certain trends in the Canadian society would continue. They suggest a continuing inflationary spiral, economic problems, and unemployment. Some of the more drastic changes which will affect us are the massing of people into cities with populations in the millions and the upward shift from the current 62 percent white-collar employment to 80 percent. *It was further predicted that by 2000 A.D. a computer terminal will be a standard home appliance and will be used in many different ways.* After a recent computer-assisted learning demonstration to school trustees, a number of people expressed an interest in obtaining a terminal for their homes. We asked, "Why?" The response was, "We want to provide our children with computer learning experiences." If the home terminal prediction carries any modicum of truth, it behooves today's society to provide computer learning opportunities for our youth preparatory for tomorrow.[2]

Furthermore, a computer model developed by the Club of Rome was used to project world population growth and future status of the natural resources.[3] Models and simulations, corresponding to those used by governments, can be used in the high school disciplines. Using the models, students usually play the role of an important person and make decisions which could influence the lives of many people. By entering information into the computer, various problems are raised which need to be faced. A sense of values is developed through the discussion with teachers and fellow pupils about the decisions which are to be made and the reasons for making them.

The *Programme Library Users' Manual* (PLUM) developed by the Computer Services Branch, Manitoba Department of Education, contains models and simulations which are being used in this manner by the teachers and students of schools who have computer terminals.

A student's creative ability is fostered when he reaches a stage of

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[2]*Winnipeg Free Press*, Thursday, December 12, 1974, Final Edition: Vol. 82, No. 66.

[3]*Ibid.*

wanting to construct his own programs and simulations. Such a student will be able, with or without help, to analyze the situation and to construct a model which can be used. He can then test the validity of his analysis by comparing the results of his program or simulation with further observations.

The computer can be used in other ways to facilitate learning. If we were to look with discretion at the impact computers are beginning to have in education, we would have to accept the fact that some of the educational developments, which began before computers were introduced, have been greatly accelerated by their coming. There has been a shift of emphasis from problem-solving to the formulation of solutions to problems. This formulation is an activity which needs to be clear and precise, and is facilitated by the use of a computer. Why? Because the computer obeys instructions explicitly and blindly and it can be a valuable aid in testing whether the formulation is correct. This new emphasis can be incorporated into learning in various disciplines. What is being underscored here is that problem definition and solution formulation should be emphasized as opposed to the straightforward learning of facts, and the computer is a significant facilitator in this respect.

As an aid to classroom lessons, a teacher may use the computer to enhance the presentation of a topic. For example, he may wish to show the distinction between different numerical methods in mathematics, to calculate quickly the results of a demonstration experiment, or to call on a data bank of information in the course of a special topic development. To illustrate the latter, R.D. Parker Collegiate at Thompson, Manitoba, has developed a program for storing in a computer file the academic record of each student. A student record file can then be accessed from the computer in an efficient way. Approximately 5,000 marks are entered into the student record files at the end of each trimester. According to the administrative staff, the entry, retrieval and updating of student academic records, using a computer, is now a pleasant and time-saving experience.

The computer can be used to match individual students with learning materials, resources and activities which fit their requirements as closely as possible. It can keep material and resource files which would include course packages and inventories of human resources and materials. This is commonly referred to as computer-managed instruction. In the direct involvement with the process called computer-assisted learning, the computer can be used to present instructional sequences wherein the computer serves as a tutor, analyzing the student responses to questions and branching according to his achievements.

In the drill and practice mode where the computer presents exercise after exercise for solution, the student's ability and confidence are quickly raised. This is being experienced in the Manitoba project for handicapped children and slow learners. With the computer's ability to sort, classify and analyze students' work, it can branch into remedial work when it recognizes a pattern of consistent errors. Such immediate remediation is difficult for a teacher to provide. In a classroom situation of 30 or more students it becomes an impossible task.

The computer can be used to facilitate for each high school student the opportunity to obtain an education that is best suited to his needs. By using the computer to schedule school timetables, individualized programs of study can be programmed which allow the students a wider range of options from which they may choose. The administrative tasks associated with individualized scheduling in the schools with larger enrollments are more complex and the workload is overwhelming when using the manual methods.

It was Sigmund Freud, the founder of psychoanalysis, who once said in answer to a question: "My purpose is to help people love, work, and play, and enjoy all of them." Using Freud's thought, Edmund C. Berkeley, editor of *Computer and People,* had this to say: "... the computer, I believe, can help a person work, can help a person play, and can often give him so much enjoyment that he can fall in love with a computer." People who understand the computer and its potential for facilitating, accelerating and enhancing the learning processes agree for the most part with Mr. Berkeley.[4]

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[4]C.E. Berkeley, *Computer and People,* Vol. 23, No. 3, March 1974. Berkeley Enterprises.

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Evaluation of the Manitoba Schools Computer Network[1]

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In December, 1973, an evaluation committee was organized to evaluate the Manitoba Schools Computer Network. The evaluation centered on the use of the computer in teaching computer courses in the schools. Attention was focused on those schools having direct access to a computer terminal.

It was found that the computer network was favorably received by both teachers and students. Even those students who did not have direct involvement with the computer terminal in their school were aware of its existence. Those students who were taking computer courses became highly involved, and spent considerable time on course assignments and on projects of their own. Teachers appeared well satisfied with the help they received from the Computer Services Branch and with the functioning of the network.

EVALUATION PROCEDURES

The evaluation committee determined that its major focus would be on the first objective of the Manitoba Schools Computer Network, namely, the use of the computer in teaching Computer Science 205 and 305, and Data Processing 202 and 302.

Questionnaires were designed to gather information from students who were taking computer science or data processing courses, from teachers of those courses, and from students who were not taking computer courses.

The computer science or data processing teacher was asked to have his students fill in the student questionnaire and attitudes checklist; to complete the teacher questionnaire; and to obtain responses to the student questionnaire from a class which contained few, if any, students enrolled in a computer course.

COMPUTER SCIENCE AND DATA PROCESSING STUDENTS

A total of 894 students completed and returned the questionnaire. Table 1 indicates the grade distribution of those who responded.

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[1]The material contained in this report came from the "Report on the Evaluation of Manitoba Schools Computer Network," written by Dr. Heather Sharman (chairman of the mathematics dept. at Gordon Bell High School in Winnipeg), published in April 1974 by the Computer Services Branch.

TABLE 1

STUDENT ENROLLMENT IN COMPUTER COURSES BY GRADE LEVEL

Course	Grade Level X	XI	XII	Total
Computer Science 205	17	372	88	477
Computer Science 305	6	12	131	149
Data Processing 202	2	96	112	210
Data Processing 302	0	1	30	31
Total	25	481	361	867

Of these students, the majority (76%) were enrolled in a high school program, and 24% of the students were enrolled in a business education, vocational, or occupational entrance program.

Students were asked if they planned to take a further computer course at some future time. A total of 61% of the students said they would, 30% were undecided, and 9% said they would not. For those who said they would not, comments focussed on the difficulty and the time-consuming nature of computer courses.

FIGURE 1

Type of program in which the students who responded were enrolled.

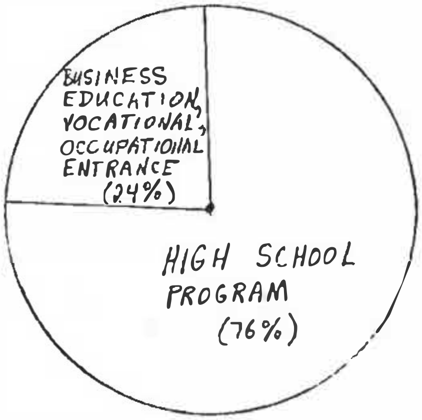
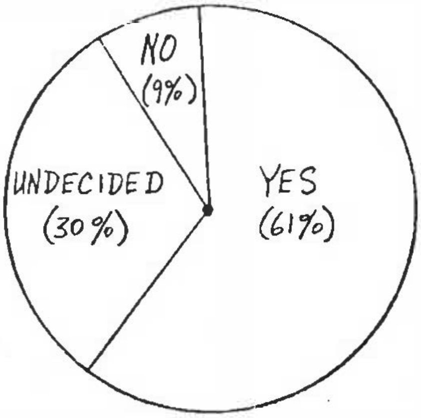


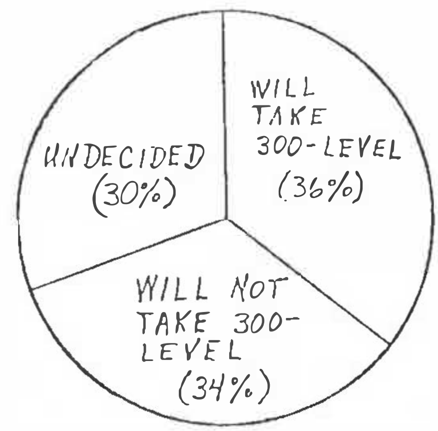
FIGURE 2

Student response to the question, "Will you take another computer course in the future if provided with the opportunity?"



In spite of the large number of students indicating interest in another computer course at some time, a question directed to students who were enrolled in the 200-level courses indicated that only 36% of these students intended to take the corresponding 300-level course, with 34% of the students stating that they would not, and 30% of the students undecided. Here, one of the major problems for students appeared to be the fact that the computer courses may not be acceptable to the university they wish to enter.

FIGURE 3
200-level students' responses to the question, "Will you take the corresponding 300-level course?"



The time-consuming nature of the computer courses is further illustrated by students' responses to questions about the amount of time spent on computer course assignments and on computer projects of their own. While the majority of students appeared to be spending an amount of time on computer courses in keeping with the time spent on all courses, 33 students reported having spent more than 10 hours a week on assignments, and 18 students reported having spent more than 10 hours a week beyond the time required by the assigned work in the course.

TABLE 2

NUMBER OF STUDENTS SPENDING A GIVEN NUMBER OF OUT-OF-CLASS HOURS PER WEEK ON COURSE WORK

Time Spend On: (hours)	All Courses	Computer Course Assignments	Students' Own Computer Projects
Less than 1	86	169	335
1-3	165	313	309
3-5	231	204	123
5-7	143	100	49
7-9	110	45	22
10 or more	135	33	18

A separation of the responses according to whether or not there was a computer terminal present in the student's school showed that while there was no difference in the amount of time students spent on all courses, there was a significant difference in the amount of time spent on computer science courses. Of the students in schools with terminals, 10.4% reported, and of the students in schools without terminals, 3.6% reported that they spent 7 or more hours per week on computer course assignments. Similarly, 12.2% of the students in schools with terminals and 3.0% of the students in schools without terminals reported spending 5 or more hours on computer activities other than assignments. It seems clear that where there was ready access to the computer, some students spent a disproportionately large amount of time on computer-related activities. Those schools with terminals were able to provide their students with the opportunity to develop in either a formal or an informal fashion an interest beyond the standard academic program.

Students in the computer courses were asked whether they thought that all students should have some form of exposure to computers. The majority (68%) answered "yes" with a number of comments on the increasing impact of the computer on our everyday lives. The 11% of the students who answered "no" gave as reasons the lack of ability or interest of some students and the need to leave the choice up to the individual student.

A set of questions regarding the functioning of the network - file storage, usefulness of error messages, turn-around time, availability of materials, facilities - showed that, in general, students have a positive view of most aspects of the network. The only negative perception that appeared was in response to an item regarding the availability of a keypunch. Of the respondents, 43% agreed with a statement that a keypunch was usually available when needed, and 57% of the students disagreed with the statement. Responses to questionnaire items regarding texts seemed to indicate that no text was being extensively used by the students.

FIGURE 4

Response to the question, "Should all students have some form of exposure to computers?"

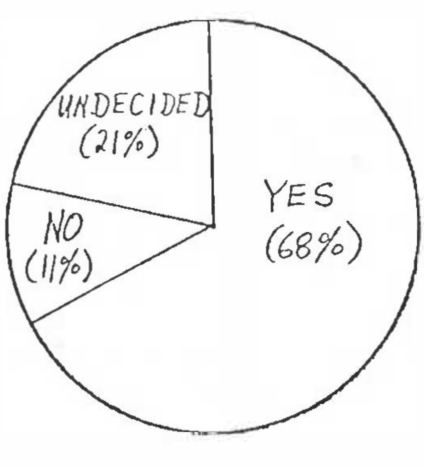
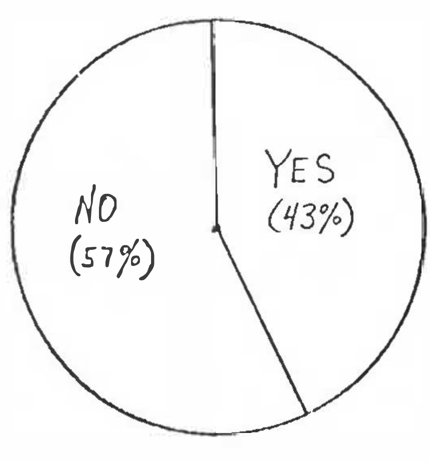


FIGURE 5

Response to the question, "A key punch is generally available when needed."



COMPUTER SCIENCE AND DATA PROCESSING TEACHERS

A total of 43 teachers of computer courses completed and returned this questionnaire in which most of the items dealt with the functioning of the network itself. Teaching a computer course in the Manitoba schools is a relatively new concept, and only 10 of the 43 teachers had more than one year's experience in these courses; the average experience prior to the 1973-74 school year was 1.07 years.

Like their students, these teachers appeared to have a positive feeling toward the services available to them - error messages, network library, permanent file space, amount of time the terminal is available, promptness of repairs, the increased number of runs per day possible now that the network is in operation. They also found both the newsletter *Computer News* (39 of 40 respondents) and *Information Release* (41 of 41 respondents) useful and responded positively to statements about consultant services and in-service programs; 36 of 43 respondents found the consultants' response time to questions satisfactory; 31 of 42 respondents found that the in-service programs met the needs of the users.

Questionnaire items regarding their local situations showed somewhat less favorable responses. While 32 of 38 respondents felt that their students had sufficient time on the terminal, 31 of these 32 teachers worked in schools where a terminal was located; only one teacher in a school not having a terminal felt that his students had sufficient time.

TABLE 3

RESPONSES TO THE QUESTION: "DO YOUR STUDENTS HAVE SUFFICIENT TIME ON THE TERMINAL?"

	Sufficient Time	Insufficient Time	Total
School has terminal	31	2	33
School has no terminal	1	4	5
Total	32	6	38

The question of sufficient student time on the keypunch showed a more even split. Of 42 teachers, 22 stated that their students had sufficient time, and of 39 teachers, 21 stated that when they needed a keypunch one was usually available. However, over half (428 of 746) of the students who replied to the same question stated that they did not find that a keypunch was usually available when they needed one.

Almost all the teachers who responded (42 of 43) felt that students, teachers, and administrators should be provided with some exposure to the computer.

Items dealing with supervision of the terminal and with assistance given to students using the terminal showed that most of the computer science and data processing teachers (34 of 38 who responded) were using their own free time for this purpose; only 2 teachers reported that they got compensatory time. Teachers were also using their free time where there were short exposure courses being given to students and other teachers, where computer clubs had been formed, and where there were other computer-related activities.

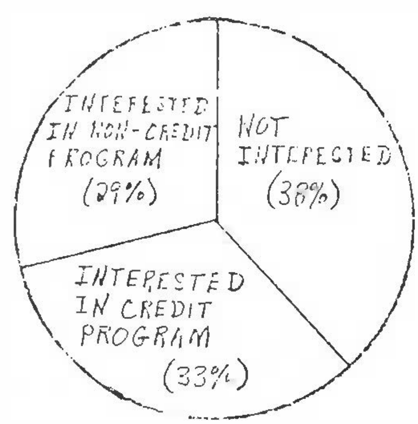
HIGH SCHOOL STUDENTS QUESTIONNAIRE

This questionnaire was designed to seek information on what was known about the computer and the network by students who were not enrolled in any formal computer course but who had a terminal available in their school. Replies were received from 817 such students. Most of them (62%) indicated that they did not intend to take any computer course in the future. The majority (80%) were aware that a terminal existed in their school, having learned about it from a fellow student or a teacher; 195 students had seen the computer used in their classes in various ways, many involving subjects other than the computer courses.

Many of these students, while not committed to a full computer course, were interested in short introductory courses. Only 38% of the respondents said they would not be interested on any basis; 33% of the students would have been interested if the short program could have been for credit; and 29% of the students would have been interested in a non-credit or extra-curricular course. However, 49% of the respondents felt that these courses should have been available before Grade XI, 12% felt they should not, and 39% were undecided.

FIGURE 6

Response to the question, "Would you be interested in a short introductory course?"

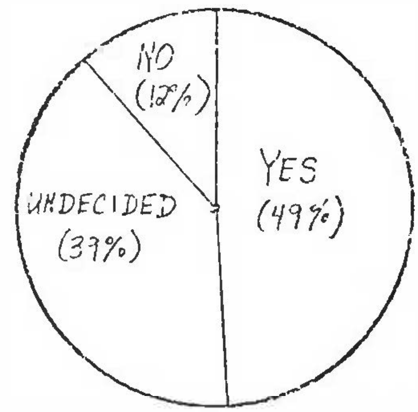


ATTITUDES CHECKLIST

A 20-item checklist was designed to query students on the effects of the computer on their attitude to school subjects, to their future, to their personal relationships, and to the role of the computer in society. Each student responded to the set of items twice - once on the basis of what he perceived were the computer's effects on him and once on what he felt should be the computer's effects on him. While most of those who replied perceived the computer as influencing their lives very little or slightly favorably, there was little difference between their perceptions of how it affected them and how it should affect them.

FIGURE 7

Response to the question, "Should an introductory course in the use of the computer be available before Grade XI?"



CONCLUSIONS

The evaluation committee viewed this evaluation as the beginning of an ongoing evaluation. They felt that many questions remain unanswered and, indeed, unasked.

NCTM's New Member and Subscription Fees

Please note the changes in current membership fees of the National Council of Teachers of Mathematics as listed below (membership dues payment includes $5.50 for a subscription to either the *Mathematics Teacher* or the *Arithmetic Teacher* and 25¢ for a subscription to the Newsletter):

$12.00 (includes one journal - specify which you wish to receive)
$17.50 (includes both journals)

$ 1.00 additional fee for an individual subscription to the *Mathematics Student*
$ 7.00 additional fee for a subscription to the *Journal for Research in Mathematics Education*.

For each journal desired, add $1.00 for mailing outside the U.S.A.

NCTM Adopts Position Statements

Computers in the Classroom

NCTM's Instructional Affairs Committee recently prepared the following statement, which has been approved by the Board of Directors:

Although computers have become an essential tool of our society, their diverse and sustained effects on all of us are frequently overlooked. The astounding computational power of the computer has altered priorities in the mathematics curriculum with respect to both content and instructional practices. Improvements in computer technology continue to make computers, minicomputers, and programmable calculators increasingly accessible to greater numbers of students at reasonable cost.

An essential outcome of contemporary education is computer literacy. Every student should have firsthand experiences with both the capabilities and the limitations of computers through contemporary applications. Although the study of computers is intrinsically valuable, educators should also develop an awareness of the advantages of computers both in interdisciplinary problem solving and as an instructional aid. Educational decision makers, including classroom teachers, should seek to make computers readily available as an integral part of the educational program.

Statement on Basic Skills

The National Council of Teachers of Mathematics is encouraged by the current public concern for universal competence in the basic computational skills. The Council supports strong school programs that promote computational competence within a sound mathematics program, and we urge all teachers of mathematics to respond to this concern in positive ways.

We are deeply distressed, however, by the danger that the "back to basics" movement might eliminate teaching for mathematical understanding. It will do citizens no good to have the ability to compute if they do not know what computations to perform when they meet a problem. The use of the hand-held calculator emphasizes this need for understanding: one must know when to push what button.

Consider in this regard a disturbing result of one recent national examination. Students were asked to determine 70 percent of the 4200 votes cast in an election. Almost half of the thirteen-year-olds and one out of five of the seventeen-year-olds applied the wrong arithmetic process. Some divided, some added, and some subtracted! Computational skills in isolation are not enough; the student must know *when* as well as *how* to multiply. We must address skills, but we must address them within a total mathematics program.

In a total mathematics program, students need more than arithmetic skill and understanding. They need to develop geometric intuition as an aid to problem solving. They must be able to interpret data. Without these and many other mathematical understandings, citizens are not mathematically functional.

Yes, let us stress basics, but let us stress them in the context of total mathematics instruction.

Recommendations On Competency-based Teacher Education

The NCTM is convinced that there are good and bad competency-based teacher-education (CBTE) programs just as there are good and bad non-CBTE programs. Any assessment of teacher performance must recognize that the teacher functions as an integrated whole, and the identification and assessment of competencies necessary for the successful teaching of mathematics require the skills of those working in the discipline. Some regions have mandated an approach to certification without specifying the need to include representatives from the fields of mathematics education. (The Council's document, "Guidelines for the Preparation of Teachers of Mathematics," is an effort to delineate better the competencies needed by the beginning mathematics teacher.) Therefore, to reassert the need to encourage a variety of creative approaches to the complex problem of teacher education, the Council makes these five recommendations:

1. That CBTE, however defined locally, not be used exclusively by certification bodies until more research and evaluation of its outcomes are available.

2. That the competencies identified in the "Guidelines" be used as baseline competencies for purposes of teacher education and that efforts to identify and assess additional competencies, in particular those observable only in the classroom, be encouraged.

3. That evaluation in teacher-education programs be characterized by systematic assessment of all competencies over a period of time to identify consistent and effective performance.

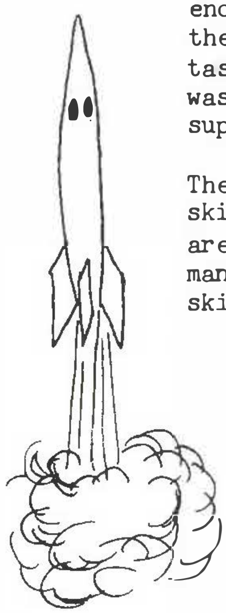
4. That the identification and assessment of performance related to mathematics teaching be chiefly the responsibility of professionals in the field of mathematics education: college professors of mathematics and of mathematics education, school mathematics teachers, and mathematics supervisors.

5. That representatives from the mathematics education community be involved in the development of competencies and assessment procedures related to mathematics teaching and that if NCTM affiliates in these areas have prepared guidelines, those guidelines be used as a framework against which proposals can be judged, and if such guidelines are not available, the NCTM's "Guidelines" be used.

These recommendations were developed by NCTM's Commission on the Education of Teachers of Mathematics. Copies are available free on request from the Reston office, including a more comprehensive statement of support.

SUMMARY OF THE NATIONAL COUNCIL OF SUPERVISORS OF MATHEMATICS POSITION PAPER ON BASIC MATHEMATICAL SKILLS

Mathematics supervisors are concerned that as a result of the "back-to-the-basics" movement, today in many schools there is too much emphasis on computation and not enough stress on other important mathematical skills. To respond to this trend, the National Council of Supervisors of Mathematics (NCSM) set up a twelve-member task force to write a position paper on basic mathematical skills. The position was first written in July, 1976, and later revised on the basis of ideas from supervisors throughout the country.



The position paper urges that we move forward, not "back" to the basics. The skills of yesterday are not the ones that today's students will need when they are adults. They will face a world of change in which they must be able to solve many different kinds of problems. The NCSM position paper lists ten important skill areas that students will need.

Problem Solving: Students should be able to solve problems in situations which are new to them.

Applying Mathematics to Everyday Situations: Students should be able to use mathematics to deal with situations they face daily in an ever-changing world.

Alertness to Reasonableness of Results: Students should learn to check to see that their answers to problems are "in the ball park."

Estimation and Approximation: Students should learn to estimate quantity, length, distance, weight, etc.

Appropriate Computational Skills: Students should be able to use the four basic operations with whole numbers and decimals and they should be able to do computations with simple fractions and percents.

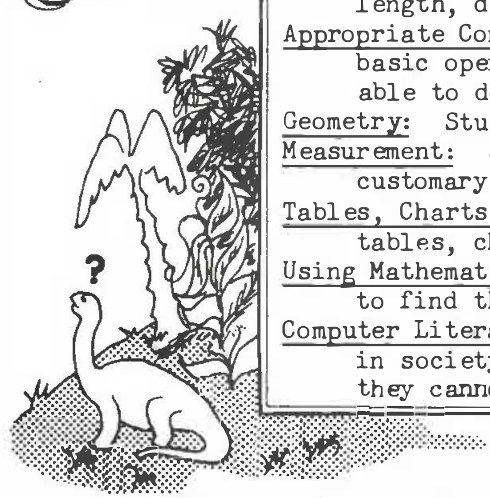
Geometry: Students should know basic properties of simple geometric figures.

Measurement: Students should be able to measure in both the metric and customary systems.

Tables, Charts and Graphs: Students should be able to read and make simple tables, charts and graphs.

Using Mathematics to Predict: Students should know how mathematics is used to find the likelihood of future events.

Computer Literacy: Students should know about the many uses of computers in society and they should be aware of what computers can do and what they cannot do.



The role of computation is put into its proper place. Long computations will usually be done with a calculator, but computation is still important. Mental arithmetic is a valuable skill. Computational skills by themselves are of little use, but when used with other skill areas they give the learner basic mathematical ability. School systems which try to set the same requirements for all students should beware of requirements which either are too difficult or which stress only low-level skills.

Rather than using only a single method such as drill and practice for learning basic mathematical skills, many different methods should be used. Hands-on experiences with physical objects can provide a basis for learning basic mathematical skills. Standardized tests are usually not suitable for measuring individual student progress. Instead, the tests used should be made especially to measure the mathematical skills being taught.

The NCSM position paper sets forth a basis for identifying which basic mathematical skills are important and for determining if students have learned these skills.

OUTDOOR MATH ACTIVITIES

RICHARD E. COWAN, Math Field Agent

This fall when the days are cool and clear and you feel a need for a break from the classroom, why not take your class outside and let them do some measuring? Many mathematical ideas can be demonstrated, and besides, it is fun.

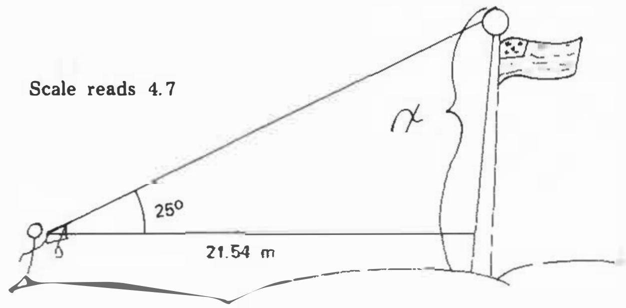
In the next few issues of this Newsletter, you will find plans for making, and ideas for using, several outdoor measuring devices.

This article will feature a clypsometer (clip-som-e-ter), so named by the author because it is a combination of two devices, the clinometer and hypsometer. The device could be used to measure verticle angles (angles in the air or up and down angles) and the height of objects. A detailed drawing for construction purposes and an explanation of how to use it will follow, but first, some possible activities.

The simplest activity we can do with the clypsometer is to measure angles. One might like to do this and make scale drawings of objects in the school yard. Remember, that by making scale drawings, one can determine measurement not directly obtainable.

A second activity which would be good for upper middle school and junior high students is to use the measured angle and trigonometric tables to obtain the height of objects. To do this, students would have to be provided with the tangents for the angles from 0^{o} to 45^{o}. You may want to provide more but these would be adequate for most purposes. To obtain the height of an object the student will measure (in metres) the distance from himself to the bottom of the object. Then the height of the object is obtained by multiplying the tangent of the angle by the distance to the base and adding the students' height (in metres). The answer will be in metres if the student measured in metres.

The third type of activity is using the clypsometer to measure heights of objects. To do this the student will read the number on the scale on the saw blade and multiply that number by the distance from the student to the object and divide by 10. The number thus found plus the students' height is the height of the object.



$\tan 25^{o} = .466$

$x = (.466)\ (21.54) = 10.04$

Scale reading = 4.7

$x = \frac{(4.7)\ (21.54)}{10} = 10.12$

The height of the flagpole is 10.04 metres plus the students' height.

This is a good way to bring in the multiplication of decimals for students in a meaningful way. One can also talk about accuracy and relative error to a meaningful way.

Clypsometer

To make it and use it:

Material needed. (all wood thicknesses and widths are given as you would purchase it and is not the actual measurement.)*

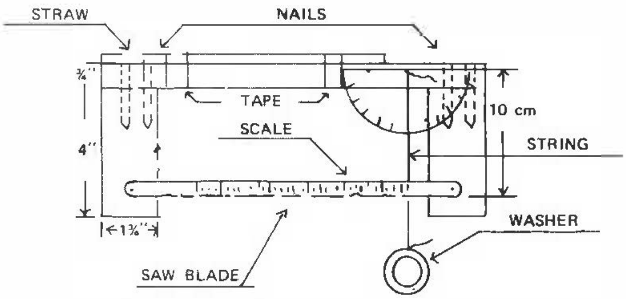
- 2 blocks of wood, one inch by two inches and 4 inches long.
- 1 block of wood, one inch by one inch and 12 inches long.
- 1 drinking straw.
- 1 hacksaw blade - used.
- 1 protractor.
- 1 washer for string weight.
- 1 piece of string 50 cm long.
- 4 # 4 common nails.
- 1 # 4 finishing nail.
- 2 carpet tacks to attach the saw blade.
- Masking tape, glue and a hammer.

---

*Standard American Measurements are given here and on the drawing because it is not possible at this time to purchase materials in metric measure.

Construction:

First nail the pieces together as illustrated. Next attach the protractor and the hacksaw blade. Do not drive in the nail in the center of the protractor until the string has been attached. Be certain that the distance from the top of the string to the bottom of the blade is exactly 10 cm. Affix masking tape to the saw blade taking care not to cover the teeth. Mark a linear scale on the tape by making the zero point of the scale directly under the 90° point on the protractor. Mark the scale in centimetres and half centimetres. Finally attach the string and washer to the center of the protractor.



Use the above drawing to construct the clypsometer.

To use the clypsometer to measure angles a student simply looks at the top of an object through the straw and making sure the string is free (not caught on the sawblade) and is not swinging, he then twists the clypsometer so the string catches on the sawblade and then reads the angle on the protractor. Notice that if a commercial protractor is used, the student must subtract the 90° from the reading. (You may wish to suggest that the students construct a protractor which would eliminate the subtraction.)

To measure heights of objects with the clypsometer a student will go through the same sighting process as to find angles but instead of reading the protractor, the student will read the scale on the sawblade. The height of the object then is the number on the scale times the distance to the object divided by 10. The height of the object will be in the same unit as the distance to the object as long as the metric system is used as the system of measurement.

Further information on this device and activities and a copy of the tangent table may be obtained by writing

Del Mod Resource Center
Delaware Technical Community College
Southern Branch
Georgetown, Delaware 19947

and asking for them. Good Luck!

Reprinted from DCTM Newsletter, Vol. III, No. 1, Sept. 1974.

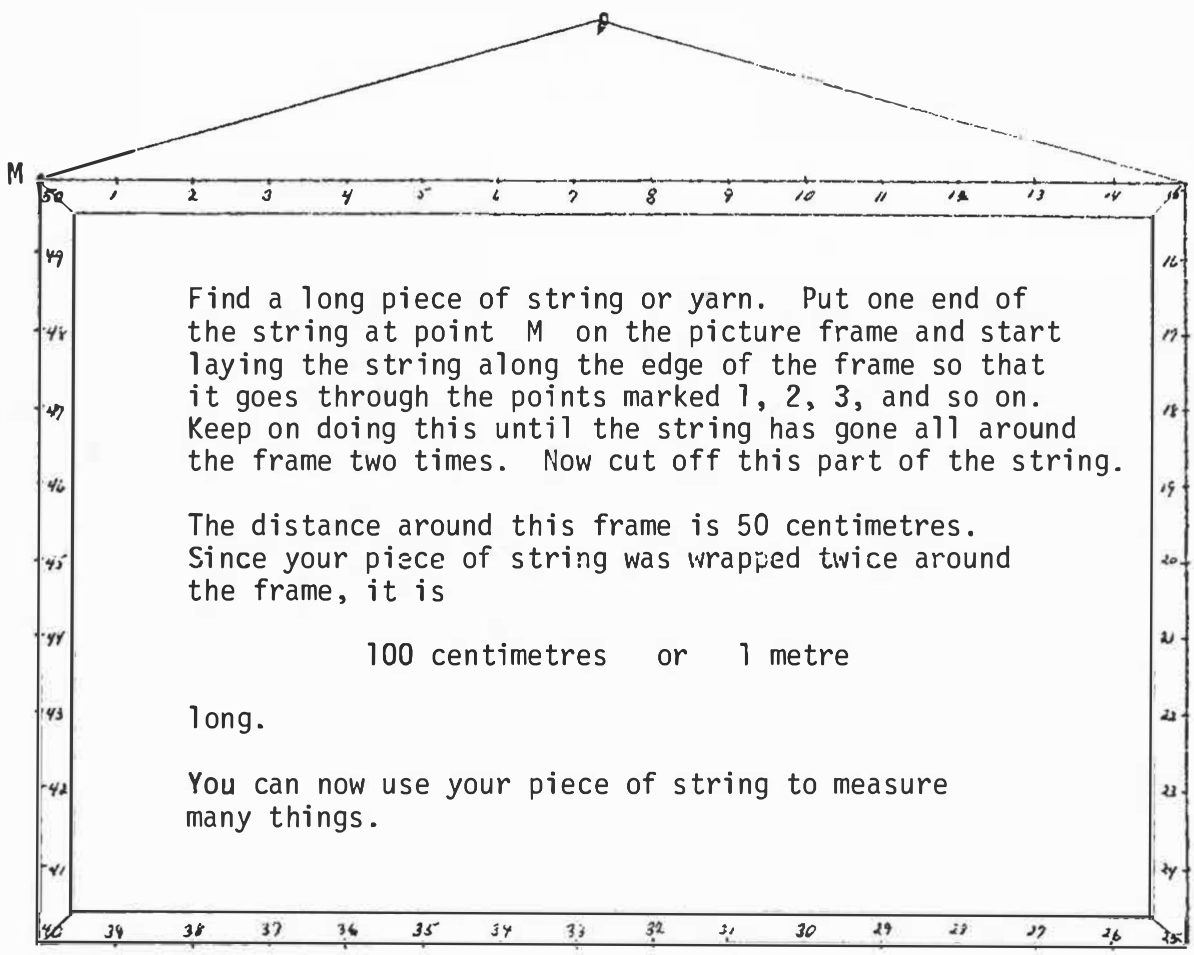
Change of Address

Please note that the address of Western Educational Activities has been changed and should now read:

Western Educational Activities Limited
10324 - 103 Street
Edmonton, Alberta
T5J 0Y9

Metre Matter A Metric Measurement Activity

Elaine V. Alton
Judith L. Gersting
Joseph E. Kuczkowski
Indiana University - Purdue University of Indianapolis



Find a long piece of string or yarn. Put one end of the string at point M on the picture frame and start laying the string along the edge of the frame so that it goes through the points marked 1, 2, 3, and so on. Keep on doing this until the string has gone all around the frame two times. Now cut off this part of the string.

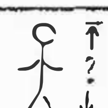
The distance around this frame is 50 centimetres. Since your piece of string was wrapped twice around the frame, it is

100 centimetres or 1 metre

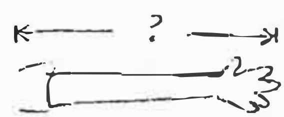
long.

You can now use your piece of string to measure many things.

Are you taller than a metre?



Is your waist smaller than a metre?



Is your arm longer than a metre?

Look at one of the rulers below. How many of these rulers laid end to end would you need to get something as long as your metre string?

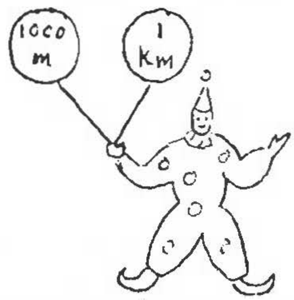
Answer: 5 rulers

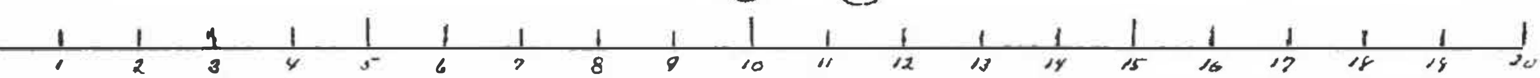
Look around you...

Can you find something that is about one metre high?

Can you find something that is close to one metre wide?

If 1000 pieces of string just like yours were placed end to end in a straight line, the giant piece of string would be 1000 metres long. 1 kilometre or 1 km is another name for 1000 metres. Kilometres are used to measure long distances.





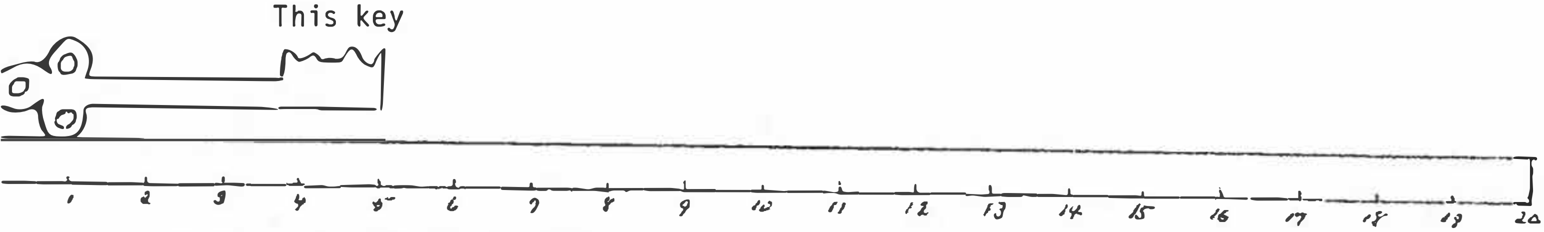
If someone asks you how tall you are, you probably say something like "4 feet" or maybe "48 inches". We usually talk about some number of inches, feet, yards or miles when we measure how long, how tall, or how wide an object is, or how far away it is. These units of length are part of what is called the customary system of measurement.

Almost every country in the world except the United States uses another system of measurement called the metric system. Because we have to trade with other countries and because the metric system is a simple system to use, we will probably soon be measuring only in metric units in this country. Scientists and doctors already use the metric system.

There is a picture of a metric ruler at the top of this page. The little marks on the ruler are all the same distance apart:

This distance, ⟼ , is one centimetre. 1 cm also means one centimetre. We use a metric ruler just like we use a regular ruler. To measure how long something is, we line up one end of it with the 0 end of the ruler.

This key



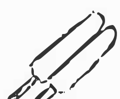
is about 5 centimetres long.

Do you think your pencil is longer than 15 centimetres? How would you find out?

That's right, you would measure it on a metric ruler and see.

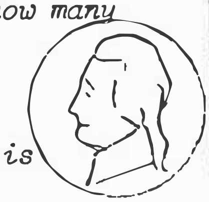
About how many centimetres long is your little finger?

Find something in your house that you think is about 20 centimetres long. Measure it and see if you were close.



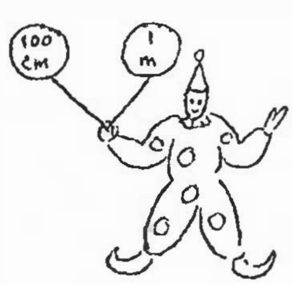
A popsicle stick is about 1 centimetre wide. This may help you to picture how long a centimetre is when you don't have a metric ruler with you.

Find a nickel. Use the ruler at the top of this page to measure how many centimetres wide it is.



Do you agree that the nickel is about 2 centimetres wide?

What if we wanted to measure the length of your bedroom? If we measured how many centimetres long it is, we would get a very big number. Instead of using centimetres, we can use another metric unit of length called a metre. One metre is 100 centimetres long. A metre is a little longer than a yard. 1 m means one metre.



Travel Metre

The new classroom-tested and revised version of *Travel Metre* is now available. It is a fascinating SI-Metric board game which also involves International Road Signs. *Travel Metre* is the only metric game to be permitted to display the logo of the Canadian Metric Commission.

The game is unique because it is educational and fun for players from age 10 to senior citizens. *Travel Metre* involves participation in estimating and measuring linear, volumetric, and mass units. It is printed on Kimberly-Clark's durable Texoprint in four colors and includes 32 Metric cards, 32 International Road Signs cards, 5 centicube board pieces, a 1.5 m tape, string and dice. It comes in an attractive red mailing and storage tube.

Travel Metre was designed by Dr. W.F. Reese, Professor of Science Education at the University of Alberta, Edmonton, Alberta, Canada. It is available from

- Think Metric Associates Ltd., 8452 - 117 Street, Edmonton T6G 1R4; or
- Spectrum Educational Supplies Limited, 1152 Mainland Street, Ste. 315, Vancouver, B.C. V6B 2T9; or
- Creative Educational Activities Ltd., Box 8232, Station F. Edmonton T6H 4P1.

Price per game is $10. Sets of three games are priced at $25. (United States prices are $12.50 per game and $30. per classroom set.) These prices include mailing.

Travel Metre has been successfully used with Grade IV through adult classes. As a family game, *Travel Metre* bridges the generation gap as most of us are on square one in terms of the Metric System.

Stettler Mini-Conference, April 30

9:30 a.m.	Elementary Provincial Curriculum Report
10:30 a.m.	Use of Calculators in Elementary Schools
1:30 p.m.	Make-and-Take Activity Workshop

9:30 a.m.	Motion Geometry in Junior High
10:30 a.m.	Math Labs in Junior High
1:30 p.m.	Make-and-Take Activity Workshop

For further information and/or registration, contact Pat Beeler, 10020 - 19 St. S.W. Calgary, Alberta T2V 1R2.

Future Mini-Conferences will be sponsored throughout the province and organized by MCATA in cooperation with the local area representatives using resource personnel obtained by the MCATA executive.

TAKE NOTE...

▶ MATH KITS are available upon request. We have no requests as yet for May or June, 1977. If you want a kit sent to your school, write to Ms. Audrey Brattberg, director. (See Mathematics Council Executive listing on last page for her address.) These kits include materials for examination only and the sources of these materials so that you may order the items you find most suitable for your school.

▶ COPIES OF THE *Mathematics Teacher,* November 1976, are available for 50¢ each from MC executive members Francis Somerville and Robert Holt. (See Mathematics Council Executive listing on last page for their addresses.) The November 1976 issue has been used for articles on mini-calculators including suggestions on how to use them in the classroom.

▶THE PLAQUE FOR RETIRING MEMBER AND ATA REPRESENTATIVE MEL SILLITO, which had been shown at the business session of the last MCATA annual meeting, was presented to Dr. Sillito during a luncheon at the University of Alberta Faculty Club on December 2, 1976. MCATA members who joined him on this special occasion were Tom Rieger, Ted Rempel, George Cathcart, Joan Kirkpatrick, Doyal Nelson, Sol Sigurdson, Tom Atkinson, Matt Pawluk, Bob Holt and Al Neufeld. Doyal Nelson, a former local school classmate of Mel Sillito, made the presentation. Dr. Sillito was ATA Representative in MCATA from 1961 to 1966 (when Tom Rieger took over and held that position until 1973) and from 1973 to 1976.

▶ DIRECTOR LYLE PUGNUCCO has been named chairman of a "name-of-site" NCTM meeting tentatively scheduled for October 10-13, 1979, to be held in Calgary, Alberta. Any ideas you may have for speakers and program subjects will be appreciated as we look forward to our third "name-of-site" meeting.

▶ THE DATES OF THE 1977 ANNUAL CONFERENCE were set for October 14 and 15 at the November executive meeting. The conference is to be held at the Red Deer Lodge in Red Deer, Alberta. MCATA members are invited to send names of speakers of their choice as well as program suggestions to the conference chairman Robert Holt, 13750 Woodcroft Avenue, Edmonton T5M 3M4.

Thanks for your Response

Editor's Report on Calculator Questionnaire

Remember the questionnaire mailed to you with the September issue of *Delta-K?* We asked you to respond to a number of questions with regard to the use of the hand-held calculator in mathematics classes, and we promised to publish a summary. Here it is!

How do Alberta teachers feel about the use of mini-calculators in our schools?

The first impression gained from the answers is that we have a valuable instrument. Where it is more convenient, it can replace the slide rule and math tables in solving complex problems. It is used to increase the rate of solving complex problems where the principles to be learned are basically how to interpret data, particularly in areas of science and business.

Answers to specific questions reveal the following:

1. Many students have calculators available at the secondary level, and some have them at the elementary level.

2. Most teachers have a calculator or have access to a calculator and use it.

3. Calculators belong in the secondary schools, and a few teachers in elementary grades would like to see them in elementary classes.

4. Calculators belong to all students, not just to the "good" students.

5. The use of calculators by students who cannot remember their basic skills need to be further explored. Respondents to the question do not agree on this point.

6. The schools should not be made responsible for furnishing calculators.

7. The need for special courses in the use of calculators must be investigated more thoroughly. There is no agreement on this point.

8. Do parents favor or oppose the use of calculators? We don't know the answer to this question as yet. However, it is suspected that most parents are as unsure of this as they are of the "new" math which they do not fully understand.

9. Special materials on the use of calculators are wanted and needed. (See section "PLEASE NOTE ..." in this issue of *Delta-K* as to availability of *Mathematics Teacher*, November 1976, as one way to get such materials.)

10. Most teachers would allow the use of calculators on tests designed to evaluate problem-solving ability and as an aid to improving problem-solving ability.

11. The use of a calculator leading to a breakdown in basic skills may be a liability. This needs extensive investigation.

12. Units of study on how to use the calculator need to be part of the program. We need to ask, "at what level?" From the responses it appears that such units probably should be introduced at the Grade VI or VII level.

13. Special in-service training in the use of calculators should be given to teachers. (MCATA is working on this through the mini-conference and will help to supply expertise for professional development groups desiring workshops as part of professional days, institutes, and conventions.)

14. Calculators are helpful in inspiring students to do more math and to continue their studies in math.

15. There is no agreement on the extent to which machines will replace computation, and about one-third of the respondents has no definite position.

16. No consensus has been reached on the question as to whether the use of the calculator should be a "must" area. (It is speculated, though, that many students with limited basic skills will learn the simple operation of a low-cost mini-calculator regardless of what is being done in the classroom. Therefore, more teachers are seen moving toward the "must" position in time. Do you agree?)

17. The calculator is useful in other subject areas, particularly science, business and industrial arts.

18. Senior high teachers want the calculator to become part of classroom tools now. Other teachers are not so concerned. Most teachers in the senior high schools use calculators when available to the students; junior high school teachers are divided, and elementary teachers are not using them.

Some of you may have answered differently, and you may feel differently. However, the above is the general feeling of those who responded to the questionnaire. The areas where we left doubt are those where the statistics left uncertainty about the majority opinion of the issue involved.

We will have to decide whether we want to teach the use of the mini-calculator as part of the mathematics program or whether we will leave it to the business education teachers to make it a part of the business machine and/or office practice program of studies, with many students becoming self-taught and getting only limited skill in its use.

Our school boards will have to decide whether the purchase of calculators should be the responsibility of each student or should be included in the budget as are texts and other school supplies. This will vary from board to board as it should, unless the ASTA decides to make a policy on this matter. Should we as professionals attempt to influence our boards? We should be prepared to make suggestions and/or recommendations when requested. Perhaps some of us will be in a situation in which a positive influence is desirable. At present, MCATA and The Alberta Teachers' Association have not made any policy statements or policy recommendations. Should MCATA make a statement with ATA approval? Let us know your opinion on this matter so that we can act on your behalf.

METRICATE! © 1976 Will Reese

DEAR FELLOW EDUCATOR:

The copyright on "METRICATE!" is intended only to protect it from commercial or media use without permission. Please feel free to copy this song and use it with your school classes.

Willard F. Reese, Ed.D., Professor of Science Education

MCATA Annual Conference, October 1976. Were you there?

◀ Dr. W.F. Reese leading the singing of "Metricate" (see opposite page - 26) at the SCATA Variety Show on Oct. 9, 1976.

Plan to attend this year's Annual Conference to be held October 14-15 at the Red Deer Lodge

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