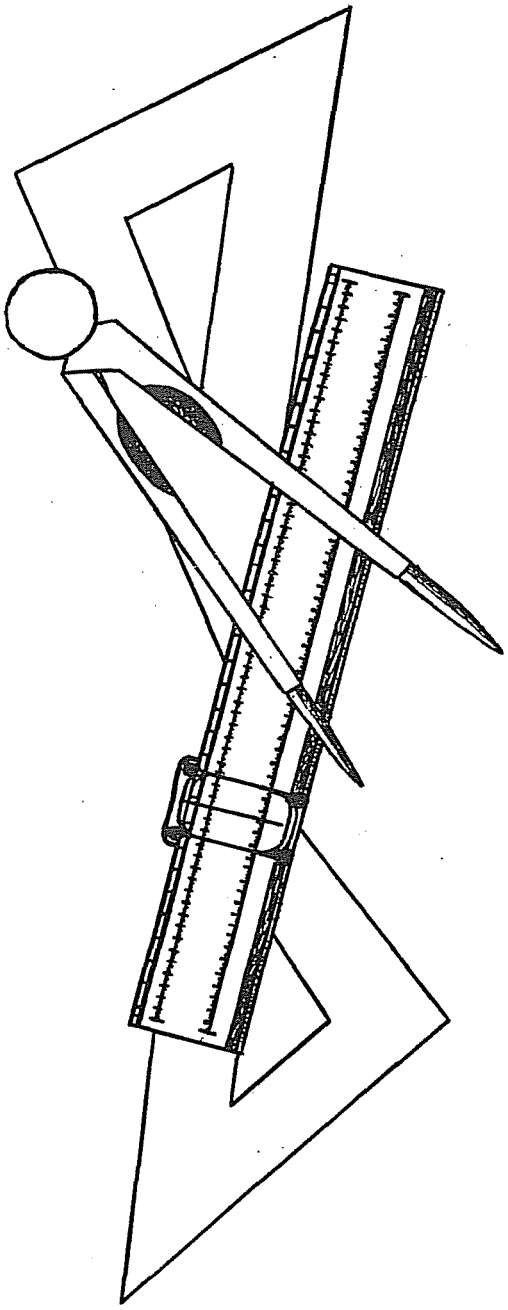
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EDITORIAL

At the annual meeting of the Ontario Mathematics Commission, a discussion took place on the subject "How may the Gazette meet the needs of a unified organization?"

We see the Gazette as the principal channel of communication between individual school teachers, consultants, the Department (or Ministry?), community colleges and universities. To many members the Gazette is the only 'benefit' of membership, so the editors have the task of providing a journal which entertains, informs and involves the membership. Changes in curricula should take place in these pages - what is being planned, how individuals may contribute to plans and make suggestions, and the results of these discussions. A correspondence section combined with a greater frequency of publication was suggested. It was pointed out that the membership are the eyes and ears of the editors, all we do is to sift, co-ordinate and follow up leads you give us. We cannot institute a correspondence section on our own, but have set up some questions and comments which we hope are provocative enough to stimulate your participation. If you hear of anything of interest, tell us. If you want to know about something, ask - we'll pass your query on. Would you like to see less emphasis on philosophical articles and more on classroom-type problems which are immediately useful? The Gazette exists to serve the members, and we would appreciate hearing about suggestions for improvement.

W. Eames
J. S. Griffith

COMPUTERS, CALCULATORS, AND SUCH

James T. Walker, John Abbott College, Ste. Anne De Be levue, Quebec

Many mathematics teachers are faced at this time with the problem of deciding whether to use mechanical, electrical, or electronic aids in their classrooms; and if the decision has been made to use such aids, they must then decide what specific aids to use.

In line with the current trend towards spending more on education - after all, it's not one's own money, is it? - they sometimes tend to think in terms of buying the most sophisticated - and consequently the most costly - machinery available. Many, having done so, are now pausing for second thoughts. It is the purpose of this paper to sort out certain relevant facts for the guidance of teachers now facing the decision to mechanise or not to mechanise.

There are three basic objectives in introducing such aids to a mathematics class. First, they give the student an opportunity to acquire skills in the use of the specific machines provided. Second, they relieve the student of many of the arithmetical chores involved in working examples. Third, they enable the student to 'see things happen', as for example, where they are used to divide a number by a decreasing divisor, demonstrating that as the divisor approaches the limit of zero, the quotient approaches infinity. These objectives are not necessarily in

order of priority.

At the outset, the teacher must make up his mind which of the basic objectives apply to his case. This decision will colour much of his subsequent thinking on the subject.

The first objective, teaching the use of the machines, is perhaps the least important, except in the use of computers to train computer operators. The chief danger is that the student will wind up being trained on machines far more sophisticated than any he will encounter in his first few years of employment. The classroom machine will be the 1972 super-product; the employer's machine will be 1962, 1952, or perhaps even older.

Salesmen of the very sophisticated equipment, will gleefully tell the teacher that 'within a few years, there will be one of these in every office, factory and home'. This is a salesman's beautiful dream, and I've heard it so often that I have come close to believing it. But then I think back to the publicity that we produced in the 1945-48 period when everybody was busy with post-war planning; then it was confidently predicted that within a few years there would be a computer in every kitchen. When pressed for a more accurate forecast, the predictors ususally settled for 'about 1955'. Well, there are the Seventies. Do you have a computer in your kitchen?

I have recurring nightmares about one of my students

nor his teacher haveany idea where he went wrong in the first place. A tape print-out is mandatory, so that they can check back on his original entries.

If you are about to object on the grounds that arithmetic accuracy isn't that important, I would ask you to pause and reflect. How would you like to drive across a bridge that had been built 8 feet short? If examples in mathematics are to have any meaning other than just 'drill', then the answers must be right. With a tape, they can be made right, without it, many of the advantages of using the machine will be lost.

While we're on the subject of arithmetic, the question comes up whether your calculators should have an automatic square root. This is of some importance to teachers of Statistics, so what are the facts? Finding a square root rarely involves find-

hour over the year. And an automatic square root button may cost you as much as $100 extra. This is more expensive time than the last lot we mentioned.

Now, to the third objective, demonstrations of mathematical phenomena. In Mathematics and Statistics, as in Physics, Chemistry, and other science subjects, it is often useful to give students fifty sets of data for the same problem, for the purpose of comparing the results as the nature of the input data changes. Here, the electronic calculator and the computer come into their own, the poor mechanical-electrical calculator being left far behind. The programmable electronic calculator is invaluable; plug in the programme, punch in the data or read them in from cards, and the answers come out in no time at all. This is a very useful facility in the classroom, and the expense of the more sophisticated machinery can easily be justified. But not at the level of one machine per student! Perhaps not even at the level of one machine per ten students.

We have solved this problem at John Abbott College by setting up a Statistical-Mathematical Laboratory equipped with 15 mechanical-electrical calculators for regular classroom use; one programmable calculator-computer in a separate Resource Laboratory on which students can run programmes either provided by the College Staff or written by the students themselves: and one older and simpler model of the calculator-computer on which students receive

"basic training" before being turned loose on its "big brother".

As long as the room is free, students have access to the classroom calculators, and to the Resource Laboratory by appointment made with one of the staff. Combined student-staff efforts are creating a library of programmes in common use, and eventually the Resource Laboratory will be available to students in other courses requiring computing facilities for projects. In future years - and, naturally, out of future budgets - we hope to add peripheral options in the Resource Laboratory.

By using all 15 calculators, we can accommodate a maximum of 30 students at a time, but we try to restrict classes to 24, so that 3 calculators are maintained in reserve. This permits a servicing programme on a rotation basis. The supplier was kind enough to provide us with instruction in "First Aid" so that a teacher can free a stuck key without calling on half an hour of some poor overworked serviceman's time. The arrangement has paid big dividends, and might profitably be copied by other users.

The calculators are used to speed up arithmetic bulk operations. The calculator-computers are used when the availability of large quantities of results become more meaningful than repetitive drills in methods, as, for example, in demonstrations of limits, or in comparisons of Linear Trends fitted to several dozen economic variables. They are frequently used also in checking on a student's understanding of an algorithm when he is set

the task of writing a programme based on that algorithm.

When it comes to computers, the average teacher of mathematics is usually very much in the hands of the salesman, and the final decision on rental or purchase may not even be in his jurisdiction at all. However, he still has a voice, as the person concerned with teaching quantitative subject material, and that voice should be heard. It should be crying, "What is this going to do for our students?" In one institution of my acquaintance, the entire computer installation was of one make, although a substantial majority of the computers used by potential employers in the area were of another make. That institution had made its selection on the basis that the man they had hired to teach computer programming came from out of town and was an expert on the make they selected! The cost to its graduates may never be measured!

Before you make your big decision, let me introduce you, with due acknowledgment, to what I call 'Trimble's Ladder'. Bill Trimble, Dean of Instruction at Humber College, Scarborough, has designed a ladder of Teacher Machine-Aids which begins at the bottom with a pointed stick in a sandbox, and progresses upwards through chalkborads, overhead projectors, calculators, film loops, movie projectors, teaching machines, and the rest, to computer-assisted instruction. "Trimble's Law" states that you should take a look at where you are on the ladder now, and if you can without

loss of efficiency move down a rung or two, you should. As one moves up the Ladder, sophistication increases but also, alas, personal involvement decreases. Do you really need all that gadgetry?

Finally, it may be worth remembering that people who don't matter usually judge a Mathematics Department by the level of sophistication of its gadgetry; people who do matter judge it by the quality of its graduates. The two are not necessarily directly related!

Biographical Note:

James T. Walker is Professeur de Statistiques at John Abbott College, Montreal. He is the author of Business Statistics, (McGraw-Hill, 1971) and of several articles on the teaching of Mathematics and Statistics.

MATHEMATICS AND OFF-CAMPUS EDUCATION

Harold S. Martin, Principal, Maple Grove Public School
R.R. #1, Preston, Ontario

The purpose of this article is to convey some ideas which make the teaching of mathematics more meaningful and interesting both to the pupils and the teacher. I will talk about the use of a survey, an economic study of a farming community, and the use of the school and the surrounding playground. I believe that all of these ideas are not only applicable at the grade 7 and 8 level, but that many of them can be adjusted and used at many other grade levels.

THE SURVEY

My experience of using the survey as a tool in the teaching of mathematics was twofold. On one occasion we surveyed a residential area whereas the second time (with a different class) we surveyed a downtown business area. In both cases current issues which were in the news were discussed with the class. After creating this initial interest it was decided to go out and get other people's opinions on the subjects. In the case of the residential district we asked questions on such topics as the voting age, shopping habits, car and television ownership, reading habits, and their opinions about the educational system. When surveying the business area, we asked questions about volume of business according to months, effect of advertising, future water

federal governments, the mayor of the city, various companies, the Downtown Businessmen's Association, and the Minister of Finance. Everyone one of these people sent replies to the class. You can be assured that pupils find it rather exciting to get letters from business executives, mayors, members of parliament, and from the federal Minister of Finance. Add to this the fact that the two local radio stations, the local television station, and the city newspaper all gave the projects excellent coverage on the day the surveys were done and on the day the results came out, and you have a class of students who are very enthusiastic, not only about mathematics, but about school in general.

There were other interesting results. A city alderman, the chairman of the area planning Board, and the local member to the provincial legislature visited my class. The class also attended a city council meeting as a guest of one of the aldermen.

ECONOMIC STUDY OF FARMING COMMUNITY

The purpose of this project was to discover the economics which are involved in running a farm. A whole day was spent in visiting a farm and the various places where a farmer spends money and receives money. The pupils were given specific questions to ask at each place.

The places visited were a farm, drainage tile factory, apple juice canning company, creamery where they make butter, flour mill, blacksmith shop, and artificial cattle breeding company.

The questions were structured in such a way that the pupils discovered how a farmer could make a profit on raising a pig or selling milk. They were also able to discover such things as the cost of producing a loaf of bread or a pound of butter.

The information from the questions was later used to teach per cents, business arithmetic, etc. Besides this it gave them a fairly basic understanding of how and why a farmer makes a profit or a loss.

THE SCHOOL AND THE PLAYGROUND

The use of the playground can be used in the teaching of mathematics at any grade level by simply gearing the questions to the pupils' age level and capabilities. Approximately ten different problem questions may be made up involving ten different areas of the playground. The class is then dividied into ten groups and they simply rotate from one problem to the next. Some possible problems might be; area and perimeter of walls, sidewalks, soccer goals, etc., cubic feet of cement in a sidewalk, soccer goal post, parking guide, etc., distance a swing would travel if it went all the way around, and the volume of various containers.

SUMMARY

Obviously projects of this nature do not relate to mathematics only, but also to English, geography, and sociology. The surveys in particular are good public relations for the school as well as for the whole educational system. The surveys are of

great value because they give the pupils the opportunity to go out and meet the public in such a way that they are given the responsibility of acting as mature young adults.

Using ideas of this nature as tools in teaching mathematics makes the subject much more interesting than simply using figures from textbooks and questions on the blackboard. When the subject becomes more interesting it also becomes easier to understand.

SCHOOL MATHEMATICS PROJECTS

(based on a talk given by David Taylor, Assistant Director of SMP at the Ottawa OATM Annual Meeting).

SMP started in 1961 as a conference or convention, held in Southampton University in Southern England in that year. This was not a maths convention as such, it was a convention which school masters, mathematicians, teacher-trainers and, I think, most important, industrialists from the leading industrial concerns in England attended. There were one or two other odd bodies around but these categories were the most important.

At this conference, Brian Thwaites, who was then a professor of Theoretical Quantum Mechanics at that University, delivered a paper on the shortage of mathematics graduates in the United Kingdom. As a result of this paper, some of the leading and enlightened heads of mathematics departments in the independent schools, which in England we call Public Schools, met Dr. Thwaites to discuss these matters further. There were heads of mathematics there from four of the leading public schools who sat down to investigate just what was wrong with the form of mathematics being taught and the way in which it was being taught. After these lengthy talks (over three days in Winchester, one of the leading public schools in England) sixteen deck chairs had been broken! In addition to that, they had a 'go' at a new syllabus, which they thought was more appropriate.

following basic ideas: That mathematics taught must be relevant, it must be relevant to the children in our charge.

I don't know how you teach square roots or why you teach square roots or if you teach square roots. But I seem to remember that when I was at school, if we wanted to find the square root of something, we had to divide it off into pairs - I really did not know why, etc. How many people really understand what they are doing in this - in fact, how many of you know why that works? I don't want you to put your hands up but I think that if you don't understand it, you should not be teaching children this way, and if you are teaching children that method, you should be teaching them why it works, as well. Mathematics must be relevant, and must be relevant to the child and to his parents, and must be relevant to the needs of the 20th Century, and we must be thinking about the needs of the 21st Century, although it is rather difficult to know what these needs might be in 30 years' time. Computer and computer capability increases with amazing and horrifying speed but we ought to be trying to teach mathematics relevant to the needs of this and the next century. We still want to make mathematics relevant to one area of study. Mathematics is the queen of science but it is still the tool of the other sciences - bear this in mind. While we are making it relevant to the subject we should see that it is efficient and effective, and mathematics must be relevant to the future mathematical needs of

the child, the future mathematical needs of society, the future mathematical needs of science and technology. Equally important to this, the mathematics must be meaningful, mainly for the child, and equally meaningful for the teacher. I think the two go together, but I am not always convinced that this happens in practice. Mathematics must be exciting, it must be stimulating. I am sure all of you have found that mathematics is exciting and stimulating, but how much of this excitement and stimulation do you put across to your pupils? It is not enough to present another maths book, even if it has pretty pictures in it. You have got to be alive to the subject. A new syllabus or program is not the total answer in itself. It is important to cut out what I might describe as "dead wood" in any existing syllabus. It is equally important to keep the parts of the syllabus which are valid and still relevant.

There is no point at all, I think, in scrapping a syllabus completely and starting again from scratch. I would guess that any sensible modern teacher would work in this way. I reckon that any modern syllabus in the United Kingdom has at least two-thirds of its contents in common with any tradiational syllabus, and I think this is as it should be. Change just for the sake of change is useless. Considered variations on a theme or relevant alternations to an existing theme, I think are much more valid. With these thoughts in mind, these thoughtful masters sought the

assistance of another four schools who started to write the syllabus and to revise their existing syllabuses and trying to get a common syllabus amongst the eight schools which they thought was suitable.

It was all very well writing a syllabus but there weren't any books for the children to have, so at the same time they had to write their own textbooks. They had to write textbooks which they felt would be appropriate to their own needs in their own eight schools.

You might ask "where did the money come from". Money is always the problem, I think, in any country and this is why I said it was important that industrialists attended this conference in 1961. Considerable funds were obtained from leading industrialists in the United Kingdom, some in the form of gifts and some in the form of covenants. This is a splendid scheme, I don't think it is of importance here. If a fellow wants to guarantee a certain sum of money each year for seven years, then the person receiving that money could reclaim all the income tax on the amounts paid on it. This meant that we had considerable funds at our disposal, and mean that the finance of the project in early days was adequate.

How did we use this money, apart from materials? We

thought it was important that the texts be written by school masters - practicing school masters in classroom situations and in tough with the children so they were able to put their ideas into practice to see how they worked.

Equally important, it was known that after a hard day's work in school, it was difficult, if not impossible, to come home and then work at such a task. We appointed a number of relief teachers to most of these eight pilot schools. These relief teachers took over the half-time table of two existing members of staff who had been full of enthusiasm for SMP. They would spend half their time writing and half their time in the classroom where they were able to try out the syllabus and see what they could do with it, and if it was any good.

These early books, which were typewritten and duplicated in a very bulky form, are in the archives in the office. I have some of the original books which were about 7 inches thick. It was difficult for kids to take these home for homework, and so we didn't keep them very long!

They were the beginning of the existing SMP series. Every one of the SMP books came out in draft form originally, and after they were in use for a year in the eight schools, were commented and criticized. The second draft version was produced by a professional firm of printers, processed and produced by a reasonably cheap type of printing (and a little bit thinner than

6 or 7 inches!). These books were taken by a certain number of schools for a trial period.

At the end of the trial period in 1964, our first book was published on a commercial basis. After it was published and was available for anyone or any bookshop, the project began to grow. Lots of people bought the books - anything that was called "new Maths" was something the schoolmasters would want.

When other people began to buy these books, it became apparent that the wished of these eight schoolmasters in revising their syllabus were similar to those of a large number of other schoolmasters. These other school masters were not in a position by themselves to do anything about it. They weren't powerful enough in the state schools. (Our public schools which are private schools - our state schools which are your public schools) had a different sort of freedom. All our school masters have freedom - theoretically! I would like to stress that all of our books, everyone of the SMP texts now and then, were the entire effort of school masters. We consider this is important. The SMP organization occastionally arranges for relief teachers so that the writer-teams can be relieved of their teaching duties and, what is very important, received unfailing help and encouragement from university mathematicians and from the College of Education lecturers. The universities have not told us what to do - we suggested what to do and asked if it suited them, which I think is an important

distinction between projects in some parts of the world and ours.

I think perhaps we should just look at the syllabus. I haven't learned about your grades yet. I believe that there is a formula that if you add 3 to the grade, you come us with the age of the children.

Mathematics is one subject. Traditionally, mathematics has been divided into three or four areas - something like this: We do Algebra on Monday, Geometry on Tuesday, Arithmetic on Wednesday, and this subject which I will call Data Processing is not what one ordinarily associates with data processing - I mean the sorting out of a data. I suppose some people would even sub-divide these subjects even further. (This is only up to the 15-16 year olds, and calculus and the other topics are not mentioned.) I would much rather see the subject not made into these four main divisions. I don't believe one can teach Algebra in a vacuum, I don't believe one can teach Geometry in a vacuum, or any of the other subjects. They are all inter-related. Mathematics is one subject and I think it is important that inter-related topics are taught.

The main things we have changed in our course is the geometry. We do not teach Euclidian geometry in the way Euclid taught it 2,000 years ago - (and many schools in England still do). But we have changed to those ideas on transformation geometry through which one can teach or can demonstrate every one of the

Euclidian results relatively simply. It does have the advantage, I think, that it shows useful inter-relation between geometry and algebra at a very elementary stage.

We treat our geometry geometrically and treat it algebraically, and tie it all together.

We no longer teach that multitude of arithmetic calculations - (convert two miles, three furlongs, and so on, into metres). This is becoming less necessary because in England we are now metricating outselves. Most people don't know how far a kilometer is and I was horrified when my wife came home with a kilogram of butter and it wouldn't go in the fridge!

All of our newspapers - and I am sure this is true here as well as in England - contain graphs of statistical information. If you look closely at these, this is usually an abuse of statistics. They fiddle about with the axis, they fiddle about with the numbers on the axis just so they can convince you that they know what they are talking about. The Editor of the Times is getting a little bit fed up with me as I call him up just about once every week, complaining about the scales he has used, and asking him just what he is trying to prove. If he had drawn the graph properly and had used the statistics accurately, he would have produced a very different result.

The statistics and probability are becoming much more a part of everyday life. We regard it as important, and we teach

them at a simple level right down at the bottom at age 11.

This fine subject called Algebra, we used when I was at school, used to consist of arithmetic literacy and little else. I agree that this is an algebra of numbers but it is an algebra of numbers and there are many other algebras that ought to be studied (each system has its own algebra). So consider the algebra of rates, the algebra of sets, the algebra of statistics, Boolean algebra, the algebra of circuits and all that. We now try to teach algebra and see what common structures they might have.

It has been suggested that I ought to explain the significance of teaching groups in the lower parts of the secondary schools. I have no intention of saying "Why don't you teach groups?" I don't think that to the secondary child a group in itself is important. But I think that those parts of group structures which go to make up groups are important. I think it is important to consider ideas of associativity. What is an identity? The formal definition of a group is fairly meaningless to a boy of 15. Thereafter, it becomes more meaningful.

SMP over the past nine years has grown, partly because many mathematicians were dissatisfied with what they were doing, and partly because a lot of mathematicians thought it was a good thing to change. And we had the terrible band-wagon effect of people buying the books and using them and they say "we are doing

circles either, so they had to go back and use squares, and so on!

But they hadn't any understanding, and understanding is one of the important things, I think. You have to teach an understanding of the subject. We are not trying to teach techniques to get through an examination. Our main aim in all of our books is to breach mathematical concepts through the experience of the children through situations. We try to present them with a situation, not necessarily mathematical but one with which they are familiar, and lead them to investigate how they might tackle the problem.

There is the problem of converting the physical situation into the appropriate mathematical model. This has always been a problem and I am sure it will continue to be a problem. but I don't think the problem is quite as great nowadays as it used to be.

We do not claim that our books or the mathematics in our books are perfect. They are not. There is a lot wrong with them, and we place a great deal of importance on the feedback we get. In the early stages, the type of feedback between the various schools in the project was sufficient, but nowadays we have to rely on the feedback coming across to us through gossip, telephone calls and through meetings. We take very seriously any comments we get and we regard this as a continuing venture. There is a lot to be done still in the existing course. There are things

wrong with it, and there are things we left out and there are things we haven't done well!

(That all sound terribly negative but there are things we have done very well!) We consider it important to be looking at the work all the time.

In England we have these nine examining boards; each write the examinations according to their own syllabus. This has always been their tradition and their freedom. With the SMP examinations, we override all these divisions. There is only one group of papers set on the SMP Syllabus, set by one of the Boards and made available to all the other groups. Thus, we have a uniform examination throughout the whole of England. We had to make sure at the same time, that these examinations, or at least the syllabus on the whole set fulfilled the needs of the universities. The results of our examinations are the main means of determining a pupil's aptitude or ability towards the university and so we had to make sure that these were in keeping with what the universities required.

Another part of our work which we consider terribly important is the in-service training of teachers. We are an independent organization; we have no government control or government support. But we think it part of our duty to run courses for teachers so that authors of books and the revisors of books can discuss with teachers who are trying to use the material, why

agree that anyone should be able to read a reasonable flow diagram. We do consider computers as important but not as a main SMP course.

Last August, Brian Thwaites, who was at the International Congress of Mathematics at Lyons, launched a new project which goes by the title of IPCS - International Project for Computers in Schools. It is international because we have people in Scandanavia, Germany and Poland and, I believe, one or two in the United States. At home there are some people in Scotland - that other country at the top of England - who are quite interested in this type of work. And we are developing some books on computing in mathematics, so this will probably form a separate course, eventually, in computer science in schools.

The SMP side of this organization is going to produce books like "Introduction to Calculus via the Computer", etc. These books will be language free and machine independent.

The Scottish branch of ICPS will produce books on the relevance of the computer in general studies. Together, we shall have built up a reasonable library on computing in the schools.

I realize that I haven't said a great deal about mathematics but I hope we might have a chance to talk about mathematics in the ensuing sessions. I would like first of all to give you some idea of the rate which SMP has grown in England. It is difficult to know how to do this. It is difficult to know what

standards to go by. We know, for example, that one-sixth of the secondary schools in England are using our books. I say "are using our books". I don't know how many are following our project! The only other factual way we can measure the growth rate is by the number taking the public examinations.

Our basic aim then is to make mathematics relevant and meaningful, exciting and stimulating. This is what we try to do through our books, through our courses for teachers and through our examinations.

I hope that some of these ideas and some of the mathematics we are able to discuss in later sessions will prove useful to you.

ANALYTICAL GEOMETRY IN GRADE 10

A. J. Francis, Hillfield Strathallan College

At the grades 9 and 10 level the properties of plane quadrilaterals are often discussed in school texts. Most discussions are either outlines of the properties of these figures, or involve problems on sets, subsets, or supersets relating to the hierarchical categories of quadrilaterals.

Very little mathematical method is used in analysing quadrilaterals. The objective in this paper is to show how studends can evolve steps in their analysis of quadrilaterals using methods with which they are already familiar in part.

Assumed knowledge will be:-

(a) Plotting points with respect to rectangular axes, given their coordinates.

(b) Drawing quadrilaterals given the coordinates of their vertices.

(c) Finding the mid-point of the line segment $A(x_1,y_1)$, $B(x_2,y_2)$.

(d) Finding the length and slope of the above line segment.

Part (d) need not be known so well as the others since the following development will give practice in (d) but will require (c) as a point of embarkation.

THE PROBLEM

Do the four points A(3,2), B(8,3), C(6,-1), D(1,-2) form the vertices of a parallelogram?

At this point the students will make several suggestions, including the following:-

(i) Draw ABCD using perpendicular axes.

(ii) Find the slopes of AB, CD, and of BC, AD.

(iii) Find the lengths of AB, CD, and of BC, AD.

Although correct, the above require either accurate drawing or tedious calculations which many students may not be used to!

What else do we know about a parallelogram? ... that the diagonals disect each other (this may have come from previous discussion when quadrilaterals were drawn as practice in plotting points).

Now suppose the mid-point of AC is the point P, and that the mid-point of BD is the point Q. What does the above paragraph imply with respect to P and Q?

We conclude that if the diagonals of ABCD bisect each other, then the mid-points of AC, and BD are coincident. That is, they have the same coordinates; they are the same point!!

For the quadrilateral A(3,2), B(8,3), C(6,-1), D(1,-2) we have P(9/2,1/2), Q(9/2,1/2). The quadrilateral ABCD is therefore a parallelogram.

that of "equal adjacent sides". A summary of the analysis is given below

	Parallelogram	Rectangle	Square	Rhombus	Trapezoid	Kite	Non-Regular
mpt	✓	✓	✓	✓	x	x	x
dt	x	✓	✓	x	✓	x	x
ast	x	x	✓	✓	x	✓	x

mpt = mid-point test
dt = diagonal test
ast = adjacent side test

Mid-point test:- Mid-pt. AC = Mid-pt. BD.

Diagonal test:- Length AC = Length BD.

Adj. side test:- Length AB = Length BC. (or length DA = length AB)

In practice the students need not be confronted with quadrilaterals which have two adjacent sides equal and no other properties. The point of the exercise is to show how an analytical method of treatment works. This will be their first abstract treatment of plane figures. That is, it is a treatment where figures are defined and analysed solely from the knowledge of the coordinates of their vertices. No figures are drawn!

To make up questions for the above analysis, transformations such as $(x,y) \to (y,x)$ or $(x,y) \to (x^{\pm a}, y^{\pm b})$ or $(x,y) \to (y+p, x+q)$ or $(x,y) \to (ax, ay)$ may be used once the coordinates

of the vertices of one quadrilateral in each category are known. Such expedients may be revealed later in the treatment of transformations.

NOTES AND QUERIES

If you can answer any of these points or have additional queries, write to the editors.

The Secondary Advisory Committee contributed several games to provide practice and to improve mechanical drills to the last issue of the Gazette. Do you want more, do you still get your students to recite 'tables' (there is something akin to the rhythmic pleasures of poetry in the recitation process).

In view of the fact that many elementary school teachers are not solely devoted to the teaching of mathematics, should the Gazette occasionally expand into other areas?

Metrication is a good example of this interaction, where the changeover is not the preserve of mathematics alone. How do you think this changeover could best be accomplished? How can we get students to appreciate centimetres, kilograms, litres?

Do you like abstracts for articles? Would you like french language abstracts or articles? The Handbook for Teachers of Mathematics is now available in a French Editing -- write to J. Eugene Durrant for a copy.

The advisory committee on colleges of applied arts and technology is preparing reports on a list of teaching aids and on the particular areas of mathematics which are of the greatest relevance and concern in business and industry today. Have you anything to contribute?

Would you like a greater frequency of publication of the Gazette?

Should jargon and terminology (the 'new math'?) be jettisoned and emphasis placed on understanding and ability to manipulate?

Would a specific section of the Gazette devoted to elementary school teachers be advantageous?

What about specific issues devoted to mathematics in different areas of industry and business?

What do <u>you</u> want to read about?

What is the Travelling Library? What are Leadership Seminars?

How can the Gazette serve <u>you?</u>

THE ONTARIO ASSOCIATION OF TEACHERS OF MATHEMATICS

NOTICE OF MOTION

Whereas a committee composed of members of the Ontario Association of Teachers of Mathematics and Ontario Mathematics Commission have studied the value of amalgamation of the above two organizations and have written a proposed constitution, a notice of motion is hereby given that Ontario Association of Teachers of Mathematics disband with the purpose of amalgamating with Ontario Mathematics Commission to form a new association. This motion is to be contingent on a similar motion supported by the members of Ontario Mathematics Commission. This notice of motion is to be given widespread publicity from May 1972 to May 1973.

Said notice of Motion to be voted on at the 82nd Annual Meeting of Ontario Association of Teachers of Mathematics at North Bay - May 1973.

Signed

Morley MacGregor
Secretary Treasurer

Dated May 12, 1972

SENIOR HIGH SCHOOL MATHEMATICS CONTEST

This annual contest will be held on March 13, 1973.

All interested should write to

R. A. Haslegrave
Regional Contest Chairman
Canada Life
330 University Avenue
TORONTO 100, Ontario

(368-7432)

HIGH SCHOOL MATHEMATICS CONTEST 1972

Top 35 Schools in Ontario

Rank	School	City or Town
1	Burlington Central High School	Burlington
2	Colonel By Secondary School	Ottawa
3	Newtonbrook Secondary School	Willowdale
4	John F. Ross Collegiate & Vocational Institute	Guelph
5	Nepean High School	Ottawa
6	South Greenville District High School	Prescott
7	Harbord Collegiate Institute	Toronto
8	Ridgemont High School	Ottawa
9	Forest Hill Collegiate	Toronto
10	Sir Robert Borden High School	Ottawa
11	Georges Vanier High School	Willowdale
12	Sir Winston Churchill Secondary School	St. Catherines
13	Bell High School	Ottawa
14	Woodroffe High School	Ottawa
15	Don Mills Collegiate Institute	Don Mills
16	Waterloo Collegiate Institute	Waterloo
17	St. Andrew's College	Aurora
18	North Park Collegiate & Vocational School	Brantford
19	Burnhamthorpe Collegiate Institute	Islington
20	Martingrove Collegiate Institute	Islington
21	Cameron Heights Collegiate	Kitchener
22	Lisgar Collegiate Institute	Ottawa
23	Glebe Collegiate Institute	Ottawa

Rank	School	City or Town
24	Northview Heights Secondary School	Willowdale
25	South Carleton High	Richmond
26	Forest Heights Collegiate	Kitchener
27	Leaside High School	Toronto
28	Trinity College School	Port Hope
29	A. N. Myer Secondary School	Niagara Falls
30	Norwood District High School	Norwood
31	Community Hebrew Academy of Toronto	Toronto
32	Lorne Park Secondary School	Mississauga
33	Cathedral Boys' High	Hamilton
34	Bathurst Hts. Secondary School	Toronto
35	W. L. MacKenzie Collegiate Institute	Downsview

HIGH SCHOOL MATHEMATICS CONTEST

Outstanding Students for 1972

Rank	Name	School
1	Robin D. Jackson	Colonel By Secondary School, Ottawa
2	John R. Lawson	Burlington Central High School, Burlington
3	Larry D. Hammick	Georges Vanier High School, Willowdale
4	Mark W. Saaltink	Sir Winston Churchill Sec. School, St. Catharines
5	Marcus E. Rebick	Forest Hill Collegiate, Toronto
6	David D. Dolson	Purley High School for Boys, England
7	Donald T. Kersey	Hill Park Secondary School, Hamilton
8	Daniel Stripinis	Runnymede Collegiate Institute, Toronto
9	Mark S. Brader	John F. Ross Collegiate & Voc. Inst., Guelph
10	John F. Demarco	Assumption College School, Windsor
11	Ian P. Goulden	Glebe Collegiate Institute, Ottawa
12/14	Gregory J. Fee	Kenner Collegiate & Vocational School, Peterborough
12/14	Francis C. De Regnaucourt	Bell High School, Ottawa
12/14	William C. Lexmond	South Greenville Dist. High School, Prescott
15	Rolf L. Auer	Sir Robert Borden High School, Ottawa

Rank		School
16	John C. Torma	Norwood District High School, Norwood
17	Jeremy C. Wong	Harbord Collegiate Institute, Toronto
18	Kumar P. Murty	Woodroffe High School, Ottawa
19	Alan J. McLean	St. Mary's Dist. Collegiate & Voc. Institute, St. Mary's
20	Hugo L. Bidinot	Westgate Collegiate & Voc. Inst., Fort William
21	Bill K. Blackburn	Don Mills Collegiate Institute, Don Mills
22	George O. Frank	South Carleton High, Richmond
23/24	Howard Katz	Ridgemont High School, Ottawa
23/24	David Hally	St. Andrew's College, Aurora
25	Nancy A. Howe	North Park Collegiate & Voc. School, Brantford
26	Owen C. Leibman	Newtonbrook Secondary School, Willowdale
27	Murray B. Shopiro	Northview Heights Secondary School, Willowdale
28	Randall S. McDougall	Cameron Heights Collegiate, Kitchener
29	Sandra J. Hardy	South Greenville Dist. High School, Prescott
30	Reynold Hu	Lisgar Collegiate Institute, Ottawa
31	Randy R. Morrison	Forest Heights Collegiate, Kitchener
32	Paul F. Wharram	Martingrove Collegiate Institute, Islington
33	Johann George	Walkerton District Secondary School, Walkerton
34/35	Phillip Staiband	Cathedral Boys' High, Hamilton
34/35	Benjamin Laufer	Community Hebrew Academy of Toronto, Toronto
36	Carol J. Corben	Burnhamthorpe Collegiate Institute, Islington
37/38	Stephen C. Ross	Nepean High School, Ottawa
37/38	Keith J. Goulden	Ottawa Technical High School, Ottawa
39	Michael R. Veall	A. N. Myers Secondary School, Niagara Falls
40/41	David W. Rowat	Nepean High School, Ottawa
40/41	Bryan A. Boyd	Ashbury College, Ottawa
42/44	Gordon D. King	Canterbury High School, Ottawa
42/44	Ron S. Fullan	St. Michael's College School, Toronto

BOOKS AVAILABLE FOR REVIEW

If you would like a free copy of one of these books, write to H. P. Heinig (Department of Mathematics, McMaster University) and offer to write a review for the Gazette.

Advanced Calculus, A. Friedman, Holt, Rinehart & Winston 1971.

Algebra 13, A. J. Coleman, J. J. Del Grande, G. F. D. Duff, J. C. Egsgard, B. J. Kirby, Gage Publ. 1966.

Algebraic and Circular Functions, R. C. Paterson, R. L. S. Clarke, M. D. George, S. R. Kurys, Holt, Rinehart & Winston 1970.

Algebraic Elementary Functions and Relations, D. R. Horner, Holt, Rinehart and Winston 1971.

Analysis 13, J. J. Del Grande, G. F. D. Duff, J. C. Egsgard, B. J. Kirby, Gage Publ. 1966.

An Introduction to Algorithms, T. E. Hull, C. T. Nichols, R. C. Wong, Gage Publ. 1967.

An Introduction to the Nature of Proof, J. J. Del Grande, J. C. Egsgard, H. A. Mulligan, Gage Publ. 1967.

Applied Mathematics for Today (book 1), W. Kierstead, D. Dottori, J. Seymour, D. Maven, Ryerson Press 1970.

Basic Business Mathematics, G. Pintel, J. Diamond, Prentice Hall 1972.

Calculus, Complex Numbers and Polar Co-ordinates, H. A. Elliott, K. D. Fryer, J. C. Gardner, N. J. Hill, Holt, Rinehart & Winston 1972.

Calculus with an Introduction to Linear Algebra, J. G. Hocking, Holt, Rinehart & Winston 1970.

College Mathematics for General Education, E. D. Nichols, Holt, Rinehart & Winston 1970. Instruction Manual incl.

College Trigonometry, F. Richman, C. Walker, E. Walker, Scott, Foresman & Company 1970.

Complex Manifolds, J. Morrow, K. Kadaira, Holt, Rinehart & Winston 1971.

Consumer Related Mathematics, A Business Approach, W. W. Kravitz, V. Brant, Holt, Rinehart and Winston 1971.

Contemporary Mathematics 6, H. A. Elliott, K. D. Fryer, R. S. Dunkley, N. J. Hill, Holt, Rinehart & Winston 1971.

Elementary Mathematics, Number Systems and Algebra, A. J. Pettofrezzo, D. W. Hight, Scott, Foresman and Company 1970.

Elements of Probability and Statistics, S. A. Lippman, Holt, Rinehart & Winston 1971.

Fundamentals of Algebra and Trigonometry, E. Swokowski, Prindle, Weber & Schmidt Inc. 1968.

General Mathematics for college students, F. J. Mueller, Prentice Hall 1972.

Instructors manual to Computer Science and Data Processing, (2nd ed.) R. N. Schmidt and W. E. Meyers, Holt, Rinehart & Winston 1970.

Introduction to High School Mathematics, K. E. Brown, D. W. Snader L. Simon, Laidlaw Bros. 1970.

Introductory Algebra for College Students, E. Nichols, Holt, Rinehart & Winston 1971.

Introductory Probability and Statistical Applications (2nd ed.), P. L. Meyer, Addison, Wesley Publ. Co. 1970.

Likelihood - An Account of the Statistical Concept of Likelihood and its Applications to Scientific Inference, A. W. F. Edwards, Cambridge Univ. Press, 1972.

Mathematics 10 (2nd ed.), J. J. Del Grande, J. C. Egsgard, H. A. Mulligan, Gage Publ. Co. 1967.

Mathematics 10 (2nd ed.), Teachers Commentary, J. J. Del Grand, J. C. Egsgard, Gage Publ. Co. 1967.

Mathematics 11 (2nd ed.), J. J. Del Grande, J. C. Egsgard, H. A. Mulligan, Gage Publ. Co. 1967.

Mathematics 12 (2nd ed.) J. J. Del Grande, G. F. D. Duff, J. E. Egsgard, Gage Publ. Co. 1970.

Mathematics 12 (2nd ed.) J. J. Del Grande, G. F. D. Duff, J. E. Egsgard, Gage Publ. Co. 1965.

Mathematics 411, J. W. Casey, M. A. St. Louis, E. W. Zolinski, Copp Clark Publ. Co. 1969.

Number Systems, Structure and Properties, A. J. Pettofrezzo, D. W. Hight, Scott, Foresman & Co. 1969.

Plane Trigonometry (6th ed.), F. W. Sparks, P. K. Rees. Prentice Hall 1937.

Principles of Mathematics 1, J. E. Dean, W. R. Graham, G. E. Moore, Holt, Rinehart & Winston 1970.

Mechanical Aids to Computation, J. J. Del Grande, J. C. Egsgard, H. A. Mulligan, Gage Publ. Co. 1969.

Modern Physics and Quantum Mechanics, E. A. Anderson, Saunders Publ. Co. 1971.

Relations, Transformations and Statistics, H. A. Elliott, K. D. Fryer, J. C. Gardner, N. J. Hill, Holt, Rinehart & Winston 1972.

Series:
No. 3 Payroll
No. 4 Operations with Polynomials
No. 5 Trigonometry
No. 6 Numeration Systems
No. 7 Numerical Operations of Geometry
Copp Clark Publ. Co. 1968.

Statistical Topics 1 - Index Numbers, M. Bruckheimer, S. Steward, Chatto & Windus Publ. Co. London 1970.

Statistical Topics 2 - Sampling Inspection, M. Bruckheimer, S. Steward, Chatto & Windus Publ. Co. London 1970.

Statistics, Probability, Inference and Decision, Vol. 2, W. L. Hays, R. L. Winkler, Holt, Rinehart & Winston 1970.

Technical Calculus, H. R. Stillwell, D. H. Price, Holt, Rinehart & Winston 1970.

The Brief Calculus with Applications in the Social Sciences, J. E. Shockley, Holt, Rinehart & Winston 1971.

The Concept of Probability, J. R. Lucas, Clarendon Press 1970.

The Special Theory of Relativity - A Critical Analysis, L. Essen, Oxford Univ. Press. 1971.

The Theory of Sets and Transfinite Arithmetic, A. Abian, W. B. Saunders Publ. Co. 1965.

Vectors, Matrices and Algebraic Structures, H. A. Elliott, K. D. Fryer, J. C. Gardner, N. J. Hill, Holt, Rinehart & Winston 1972.

Mainstreams in Modern Mathematics - 1, J. E. Dean, G. E. Moore, Holt, Rinehart & Winston 1970.

Mathematics for a Modern World (Book 1), W. H. Baxter, K. E. Newton, J. J. Del Grande, Gage Publ. Co. 1970 .

Mathematics for the Elementary School Teacher, E. D. Nichols, R. L. Swain, Holt, Rinehart & Winston 1971.

Project Mathematics - Books 8-10, H. A. Elliott, M. P. Bye, R. Chives A. P. Hanwell, J. R. MacLean, K. A. Neufeld, Holt, Rinehart & Winston 1971.

Project Mathematics - Books 1-5, H. A. Elliott, R. Chives, J. M. Jorden, A. P. Hanwell, K. A. Neufeld, J. R. MacLean, Holt, Rinehart & Winston 1969. incl. Teachers Guidebook, H. A. Elliott, R. Chives, J. M. Jorden, A P. Hanwell, K. A. Neu eld, J. R. MacLean, M. P. Bye, Holt, Rinehart & Winston.

Project Mathematics - Books 6 & 7, H. A. Elliott, M. P. Bue, R. Chive A. P. Hanwell, J. M. Jorden, J. R. MacLean, K. A. Neufeld, Holt, Rine hart & Winston 1971. incl. Teachers Guidebook.

Mathset - Measurement, H. R. Jones, W. J. Hancox, J. G. Sheperd, Gage Publ. Co. 1969.

Integral Transforms in Applied Mathematics; John Miles, Cambridge University Press, 1971, pp. 96; Price $6.95.

This book discusses a number of integral transforms from a physical and engineering viewpoint. The operators considered are the Laplace transform, the Fourier- and Hankel transforms and their finite restrictions. For each of the transforms an inversion theorem is given and for the Fourier- and Laplace transform, convolution theorems are derived. From a mathematical point of view the definitions and proofs are non-rigorous, however, most applications given in the book are relevant and show clearly the power of the transform method.

The book is written for senior undergraduates in applied mathematics and engineering. It is expected that the reader is familiar with notions of complex analysis. Particularly, with the Cauchy integral theorem and the residue theorem. A further basic knowledge in the theory of ordinary- and partial differential equations is assumed.

In arguments throughout, the author relies on the bibliography which to a student may often be disconcerning and hence one of the standard treatizes must be read in conjunction with the text. It seems to the reviewer that the author failed in his effort to produce a book which effectively discusses the subject in not a too elementary way, yet not as advanced as the treaties on the subject.

The properties of the various transforms given are at best sketched and sometimes ommitted. If this is indeed the aim, one might have expected a somewhat larger list of transforms, which have applications in the sciences.

Nevertheless, despite these shortcomings the many examples and problems are valuable both to the mathematician and engineer alike.

The book could be a useful addition to the library of the CAAT's for reference to the instructor as well as the hard working, well motivated student.

H. P. Heinig
Department of Mathematics
McMaster University
Hamilton, Ontario

NOTICE OF MEETINGS

METRO TORONTO M.T.A.

February, May 1973

For information contact: Mr. J. N. Sharp,
Etobicoke Board of Education
1 Bridgeway Street, Etobicoke

OATM ANNUAL CONFERENCE IN NORTH BAY

May 11, 12, 13

For information contact: Mr. W. Sokoluk
Northern Secondary School
Sturgeon Falls

THE MATHEMATICS TYPE A SEMINAR AT LAKEHEAD UNIVERSITY

AN EXPERIMENT IN STUDENT-CENTEREDNESS

Paul Sveinson, Westfort High School, Fort Frances, Ontario

The demise of tradition-bound institutions in education is a popular trend and many educators are concerned over the loss of some of the values associated with these traditions. Too many changes have been introduced merely for the sake of change.

Such was not the case at Lakehead University this summer, as all the mathematics teachers attending the Type A seminar agreed that the change in format introduced was a giant stride towards intelligent teacher training and upgrading.

The format of the Type A seminar has traditionally been centered around the Grade 13 course content and one individual, the person conducting or teaching the seminar.

Dr. Gerry Vervoort, professor of education at Lakehead University, was in charge of the Type A mathematics seminar for the summer school session of 1972. There were two seminars, one meeting at 8 a.m. and the other at 10 a.m. Dr. Vervoort conducted the 8 a.m. session, while Mr. Doug Henderson of the Sudbury Board of Educationconducted the 10 a.m. session. Since this writer attended the 8 a.m. session the comments in this article apply specifically to that section, and they may or may not be applicable to the 10 a.m. meeting.

After visiting other Ontario Colleges of Education and

investigating their Type A programs, Dr. Vervoort decided on a completely different approach, that of a seminar being planned, implemented, and evaluated by the students involved.

Dr. Vervoort believed that this was a more realistic approach, and a viable one, for a number of reasons:

First, all the students, with the exception of one, were experienced teachers, (the average experience was 7 years) and therefore were aware of, and familiar with, problems that practicing teachers encounter and want solved. The range of experience was quite extensive, including people who had taught at the elementary level, ex-engineers and a number of teachers who had spent some years in industry. As well, six of the twelve students held some administrative position in their school, including the office of vice principal.

Second, he reasoned that the resources of thirteen people were much more bountiful than the resources of one.

Third, his belief that the people attending the seminar were professionals in their own right excluded any possibility of them making a mockery of the program, or misusing the power he did grant them.

The Plan: The program ran for six weeks, 2 hours a day. Each student was responsible for the preparation of and presentation of three seminars, one to be chosen from the group of subjects.

In addition, every other member of the seminar was

expected to be prepared to the point of being able to take an active part in the discussion.

Group one:

Role of department chairman
Guidelines for selecting text books
Mathematics clubs and contests
Alternate forms of instruction
Training of the mathematics teacher
Student evaluation
Individualized instruction
A basic mathematics library for high school and teachers
A collection of Mathematical games and activities
Some experimental mathematics programmes

Group two:

A remedial course in mathematics
A mathematics course for terminal students
An enrichment course level 6
Grade 12, 4 year program
Mathematics program for grade 6 - 10
Essential mathematical competencies for various groups of students
A collection of real life mathematics problems
Some mathematics education research studies
The psychology of learning according to Piaget
Inter-disciplinary teaching of mathematics
Some resources for mathematics teachers
Programmes and materials for French speaking students

Group three: (Methodology and Presentation Aids)

Differential Calculus
Integral Calculus
Conic Sections
Transformation geometry
Complex numbers
Probability
Vectors
Graphing
Geometry (analytic, synthetic, and vector)

Matrices
Trigonometry
Computer Science

These topics were suggested or approved by the student, at a meeting, 2 weeks prior to the start of the seminar. It was the desire of the students to study the entire high school program rather than be taught and examined on the content of Grade 13. The rationale for excluding examination on content was that all students attending were eminently prepared due to the qualifications for admission.

Implementation: The sessions were in true seminar fashion, with all persons contributing to the discussion. The informality of the sessions led to much open mindedness and frankness. As a result the arguments often became heated, but never out of control, due in large part to the professional attitudes of the students.

The research done on some of the topics was excellent, resulting in each student benefiting from the efforts of one individual. The research exposed everyone to valuable resources, ideas and guest speakers, which kept the seminar away from the "bull" session approach, where a mere exchange of ignorances may have taken place.

During or after each seminar, the students were supplied with typed information on the subject being discussed. Some of these materials were in the form of a formal paper, some were of an outline nature, and some were simply lists of materials, aids,

resources, problems, etc. Extensive bibliographies were supplied as well, which will prove to be of great value.

As well as the regular sessions, a number of supplementary attitudinal adjustment sessions were held. These were much more informal and were held in the evenings. The attendance was voluntary and the topics of discussions were open. A large percentage (96%) of the students attended these extra sessions, attesting to the high degree of interest.

Evaluation of Students' Progress: This was done on an entirely subjective basis, each individual being judged by his peers. The group was told to evaluate on the basis of the following questions, and submit a confidential resume to the instructor, who would then use these as a guide in determining the final grade of each student: How well was the seminar presented and prepared? How much did each student contribute to the discussions in the seminar? Did the student appear to be genuinely concerned with upgrading himself? If you were a department head (or principal) would you hire this student as a Type A teacher?

Evaluation of the Program: By and large, most topics were of a pragmatic nature involving realistic approaches to solutions of day-to-day teacher and school problems.

This pragmatism will allow the teacher not only to improve his own professional stature, but to increase quality of

education in his own department and school.

The discussions during the seminars could have been more controlled, as from time to time the conversation was monopolized by some of the more outspoken members.

The material handed out was usually excellent. In a few cases, however, the most potent information was communicated orally during the discussions, and will probably not be retained. The person responsible for the seminar should have taken notes during the session, then prepared the material for distribution.

With the seminar in this format, it was found that the most valuable resource that was contributed to the seminars was the experience of the individuals in the classroom.

Therefore, if this format were to be adopted elsewhere for the Type A seminar, it is recommended unanimously by this group that 3 years teaching experience be a prerequisite for attendance at the seminar. It is also recommended that this type of session be offered as an updating seminar every year, and that each teacher be required to attend such a session every 3 to 5 years. These upgrading sessions would not be six weeks long, but perhaps one or two weeks of intensive brainstorming. Too many teachers feel that their five or ten years experience keeps them up-to-date while in fact they are relying on one year of experience applied five or ten times.

It is fervently hoped that other colleges of education

will seriously investigate all the ramifications of this experiment, with the aim of improving the quality of education in Ontario classrooms, through excellence in teacher training.

If anyone desires more information on this project, please feel free to contact any of the teachers who attended the 8 o'clock session; listed below:

Richard Gainer	Hillcrest High School Thunder Bay 'P', Ontario
Allan Andrychuk	Brampton Centennial S.S. Brampton, Ontario
Art Rheault	Atikokan High School Atikokan, Ontario
Andre Despres	Hearst High School Hearst, Ontario
Don Murphy	Fort William Collegiate Thunder Bay 'F', Ontario
Irvine Johnston	Timmins High and Vocational School Timmins, Ontario
Robert Sloan	Hillcrest High School Thunder Bay 'P', Ontario
Harry Tsekouras	Selkirk High School Thunder Bay 'F', Ontario
William (Bill) Farmer	Fort William Collegiate Institute Thunder Bay 'F', Ontario
Robert Petter	Manitouwadge High School Manitouwadge, Ontario
Gary Heise	Fort Frances High School Fort Frances, Ontario
Paul Sveinson	Westfort High School Fort Frances, Ontario

ONTARIO ASSOCIATION OF TEACHERS OF MATHEMATICS
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M. Wiltse	Parkstreet Secondary Collegiate;
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Prof. D.W. Alexander	Ontario College of Education, 375 Bloor St. West, Toronto 5

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