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THE ALBERTA TEACHERS' ASSOCIATION

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INTRODUCING CHILDREN TO TOPOLOGY, by Pierre de Latil

Editor's Note: This article comes to us from UNESCO. It is a report of a daring pedagogical experiment - daring in that instead of a cautious approach to the teaching of a new subject, a radical approach was used. The old was completely abandoned and replaced by a new system. Members may find this article of interest.

When she had finished handing round red or blue paper hats, some of them with cockades, to the little girls, the nursery school teacher said to them: "At the signal, all the red hats form together on this

side! All the blue hats on the other side!" And all the little girls scampered happily to their places when she clapped her hands. "Now, we'll put a rope around those who are together!" And each of the groups was roped in. Then the teacher said: "Next, we'll tie all those wearing a cockade together".

This was more difficult because there were children with cockades on their hats in both groups, and the cord around them had to cut across the other two ropes.

Is this a new game for the kindergarten? Not quite. We've just imagined a little science fiction story about a nursery school class in advanced mathematics, where young children are put in contact with a fundamental concept of human reasoning.

For the theory of groups illustrated by this very simple example is located in the vanguard of modern mathematics, on the peaks where generalizations merge arithmetic, algebra, geometry, topology, and even logic. At present, it is almost never approached before the university.

A "group" may be defined as a "neighborhood or assembly of several entities which together become elements of a new group entity". Here, the "entities" were the little girls. But they could equally well have been hairs on a head, books in a library, the claws of a cat, figures of a multiplication table, points located inside a rectangle, or lines of light rays converging on the same point.

From Concrete Games to Abstract Reasoning

In the example above, the formation of a group of little girls with cockades on their hats from the two other groups was designed to illustrate another fundamental concept, the idea of "intersection".

With slightly older pupils, the teacher might draw colored lines on the blackboard to represent the cords enclosing the groups. She would then ask each of the pupils in turn to come to the board and mark her place inside one of the circles. "No, Mary, you're not there! You are wearing a blue hat, and you don't have a cockade. So you're not in the intersection of the 'blue' group with the 'cockade' group. You're here!"

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And so, gradually, the children would progress, effortlessly, from concrete games to the most abstract conceptions, considered today as belonging to the realm of advanced mathematics.

Papy, the Pioneer

Perhaps, our story is not so farfetched after all. Today, the teaching of mathematics dominates the scientific future of all countries; it is decisive in training engineers and scientists, in short supply everywhere. Already, several countries are moving towards a large-scale reform of mathematics teaching. And one of them, Belguim, is determinedly charting the way. A university professor, Georges Papy, who teaches "modern algebra" at Brussels University, has done pioneering work to introduce these modern theories into secondary, and even primary, schools. And top officials at the Belgian Ministry of Education are supporting his efforts by encouraging a large-scale experiment with the new methods.

To proceed cautiously in a matter like this is to court failure. Usually, when schools decide to teach new subjects, they offer them as optional courses which the pupils take - or don't - without any great interest. Or else, a few notions, so summary that they are useless, are added to the old course. The fact is, one cannot add new material to old without dangerously overloading the syllabus.

The solution consists of abandoning the old system completely and replacing it by the new. But if this were done, would not pupils run the risk of flunking entrance examinations and finding themselves barred from higher education? And how would they be able to pass examinations in subjects which they have stopped studying but which are still being taught? Changing the entire mathematics syllabus of the national school system has been suggested. But one can't launch out into such a reform without prior testing; and further, the subject is so new that it would be impossible to find sufficient teachers right away to take all the new classes.

The Test Laboratory

The Belgian solution is remarkable in that it takes account of all these difficulties. To test the new teaching, schools were chosen which are an end in themselves, since they do not prepare for higher

studies. They are the Ecoles Normales Gardiennes which train young girls to be nursery school teachers. These girls are not particularly gifted for mathematics; they are not even especially bright pupils. Therefore, if the experiment were to succeed, it would be highly convincing, and no one would be able to say that the instruction was too difficult for an average class. And even if it should fail, the careers of the young girls would in no way be harmed.

What are the results to date? After two years of experimentation, Professor Papy finds them eminently satisfactory. These girls of 14 to 16 are perfectly at home in the abstruse universe of groups. They handle problems the mere statement of which is incomprehensible to most adults.

The Belgian authorities fully realize this. In choosing the Ecoles Gardiennes as a testing ground for their new methods, they are pursuing what may develop into a long-term project. By educating future teachers in the theory of groups, they are paving the way for the introduction of these concepts into nursery schools. That may explain Professor Papy's quip: "Perhaps the crowning point of my career will be to teach one day in a nursery school."

Spare the Young

But why so much importance attached to this famous theory of groups? It was first outlined some 80 years ago by the Russian-born German-educated mathematician, George Cantor, who suggested a new conception of geometry in which every figure was conceived as a "group of points" Later the French mathematician Maurice Fréchet generalized the theory, extending it to "abstract groups" comprising any kind of object. Since then, groups have become increasingly important in mathematical thinking. Today, they are considered the common trunk of all branches of mathematics; and the principles of the theory are regarded as the very foundations of reasoning which works best starting from groups of objects rather than from an object taken singly.

By dint of abstractions, through the discovery of principles which are common to all mathematical disciplines - the principles of logic - mathematics have succeeded in achieving an extremely high degree of generalization. This took centuries of groping and hesitation. But now that the discoveries are made, young people should be spared the

tuous paths followed by past generations. They should be launched from the start on the straight road of modern mathematics.

CALGARY HIGH SCHOOL STUDENTS ATTEND A COMPUTING CONFERENCE, by B. A. Hodson

Editor's Note: B. A. Hodson, a graduate of the University of Manchester, England, is supervisor of technical computer programming for Imperial Oil. He teaches two classes on computer programming at the University of Alberta, Calgary.

The Calgary Computing and Data Processing Society was inaugurated in January of 1961 and the first board of directors was elected to office in May of that year. At the suggestion of the new president, [the author], it was decided to form a committee to study the possiblity of holding a conference on computing for high school students later in the year. A committee of three was formed under the chairmanship of Dr. J. E. L Peck of the University of Alberta. The result of this committee's work was a conference held at the University of Alberta, Calgary, January 13, 1962.

Registration of students began at ten o'clock with campus students and members of the Society assisting in registering some 140 students before 10:30. Each student was given a program of the day's activity and an identification badge supplied by the Alberta Wheat Pool. Each badge was one of seven colors, a code to establish which computer installation was to be visited later in the day.

At 10:30 the students were welcomed by the president on behalf of the Computing Society and by Dr. Peck on behalf of the University. The meeting was then handed over to the chairmanship of Bill Taylor of CES Computing Centre in Calgary. Mr. Taylor explained the purpose of the conference, to make students familiar with electronic computers and also to introduce to them the possibility of a career in this rapidly expanding profession. This was followed by an address by this author entitled "Introduction to the Electronic Computer".

He explained that an electronic computer is made up of five basic elements: input units, memory, arithmetic unit, control unit, and output units. He explained how the computer works internally by means

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of electronic devices akin to switches and illustrated the binary code used by many machines. The purpose of the input units was to convert the everyday language of business and science into the language of the computer. This could be done by means of paper tape, punched cards or magnetic tape. Samples of paper tape and punched cards were given to each of the students, who were also shown a reel of magnetic tape such as is used on the larger computers. The output units are to convert the internal language of the computer back into the everyday language of business and science. In addition to punched cards, magnetic and paper tape for output, there is also a high speed printing device and cathode ray display device. The memory is made up of magnetic cores and is divided into characters and words. It is used for storing instructions for the computer and also for storing the data the instructions are to work upon. The order in which the instructions are performed is under the direction of the control unit. If the instruction involves arithmetic then this is carried out in an arithmetic unit. Students were then introduced to P. Brown of Shell Oil Company who spoke on "Working and Playing with a Computer".

Mr. Brown told the gathering that computers were not intelligent in the least but rather the slaves of a group of people known as programmers. These people tell the computer by means of coded instructions exactly how the machine is to solve a particular problem. He pointed out how these instructions are stored within the memory device of the computer and how it is able to perform several thousand of these instructions every second. Examples of instructions for a particular computer were then given and with these instructions a simple computer program was illustrated. It was emphasized that before writing down these instructions it was necessary to analyze a problem in great detail, spelling out minutely how the answers would be derived from the given input. The results of this minute analysis were expressed in a detailed flow chart from which the actual machine instructions were then constructed.

After a brief recess Dr. J. E. L. Peck spoke on "Careers in Computing" In the next five years it is expected that the computing profession will employ some 375,000 persons in North America, in all categories. Dr. Peck outlined some of the job categories with the qualifications for each. He illustrated the jobs of machine operator and coders, for which a high school education alone would be sufficient. Operators press the buttons to make the computer operate whi

coders convert the detailed flow chart prepared by programmers into computer language code. Above these categories he listed programmers whose job is to prepare the detailed flow charts by which a problem would be solved on the computer. Training for this would be any general degree with mathematics and science, while not a necessity, being of advantage.

Systems analysts usually require an honors degree in some subject and will usually analyze problems for computer solution in that particular subject, although they could analyze problems in related fields. They usually outline the problem solution in sufficient detail that the work can then be carried on by a computer programmer who will prepare the detailed flow charts. The numerical analyst he listed as the cream of the computing profession. For this an honors mathematics degree is a necessity The numerical analyst takes the various integrals, differential equations, business mode, and the like and develops numerical methods with which to solve them on the computer. In the area of electronics there is a vast field of work in computer maintenance, for which an interest in electronics but not necessarily a degree is required. Requiring an honors degree, preferably in mathematics of physics, is the field of computer design. This is the development of the logic of computers. The actual design of components and machine "hardware" requires another group of personnel specializing in electronic and electrical engineering.

During the lunch break, the computing society members mingled with the students to answer any questions that may have arisen during the morning sessions and the group reconvened at 1:15 p.m. at which time Mr. Taylor introduced D. Wehrhahn of International Business Machines Company to talk on "The Future of Computing".

At this lecture the audience heard of the development of high speed magnetic tape readers, able to read 150,000 characters per second. Document readers that read typewritten documents were mentioned with the further development of machines to read handwritten documents directly into the computer memory. Computer memory devices would become larger in the number of characters that they could store but smaller in the volume of space that they would occupy. Scientists are now working in the field of cryogenics to develop circuits that operate close to the absolute zero of temperature which can change their state is less than a billionth of a second, requiring very

little electrical power. Present machines can perform almost one million operations per second and computers under development will be even faster than this. Machines are under study that will understand the human voice, while in existence already is a machine that will talk to you.

After this final lecture students split into groups to visit computer installations in Calgary They visited an LGP 30 at CES Computer Services, an RPC 4000 at Texaco Oil Company and at the Royal McBee Company, a 1620 at International Business Machines, an IBM 650 at Shell Oil Company, and an IBM 1410 at Imperial Oil Company. At each installation the group was shown the computer and its peripheral equipment Demonstrations were also seen showing the computer at work and at play A questionnaire completed by the students indicated that the conference was well accepted. Many indicated that they would like to see something similar for other professions. It is hoped that this conference will become an annual event.

A SUMMER AT STANFORD, by H. F. McCall

> Editor's Note: Dr. McCall, principal of Seba Beach School, was awarded the Shell Merit Fellowship last year. We plan to include an article by him in our June issue.

The chance to be a Shell Fellow and participate in the Stanford activities of this special group of science and mathematics teachers chosen by the Shell Oil Company does not come to everyone, but it did come to me. It might come to you too if you entice Lady Luck a little say, by showing your interest in this program and making inquiries from Shell Merit Fellowships, School of Education, Stanford University Stanford, California.

The eight-week program at Stanford is designed specifically for the Shell Fellows, a total of about 50 science and mathematics teachers, five of whom are from Western Canada and the rest from the United States west of the Mississippi.

For part of the day all of the group were together. Then for the rest of the time we were separated into three groups - the physics, chemistry, and mathematics sections, for specialized work in those

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fields. While together, we dealt with many things from all three fields.

The value of the specialized work in the various fields will be obvious to anyone. But the time spent together, whether in semi-formal discussions with outstanding world figures in education, science or mathematics, or whether in informal discussions with each other, had values of many different kinds - values which, in some cases, would be more difficult to measure, but which, in practically all cases, were tremendous. No effort was spared to bring us leaders in every field, Nobel Prize winners where possible; nor was any effort spared to take us to the finest research laboratories. These included the High Energy Physics Laboratory (Stanford), Radiation Laboratory (University of California at Berkeley), Plant Biology Laboratory (Carnegie Foundation), Computer Laboratory, Radio Astronomy Institute, and others no less exciting and inspiring in various areas of chemistry.

The opportunity to participate in such stimulating study and exchange of ideas is one which would serve Alberta teachers well.

EXPERIMENTAL CLASSES IN GRADE VII MATHEMATICS, by L. C. Pallesen

Editor's Note: Mr. Pallesen is supervisor for Division III, Calgary Public School Board.

Under the direction of the Junior High School Mathematics Subcommittee of the Department of Education, ten Calgary Grade VII classes took part in experimental work in mathematics. They were part of a group of 30 classes over the whole province using a new text, Seeing Through Mathematics, published by W. J. Gage, Ltd. The publishers have designed this text to be a sequel to the Seeing Through Arithmetic series which has recently been authorized for the Alberta elementary schools.

Because of the authorization of this new series in the elementary schools the Junior High School Mathematics Subcommittee feels it must consider the changing of the junior high school text. It would be the hope of the subcommittee that a text might be found which would continue to develop ideas along the lines of the elementary texts and would at the same time introduce some of the ideas of the "new" or

"modern" mathematics. Because of the emphasis on change in mathematics at the present time many of the publishers are working on revisions, most of which are not yet published. The subcommittee is examining all these publications as soon as they are available, and hopes to try in classrooms any texts that seem on examination to be suitable to the Alberta situation. The current Calgary experiments are part of this program.

Seeing Through Mathematics differs markedly from the text presently authorized. Rather than start Grade VII with a review of the basic operations of mathematics, it introduces a completely new area - the symbolism of sets. Once this symbolism is introduced it is consistently used to deal with geometric ideas and algebraic topics. A great deal of stress is placed on exactness of expression with emphasis placed on the distinction between numbers and numerals, on the meaning of open and closed sentences and on inequalities as well as equalities. The authors claim that, in their treatment, students become much more proficient in problem-solving than in traditional courses.

To attempt to yield a maximum amount of information the ten Calgary classes were chosen to include all levels of ability. Several of the classes were heterogeneous groups including students of all abilities others were homogeneous with both the top end and the bottom end of the ability scale being represented. Furthermore, approximately half the teachers had recently completed a university summer school course on modern mathematics, including the set theory, while the other half of the teachers had had no recent courses in mathematics.

The experimental use of this text was planned to continue for a four-month period ending about January 31. At that time most of the teachers returned to the traditional text for the balance of the year However, four Calgary classes have been granted permission to continue the use of the text until June, 1962. The number of classes which continued would have been larger had it not been for the administrative difficulties caused by pupil transfers, since new students could not conveniently be placed in these classes.

During the period of the experiment teachers have met twice monthly to discuss any mutual problems and general progress. Each of the participating teachers is being asked to complete a full questionnair

dealing with pupil progress and pupil reaction to the course as well as stating their own appraisal of the strengths and weaknesses of the course. Inasmuch as all these questionnaires will not be examined until the next meeting of the subcommittee no general reaction is yet available. As might be expected the enthusiasm of the ten participating teachers varied considerably. To judge the text on the basis of the four-month experiment will be difficult, not only because of the shortness of the period of time and the newness of the material, but also because the text is designed for graduates of an elementary program using the Seeing Through Arithmetic series.

Present plans in the city of Calgary schools include the introduction of the Seeing Through Arithmetic texts for Grades I to IV in all schools in September, 1962. The series will be extended to Grade V in September, 1963 and to Grade VI in September, 1964. This suggests that before September, 1965 it would be desirable that the junior high school subcommittee reach a decision. The present Calgary experiment is an attempt to assist in this task.

ELEMENTARY ARITHMETIC FILMS

Donald in Mathmagic Land, T-1397, (30 minutes)
A general interest film showing many applications of mathematics.

Today's Need in Arithmetic, (14 minutes)
An extremely well-prepared film but highly commercialized - gives a reasonably good general introduction to the Seeing Through Arithmetic series.

The following five films were prepared by Scott, Foresman and made available to the Audio-Visual Aids Branch by W. J. Gage Ltd. The production standard in these films is rather poor. The main personality in the films, Mr. George Russell, was asked to speak on the Seeing Through Arithmetic series at a teachers' institute in New Mexico. On his arrival he discovered that arrangements had been made to record all his talks on film. Mr. Russell was not prepared for this kind of an assignment and, as a result, the finished product is not the best from a technical point of view. It is true, however, that the content of Mr. Russell's talks will prove very valuable to teachers in inservice programs.

Basic Mathematical Ideas, T-1449, (29½ minutes)
Computation, T-1450, (27 minutes)
Division, T-1451, (29½ minutes)
Problem Solving, Part 1, Equations of Numbers (29½ minutes)
Problem Solving, Part 2, Equations of Ratios (27 minutes)

MCATA NOTES

1. Hi-Lites from MCATA Executive Committee Meeting, December 29, 19

Membership fees in the MCATA will cover the term September 1 to August 31.

A Mathematics Seminar on the "new mathematics" at the elementary level will be held at Alberta College, Edmonton, from July 3 to July 10.

A seminar planning committee, consisting of T. Atkinson, E. Wasylyk, M. Sillito and J. Cherniwchan was formed.

The date for the annual conference was set for July 11, 12, and 13. A tentative program was drawn up.

The executive committee will meet again on April 26 in Calgary.

2. MCATA Conference

The dates, July 11, 12, and 13 have been set aside for the conferenc We may be able to hold the conference at the University of Alberta, Edmonton.

An effort is being made to include in the program topics dealing wit curriculum revision: (a) experience with the STA series, (b) how much should be retained from our present mathematics curriculum, (c) results of Grade VII mathematics experimentation in 1961-62, and (d) an overall view of a mathematics curriculum.

We hope to include other topics: Programmed Learning, Programming for a Computer, Role of a Statistician. A more detailed account of the program will be given in the June newsletter.

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3. Membership

We have now 97 paid up members.

4. Programmed Instruction

Are you following the articles on programmed learning that are appearing in periodicals? Note that a monograph entitled, "Programmed Instruction: An Outline of Developments in Teaching Machines, Programmed Notebooks, and Scrambled Textbooks", has been published by The Alberta Teachers' Association and is available to teachers.

5. MCATA Mathematics Seminar

July 3 to July 10 inclusive are the dates for the Mathematics Seminar to be held this summer at Alberta College in Edmonton. Sponsored by MCATA, this seminar is designed to train resource people for inservice work in the "new mathematics". Delegates to the seminar will be expected to take part in this work. The seminar will be devoted to work in the elementary school but attendance is not necessarily restricted to elementary teachers. It will deal with basic concepts and teaching methods in modern elementary mathematics and is expected to provide teachers with new ideas and new approaches in arithmetic teaching. An outstanding staff, including both experts who have organized such seminars throughout the United States and Albertans who have taken a leading role in experimental work with the "new mathematics", will provide the instruction.

The costs of the seminar will be: accommodation, $28; fees, $5; and transportation, variable.

Applications are invited from interested teachers. If you are interested, complete the form on the last page of this newsletter; if you know of someone who might be interested, please pass on the form to them.

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Mail under cover to:

M. T. Sillito
Executive Assistant
The Alberta Teachers' Association
Barnett House
11010 - 142 Street
Edmonton, Alberta

I am interested in attending the Mathematics Seminar in Edmonton, July 3-10, 1962. Please consider my application and send further information as it becomes available.

Name _____

Address _____

_____

Grade Taught 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ]

7 [ ] 8 [ ] 9 [ ] 10 [ ] 11 [ ] 12 [ ]

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