a set of points dividing a plane into two regions. Class discussions on definitions arising out of these conceptions prompt discussions of great interest and value. Ideas of greater and lesser infinites arise. Other challenging ideas are posed and discussed. As to graphing, the concept of ordered pairs provides a unique and interesting approach.

Teacher questionnaires returned from 30 experimental classrooms led to the following conclusions:

1. The course took longer to teach than had been anticipated.
2. Classes showed more interest in this course than in usual ones.
3. There was a negative reaction to the geometry section which students found hard.
4. Concern was expressed by one-third of the respondents about difficulties encountered by slower students.
5. It was felt that additional training would have aided teachers in doing a better job.

In the coming year (1962-63) further experimentation will be carried out. Follow-up on the Seeing Through Mathematics series is being carried out in nine classrooms in 1962-63. Action research is being conducted on several other texts.

PROGRAMMED LEARNING, by J. A. McDonald

Editor's Note - Mr. McDonald, past president of the Association, spoke to the teachers at the Mathematics Council conference last summer on the topic of programmed instruction. A short summary of his remarks follows.

Teaching machines were conceived as early as 1873 for the purpose of teaching "logic". A tutoring machine employing defined procedures appeared in 1915 but was dropped as a research project in the thirties. Work was resumed on teaching machines in 1952 by Dr. B. F. Skinner. Development of the "reinforcement technique" on birds and animals formed the basis of Skinner's studies. N. A. Crowder had taught "logical trouble shooting" to American air force personnel. Dr. L. M.

Stolurow conceived programming as an art as opposed to a science. Many additional authorities have since pointed to valuable evidence for evaluating the techniques developed by these men.

The presentation of subject matter is by means of "frames" which present ideas in extremely small steps, easily understood. Correct responses receive confirmation and every effort is made to eliminate and minimize error. This is regarded as basic motivation. Accordingly, responses become the basis of progress, and cues practically ensure that these are correct. Confirmation of correct response reinforces the satisfaction obtained and provides further incentive. Error rates should not exceed 10 percent. These remarks apply particularly to linear type programs.

The branching type program stresses communication. Responses are selected from a number of choices. Incorrect responses require repetition of the program or the following of a substitute frame to the point of the error.

Programming (the art of writing frames in sequence, to obtain a particular objective) requires much practical testing so as to eliminate the possibility of error. Rewriting of sequences is time consuming, but very rewarding for teacher programmers, since they begin to understand how students really learn.

Teaching machines are used to present many types of programs. Since their basic purpose is to program particularly for one course, they are expensive compared to the cheaper forms of programming found in textbooks. Since no significant advantages have been demonstrated for the machine over the textbooks, most researchers use textbooks although the trend is toward machines because of their obvious advantages of presentation.

Both good and poor programs are available in an increasing range of subjects. Criteria for evaluation are included in the ATA monograph entitled Programmed Instruction. School districts have employed programs in widely varying amounts in assisting slow learners in adding material for accelerated students, and for improving grasp of difficult concepts. A great advantage is that the student can progress

through the material at his own rate. The Alberta Teachers' Association has taken the lead in training personnel in this field. Dr. J. D. Ayers and Executive Assistant M. T. Sillito attended an intensive course organized by the Centre for Programmed Instruction, and seminars for teachers were organized. More experimental work is needed, but the evidence points to the possibility of increased use in Alberta of this most important learning process.

1962 ANNUAL REPORT

Representatives of specialist councils attended a meeting of the ATA Curriculum Committee in January, 1963, at which they presented a report of the past year's activities. This is a portion of the report made on behalf of the Mathematics Council.

Executive and Committees for 1962-63

Officers

President - Fred Tarlton, 7636 - 91 Avenue, Edmonton
Vice-President - Charles Tymchuk, 10642 - 61 Street, Edmonton
Past President - John Chernwichan, 276 Evergreen Street, Sherwood Park
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Committees

Executive Committee - The officers above plus the following appointed members: Representative of the Elementary Division: Mrs. Ruby Lester, 1505 - 14 Avenue S., Lethbridge; Representative of Junior High Division: E. Elkins, 2344 - 22 Street N. W. Calgary; Representative of Senior High Division: Gordon Mack, 2528 Cherokee Drive, Calgary; Faculty of Education: Professor W. F. Coulson, University of Alberta, Edmonton; Department of Mathematics: Dr. Wm. Bruce, University of Alberta, Edmonton; ATA Representative: M. T. Sillito, Barnett House, Edmonton.