TERTIARY ALGEBRA

EARLY ALGEBRA EDUCATION

This section encompasses two different readings of the title, being concerned with both the algebra education for young children – say age 6 and above – and also the initial steps in more formal algebra education, which happens in some countries when students are about 12 years old. An ongoing concern is the relationship between arithmetic and algebra. Previous research has documented ways in which students' limited arithmetical experience can constitute an obstacle to the learning of algebra, so that an earlier start might reduce the problem; approaches have been proposed to achieve that. On the other hand, a much favoured approach to initial algebra education is based on the view of school algebra as generalised arithmetic, in which case an earlier start may not be appropriate. The general point here is that different views on the relationship between arithmetic and algebra will probably result in different views on algebra education, and this most important fact is a central concern in this section. The interest in algebra education for students at an early age is recent, and so there are as yet only a few studies in this area. It is important that answers to the following questions be thoroughly research-based:

- How early is «early algebra» and what are the advantages and disadvantages of an early start? How do the answers to these questions link to views on cognitive development and on learning, and on cultural and educational traditions?
- What aspects of algebra and algebraic thinking should be part of an early algebra education? Since the symbolic aspect of algebra is so essential, its early introduction may be beneficial, but is an awareness of algebra as a method to solve problems (for example) more important?
- What are the consequences of an early start to algebra for teachers and teacher education?

TERTIARY ALGEBRA

Problems exist in the teaching and learning of tertiary algebra courses such as abstract algebra, linear algebra, and number theory. Some are similar to the problems of secondary algebra: students' difficulties with abstraction, concerns of relevance, what to do with computing technology, etc. Other problems such as proof-making or seeing the objects of calculus as algebraic objects seem particular to the tertiary level. The questions below are concerned with these issues of learning and teaching and also with the specific question of education for prospective teachers.

- What are the contributions of tertiary algebra courses to the education of prospective secondary mathematics teachers? How do secondary teachers perceive the value of their tertiary algebra courses to their teaching experience?
- Secondary algebra has been well researched, and specific obstacles have been found in making the transition from arithmetic thinking to algebraic thinking. Do tertiary level students similarly experience obstacles in making the transition from secondary-level algebraic thinking to that required for the tertiary level?
- Why are certain types of definitions difficult for students? For example, why are definitions given in terms of properties to be satisfied (for example, subspaces

and group automorphisms) so difficult for students ? How can this problem be addressed ?

- There are specific questions about specific aspects of specific courses in algebra; for example, why do students who seem competent in $\mathbf{R}^n$ have difficulty with more concrete questions in $\mathbf{R}^2$ and $\mathbf{R}^3$? How can such questions be resolved ?
- How does symbolic logic (through statements, connectives, quantifiers, qualified statements, and arguments) affect students' proof-making and their view of the value of proof-making ?
- Secondary school algebra seems to lead more directly to applied mathematical modelling at the tertiary level, rather than to abstract algebra. What is going on here ?
- Should secondary students learn more about algebraic structure ?

HOW TO PARTICIPATE

The study conference will be held at the University of Melbourne from December 10 to December 14, 2001. As is the normal practice for ICMI studies, participation in the study conference is by invitation, given on the basis of papers submitted. A submitted paper may address issues from a number of sections above but it should identify one section as the primary focus. The pre-proceedings will contain the submissions of all participants and will form the basis for the scientific work of the study conference. The study volume, published after the conference, will contain selected revised contributions and reports. Submissions should pay particular attention to implications for the future of the teaching and learning of algebra. The work may report the results of individual studies (completed or in progress), or offer well-argued opinions. Survey and overview articles are especially welcome.

Submissions are invited from all interested who will be able to make a sound contribution to a scientific meeting. New researchers in the field are especially encouraged to submit, as are those with significant responsibility for curriculum development and implementation. The study conference is a fine opportunity for international exchange, so participants from countries under-represented in mathematics education research meetings are very welcome to submit. We hope that interaction in this study of mathematics teachers from the early years to tertiary levels, mathematics educators and mathematicians will produce new insights and guidelines for future work.

Submissions should be a paper 5 to 8 pages in length and should reach the Program Chair at the address below by January 31, 2001. Camera ready copy for the pre-proceedings is required. All submissions must be in English, the language of the study conference. Further technical details about the format of submissions will be available on the study website (see below), which will be progressively updated with all study and travel information. The combined fee for registration and college accommodation is expected to be less than US$ 500.

The members of the International Program Committee are: Program Chair Kaye STACEY (Australia), Dave CARLSON (USA), Jean-Phillipe DROUHARD (France), Desmond FEARNLEY-SANDER (Australia), Toshiakira FUJII (Japan), Carolyn KIERAN (Canada), Barry KISSANE (Australia), Romulo LINS (Brazil), Teresa ROJANO (Mexico), Luis PUIG (Spain), Rosamund SUTHERLAND (UK), Bernard HODGSON (ex-officio, ICMI). Helen CHICK (Australia) is the conference secretary.