2. THEMES AND ISSUES PERTAINING TO RESEARCH ON THE TEACHING AND LEARNING OF MATHEMATICS AT UNIVERSITY LEVEL

◊ to identify, publicise, and expose to scrutiny, new teaching methods and the positive use of technology;

◊ to discuss the transition and the relations between secondary school and university;

◊ to consider ways to improve the preparation of teachers of mathematics at university level.

Leading up to and during the Conference relating to this Study, it is expected that there will be debate as to why mathematics is taught and what mathematics education is at university level. In addition, consideration will be given as to what is the current teaching and learning situation in universities, what it is believed that the situation should be, and how desired changes can be effected.

2. Themes and issues pertaining to research on the teaching and learning of mathematics at university level

Most academic mathematicians know little about the research that has been undertaken in mathematics education in general, or at the tertiary level in particular. Generally speaking, they are unaware of the methods used by researchers in education. One of the most valuable aspects of the current study is that it could collect together the major findings of mathematics education research, review them, and make them readily accessible to a wide audience. The potential usefulness and limitations of this research should then be considered in the light of the practice of teaching. At the same time, it would be valuable to determine research areas which have not yet been explored and to encourage work in them.

The following questions are of particular interest for the Study.

⁂ *What is mathematical understanding and learning, and how are these achieved? What are the underlying theories behind these and how do they relate to teaching at university level?*

⁂ *What research methods are employed in mathematics education? What are the major research findings of mathematics education? What are the obstacles to having teaching practice become informed/influenced by research findings?*

⁂ *Might insights into the nature of the learning process play out differently at different grade levels? Are the theories that are relevant at school level, relevant at university level as well? Is there a need for theories that are specific to university level?*

⁂ *What research has there been into traditional and alternative methods of teaching and what do the results of such research tell us?*

⁂ *In what ways can teaching change to take into account the different background, abilities and interests of the learner? What methods are effective for teaching large classes?*

⁂ *What do we know about the learning and teaching of specific topics such as calculus and linear algebra? Are there characteristics which are relevant to specific topics? Are there characteristics which are pertinent to a number of topics?*

⁂ *What alternative forms of assessment exist? How can assessment be used to promote better learning and understanding?*

- *What are the mathematical competences that are required in the different professions ?*
- *What are students' attitudes and beliefs concerning mathematics ? What causes them to change ? How do these affect their enrolments and success in courses with substantial mathematical components ?*
- *What are the effects of the use of technology in the teaching and learning of mathematics ? In what ways can technology be used to enhance understanding ?*
- *What important issues are under-represented in the research literature and how can researchers be encouraged to work in these areas ?*

3. Themes and issues pertaining to practice

We divide this section into four parts : Clientele, Curriculum, Student activity, and Pedagogy.

Clientele

The students who are of interest for this Study include all those students who are taught mathematics at university level, whether as mathematics majors, as students of other subjects using mathematics as a service course, as prospective mathematics teachers, or as recipients of some form of general mathematics appreciation course. Hence we are addressing the needs of not only future research mathematicians but also other categories of future mathematics professionals as well as graduates in other disciplines who require varying amounts of mathematical knowledge, skill or insight.

For several reasons, in many countries there has been a move to mass education at university level. As a result many mathematics departments are providing courses for a much wider range of ability and needs than was formerly the case. Simultaneously with this increase in student numbers, there has been a change in the kind of student preparation in secondary schools as well as in students' interests and motivation. Consequently many students have not met material which was in most secondary school curricula of the 1970s. In addition they may have been taught by an approach which places more emphasis on the intuitive and pragmatic. Some university mathematics departments have been slow in recognising these changes in their student intake. Others have developed new courses to cope for the range of content needs but have made few pedagogical concessions.

There are a number of special groups of students including potential teachers of school mathematics, scientists, engineers. What should the interaction between mathematical and professional knowledge be ? To what extent do these groups need specially designed courses ?

Curriculum

By curriculum we mean matters pertaining to the purposes, goals and content of mathematics education. Current curricula may need to be reconsidered for at least two reasons. There are the different student needs that were mentioned above and there are the developments in mathematics itself.