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Autor: TALL, David

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COMMISSION INTERNATIONALE DE L'ENSEIGNEMENT MATHÉMATIQUE

(THE INTERNATIONAL COMMISSION ON MATHEMATICAL INSTRUCTION)

UNDERSTANDING THE PROCESSES OF ADVANCED MATHEMATICAL THINKING [1])

An invited ICMI lecture at the *International Congress of Mathematicians* (Zurich, August 1994)

by David TALL

INTRODUCTION

In preparing successive generations of mathematicians to think in a creative mathematical way, it is difficult to convey the personal thought processes which mathematicians use themselves. So many students, unable to cope with the complexity, resort to rote-learning to pass examinations. In this paper I shall consider the growth of mathematical knowledge and the problems faced by students at university. If they are given opportunities to develop mathematical thinking processes, albeit with initially easier mathematics, they may develop attitudes to mathematics more in line with those preferred by mathematicians while standard mathematics lectures designed to "get through the material" may force them into the very kind of rote-learning that mathematicians abhor.

THE DEVELOPMENT OF MATHEMATICAL THINKING

Mathematicians struggle with ideas in research, but the ideas taught to undergraduates have been organised in a clear and logical sequence. Why is it that, when presented with these well-organised theories, students struggle too ? Is it just students' lack of effort or intellect, or are there other reasons ?

[1]) The author wishes to thank Yudariah Binte Mohammad Yusof for her research used in this presentation and Tommy Dreyfus, Eddie Gray & Anna Sfard for helpful suggestions.