

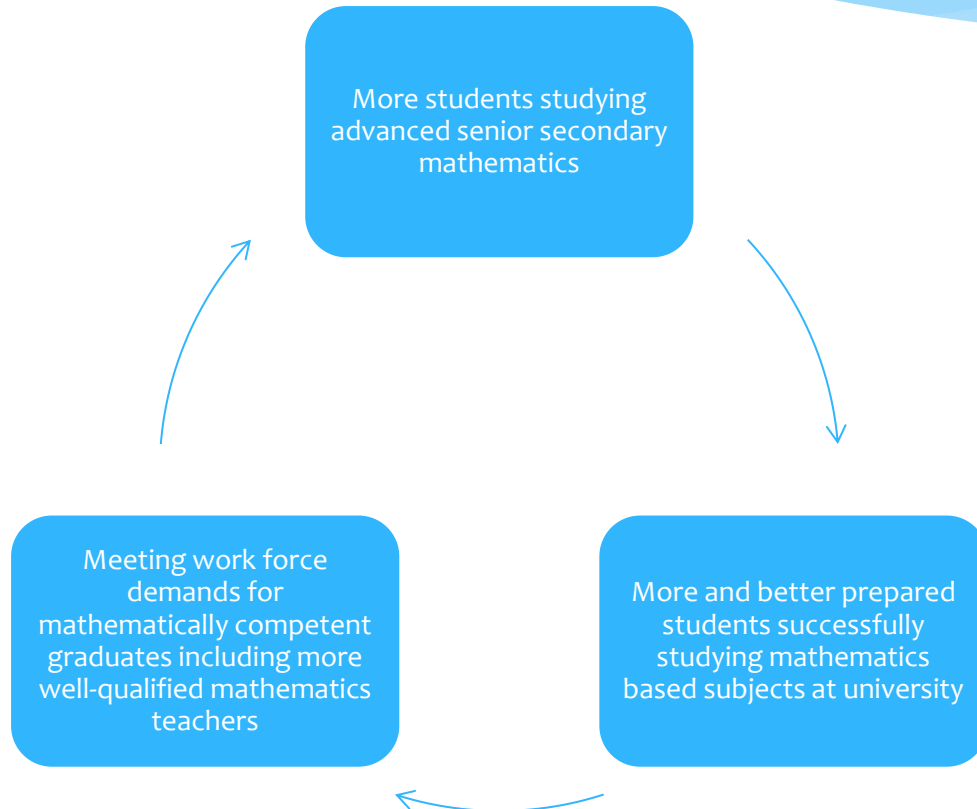
What can we do as tertiary educators to influence student choices at high school, concerning maths subjects?

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Some things we need to do

- * Think carefully about the influence we want to have
- * Consider the assumptions underpinning what we think we want
- * Consider the evidence for our assumptions
- * Rethink what we want
- * Share ownership of the issues and responsibility for the solutions

A virtuous cycle



What do we want?

- * More students studying advanced mathematics subjects at Year 12
- * Students considering senior secondary options to have accurate advice about the value of advanced mathematics subjects
- * Students in our university classes with stronger mathematics skills
- * Students in our university classes with stronger mathematics understandings
- * Students who are keen to learn more mathematics
- * Students who appreciate and 'love' the discipline

Why do we want ...

- * ... more
- * Students in our university classes with stronger mathematics skills?
- * Students in our university classes with stronger mathematics understandings?
- * Students who are keen to learn more mathematics?

We want ...

- * Better pass rates?
- * Better quality graduates?
- * To avoid the need to rethink our pedagogy?
- * Healthy departments?

Year 12 advanced maths and better skills

- * Study of Year 12 advanced maths is associated with better skills
- * But:
 - * Students with bare pass results often have weak skills
 - * Many students who do well at Year 12 advanced maths subjects still struggle with fractions, especially when they involve algebra
 - * Consolidation of skills takes time so more recent topics (e.g., calculus) are likely to present most difficulties

An aside about understanding

- * Skemp (1978) described two distinct ways in which “understanding” is used:
 - * Instrumental understanding – if you know a rule and can use it you understand.
 - * All too common in schools and university maths classes. It seems easier in the short term but ...
 - * Relational understanding – deeper and involves connections among ideas.
 - * More likely to facilitate transfer
 - * Easier to remember in the long term because it provides a basis for reconstructing ‘forgotten’ facts
 - * If relational understanding is the aim learning is more intrinsically interesting
 - * Facilitates growth in knowledge by adding further connections and ideas.
- * When I refer to understanding I am meaning **RELATIONAL UNDERSTANDING**.

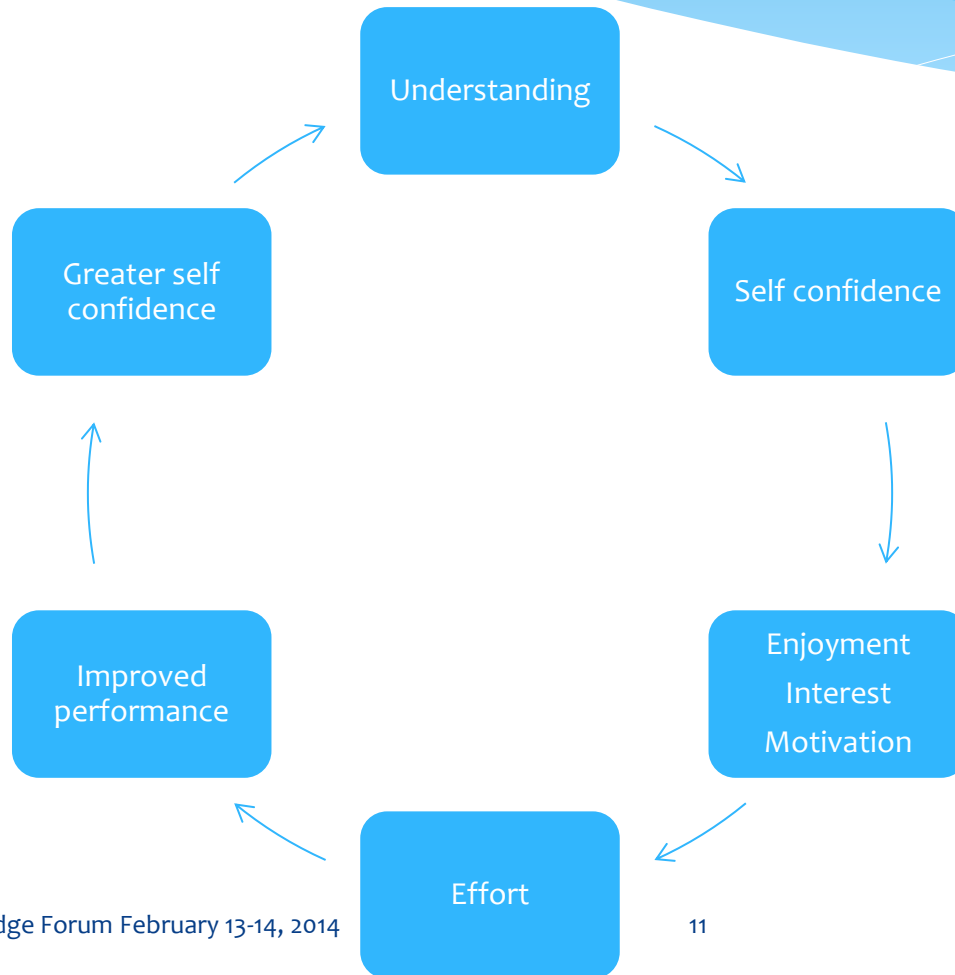
Year 12 advanced maths and better understanding

- * There is a relatively little evidence re whether the study of Year 12 advanced maths is associated with better understanding
- * What evidence there is suggests that it isn't
- * Evidence of inability to transfer skills from one context to another suggests no strong connection
- * Skills are relatively easy to assess but understanding is harder

Year 12 advanced maths and wanting to study maths

- * There is evidence that many students who study advanced Year 12 maths do not like maths
- * Focus on performance rather than on learning is associated with negative attitudes to mathematics
- * Learning environments that communicate valuing of performance over learning influence students to similarly value performance over learning
- * Students in classes where learning is valued achieve better and have higher self efficacy in relation to maths

Understanding and liking maths



Assessment

- * Assessment communicates what is valued
- * Year 12 students studying advanced maths, their teachers, and universities value passing subjects, and ATAR scores
 - * Teachers are accountable for their students' achievement
 - * Any predictable assessment, including Year 12 exams, can be reduced to skills
 - * Even assessment designed to assess understanding will be approached as if it requires only reproduction of skills or simple recall if students' believe that's what maths and learning maths is about
 - * Focussing on skills and reproduction is too often a successful strategy at school and university

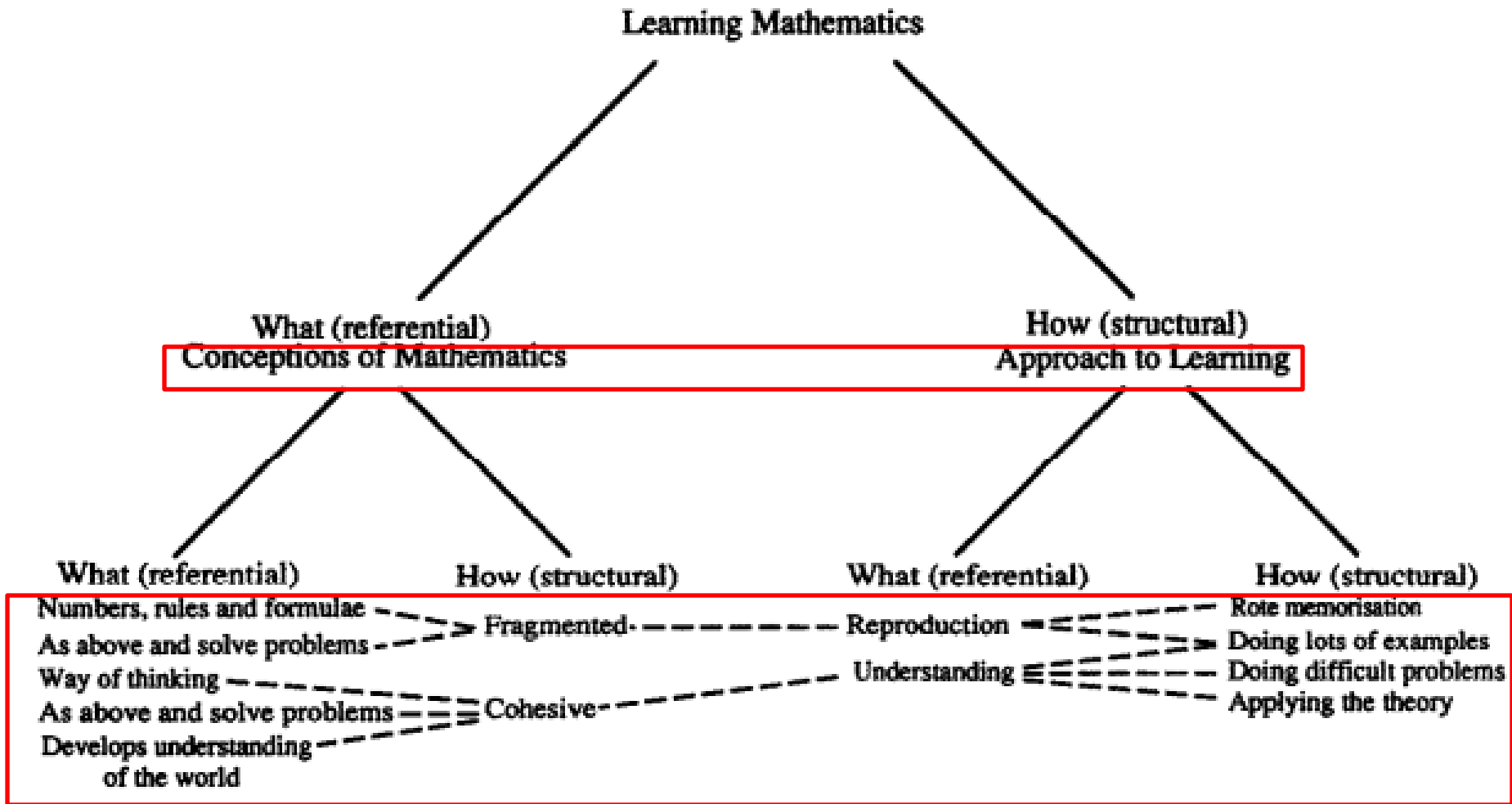


Figure 2. Relationship between conception of mathematics and approach to learning mathematics.

* From Crawford et al. 1994

What do we want?

- * More students who see maths as a way of thinking and making sense of the world
- * More students with a sound (relational) understanding of (perhaps less?) maths
- * More students who **want** to study more maths

What can we do?

- * Work together to improve the teaching of mathematics at school and university
 - * Consider exactly what understandings we want students to bring to university maths
 - * Consider implications for the school mathematics curriculum
 - * Ensure that prospective teachers see models of maths teaching that value learning/understanding and receive consistent messages across their whole teacher education program
 - * Look for ways to assess the understanding we want in senior secondary school and university
 - * Explicitly address students' beliefs about effective maths learning