

Analysing the Transition from Secondary to Tertiary Education in Mathematics

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The main aims of the project:

- To investigate whether there are any **key differences** between secondary and tertiary approaches to teaching mathematics using the following variables: assessment, teaching style/emphasis (e.g. procedural versus conceptual), curriculum (intended, delivered, received), teaching materials, technology (e.g. graphics calculators, computer labs), mathematical knowledge for teaching, teachers' experiences and preparedness and students' experiences and performance. If so, to provide evidence of the nature of those differences.

- To identify and analyse the **reasons for any differences** and explore ways to enrich mathematics teaching and learning by employing ideas from both school teachers and tertiary lecturers.
- To establish an ongoing **dialogue, partnership and collaboration** between the two parties on the issue of the transition from school to tertiary mathematics that will last long after the project will be completed (in particular, via an online discussion forum on the website of the New Zealand Association of Mathematics Teachers).

In Practical Terms (objectives):

- To analyse the best pedagogical strategies to make the transition period smoother
- To investigate for whom those strategies work best and why
- To select appropriate pedagogical strategies used at university (such as collaborative learning, project-based learning for enhancing modelling skills, using counter-examples for deeper conceptual understanding, and others) for implementation at school

- To investigate the role of bridging/ remedial/developmental courses offered at tertiary institutions to fill the gap and any reasons why they might not be working
- To develop a set of recommendations that can make the transition period from school to tertiary mathematics smoother
- To disseminate widely the research findings for the benefit of all teachers and learners through seminars, conferences, workshops, journal papers

- A comprehensive study involving questionnaires, interviews and lesson observations
- Three groups: 76 first-year university Calculus students, 178 school Calculus teachers and 25 university Calculus lecturers – from all over New Zealand

Example: Teachers' Mathematical Knowledge: The Influence of Attention

- This is just one aspect based on one question from a comprehensive questionnaire (68 questions)
- Teachers: all 350 secondary schools, self-selected sampling, response rate 30%
- The ability to use mathematical knowledge
- A function of what we pay attention to
- Relates to Mason's "discipline of noticing"

Theoretical Framework: A developing theory by Tall

Mathematical thinking exists in 3 'worlds':

- an **embodied world** where we make use of physical attributes of concepts, combined with our sensual experiences to build mental conceptions
- a **symbolic world** where the symbolic representations of concepts are acted upon, or manipulated
- the **formal world** where properties of objects are formalized as axioms, and learning comprises the building and proving of theorems by logical deduction from axioms.

Conclusion

- The majority of the respondents are **symbolic world thinkers**. They emphasise techniques, procedures, intuition, ‘common sense’ or pictures and can miss things it is important to notice, preventing them to justify, prove, verify a solution in mathematics
- In the transition to university study of mathematics students need to move toward **formal thinking**
- Explicit training in the discipline of noticing could be a useful addition to school mathematics teaching, and might help smooth the transition

**Thank you for your
attention**