Crossing Boundaries: Fostering collaboration between mathematics educators and mathematicians in initial teacher education programs

Merrilyn Goos
School of Education

The University Of Queensland
AUSTRALIA
Create change

Remembering Jon Borwein

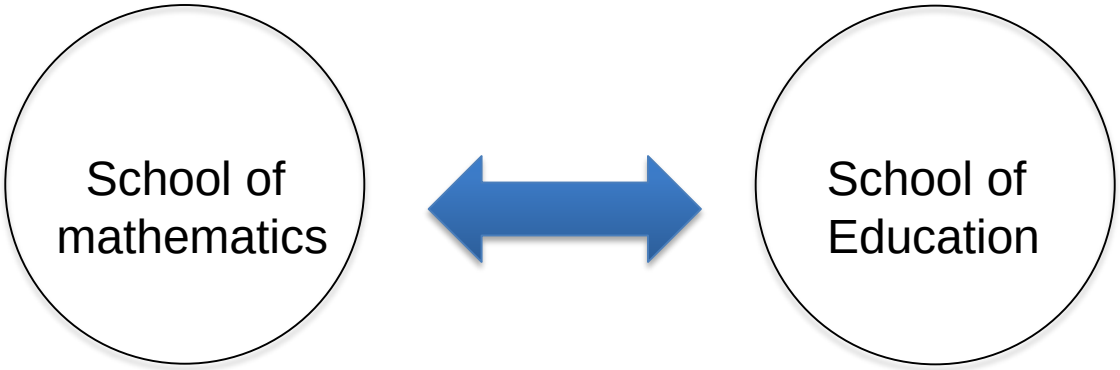
PRIORITY RESEARCH CENTRE for
COMPUTER-ASSISTED RESEARCH MATHEMATICS AND ITS APPLICATIONS

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Create change

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
Create change

Where are the boundaries in teacher education?



Know the content

Know how to teach the content

IMSITE project aim:
Foster collaboration between communities of mathematicians and mathematics educators as a means of integrating mathematics content with mathematics pedagogy in teacher education

Boundaries can carry potential for learning

- Wenger (1998) writes of *boundary encounters* that give members of one community of practice a sense of how meaning is negotiated within another practice.
- When boundary encounters become established as an ongoing forum for mutual engagement, longer term *boundary practices* start to emerge.
- Boundaries are “markers of sociocultural difference leading to discontinuity in action or interaction” (Akkerman & Bakker, 2011).
- When boundaries shape new practices they carry *potential for learning*.

We were curious …

1. How did boundary practices that emerged between the two communities lead to integration of content and pedagogy?
2. How did learning occur at the boundaries between communities?

Research project

- 23 mathematicians and mathematics educators from 6 Australian universities
- Collaboration in university-based teams over three years
- Two rounds of interviews with investigators
- Written annual reports from each university team
- Analysis identified themes corresponding to Akkerman and Bakker's (2011) mechanisms for learning at the boundary

Boundary practices leading to integration of content and pedagogy

1. Co-developed and co-taught courses integrating content and pedagogy: Compulsory courses in teacher education programs

Mathematical Content Knowledge for Lower Secondary Mathematics Teachers

Well it's a subject specifically aimed for […] pre-service maths teachers. The university has never had a subject like that and I'm not aware of many around the planet even. But it was a need that [mathematics educator] had expressed to me early on. [Her] opinion had been formed by her own students that they were getting a bunch of subjects in the maths department, that they felt as though didn't really prepare them for the maths they were going to teach in the classroom. [Mathematician]

Boundary practices leading to integration of content and pedagogy

1. Co-developed and co-taught courses integrating content and pedagogy: Compulsory courses in teacher education programs

Thinking and Working Mathematically

Mathematics course introduced into the mathematics education program as a compulsory course, to offer education students insight and experience into the nature of mathematics.

In consultation with mathematics education academics, it was redeveloped into a blended course (face-to-face and online) to enhance its transferability.

Within the scope of the mathematics that students have already studied, they engage with the process of using mathematics in open-ended problems, the way in which new mathematics can be developed, and mathematics as a human endeavour.

Boundary practices leading to integration of content and pedagogy

1. Co-developed and co-taught courses integrating content and pedagogy:
   Elective courses in non-education programs giving students “a taste of teaching”

Reflective Communication in Mathematics

We both realised that [these students] had not made connections between their maths subjects and their pedagogy subjects, and the maths they were going to be teaching at school. This was the first subject that they’d had where we were talking about both at the same time, taking it further than anything had been taken. – like take the syllabus from high school, push it into where it goes to university where they come back and talk about how might you teach it so that you get those outcomes. [Mathematician]

Boundary practices leading to integration of content and pedagogy

2. Communities of pre-service mathematics teachers

Then I think you and I just started chatting one day … and we thought, you know what? You teach the students maths and I teach them education. We should at least be sharing what we know about the students; starting to compare contrast, talk about issues, retention. We started talking about the fact that we would lose some of them. [Mathematics educator]

Cohort building activities developed a sense of "teacher identity" amongst first-year students in large mathematics courses:

- Special tutorial groups for future mathematics teachers
- Lunches and networking with later-year teacher education students
- Alumni conference for current students, recent graduates, mathematics educators, mathematicians

Boundary practices leading to integration of content and pedagogy

2. Communities of pre-service mathematics teachers

Newcastle Mathematics Educator's Conference III

For Math's sake: Let's sustain this community!

In response to the positive feedback and outcomes from both the 2015 Newcastle Mathematics Educator's Conference (NMEC I):

"For Math's Sake: Let's Get Together! "

and the 2016 Newcastle Mathematics Educator's Conference (NMEC II) :

"For Math's Sake: Let's Stay Connected ! "

we are pleased to advise that the University of Newcastle's IMSITE team will be hosting a 2017 Newcastle Mathematics Educator's conference.

Friday 31st March, 2017.

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

NMEC III DRAFT PROGRAM:

CONNECT

Learning mechanisms at the boundaries

Identification

Reflection

Coordination

Transformation

The University Of Queensland
AUSTRALIA
Create change

Processes of transformation

Process	Example
Confrontation	I can't believe they don't know any maths!
Recognise shared problem	Teaching the same students
Hybridisation & crystallisation	Co-develop and co-teach courses
Maintaining uniqueness of practices	Respect for each other's disciplinary knowledge
Continuous joint work at the boundary	Weekly project meetings Teach into each other's tutorials in mathematics and mathematics education Joint supervision of research students Joint professional development workshops

Challenges

- Mathematics and mathematics education are fields that differ in the kind of knowledge produced and ways of pursuing knowledge.
- The key to collaboration lies in acknowledging these differences, but recognising “that each side is looking in the same direction but with very different, complementary eyes” (Fried, 2014, p. 15)