

Building Maths Bridges

Current issues in mathematics learning and teaching for adults: an international perspective

**Internet Conference between Bridging Mathematics Network Conference in
Toowoomba, Australia
and the Adults Learning Mathematics Conference in
Utrecht, The Netherlands**

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Abstract:

Adults Learning Mathematics Conference in Utrecht, The Netherlands and the Bridging Mathematics Network Conference in Toowoomba, Australia share similar goals and interests. To facilitate exchange of ideas and build bridges between the two groups a real time Internet linkup was conducted.

Two speakers at each conference site introduced discussion topics on Access to Mathematics (Glen Postle - Australia), Empowerment (Iddo Gal - Israel), Climate of the Classroom (Moirra Statham - New Zealand) and Adult Maths and Everyday Life (Jeff Evans - United Kingdom). Exchange of ideas and discussion followed each topic and are summarised.

The linkup was facilitated by Janet Taylor in Australia and Mieke van Groenestijn in The Netherlands.

Chairs :

Janet Taylor in Australia

Roseanne Benn in The Netherlands

Presenters:

Glen Postle (University of Southern Queensland, Australia)

Access to Mathematics - design issues

A key task for those who prepare access/bridging maths programs for "alternative entry" students to tertiary programs is to base the design of such programs on the promotion of "novice to expert" performance. This is not an easy task for it requires the designers of such programs to work closely with faculty "experts" (first year maths teachers) to determine optimal mental models and associated organisation of the knowledge base expected in foundation maths programs. It also requires that course designers seek the input of these "experts" to assist in the identification of the

"novice knowledge base" of these access students. Successful programs are those where access personnel and faculty members work together on these tasks and derive programs which are developmental and address the novice to expert continuum. Where such collaboration is absent, the result is more likely to be programs that are marginalised from mainstream courses and viewed merely as "content top-up" programs.

Iddo Gal (University of Haifa, Israel)

Empowerment and Numeracy Development: Research challenges

Empowerment is a multi-faceted construct that has emerged in recent years in several disciplines and appears to be a promising framework for thinking about mathematics education in general and about adult numeracy education in particular. The empowerment construct is complex as it has multiple meanings: an ideology, a characterisation of desired goal states of diverse learners, change processes in learners, and the educational practices or interventions that can bring about desired changes. Likewise, mathematics education for adults (which in some cases is subsumed under the term "adult numeracy education") involves diverse types of learners with diverse backgrounds and goals who participate in a wide range of different flavours of mathematics education.

This talk will discuss key premises, concepts, and dilemmas associated with empowerment in the context of mathematics education and specifically adult numeracy education, in light of overarching goals of lifelong learning and the need to develop autonomy, participation, and effective functioning of citizens. Among the issues discussed will be the nature of numerate behaviour and its reliance on knowledge bases from mathematics but also literacy, the need to attend not only to the cognitive but also to the dispositional and affective aspects of numerate, empowered individuals, as well as the need to broaden the current thinking about the goals of mathematics education for adults if an empowerment perspective is adopted. Implications of the empowerment perspective will be presented for research and evaluation efforts, regarding both the need to focus on empowerment processes and outcomes among learners (but also among teachers) as well as the need to employ research approaches or designs that can foster empowerment of all stakeholders. Implications for instructional practices, teacher training, and assessment will also be briefly raised.

Moira Statham (University of Auckland, New Zealand)

The Climate of the Mathematics Classroom

The University of Auckland, New Zealand offers a year-long, pre-degree course, the Wellesley Programme, to students who can claim to have been educationally disadvantaged. One of the criteria for admission is that the student should be at least two years out of school, which makes the majority of them 'adults'. The programme aims to prepare students for tertiary study, and mathematics is one of the two compulsory subjects. The students are from a diverse range of backgrounds and have

varied experiences from mathematics classrooms. Nearly all are anxious about 'doing' mathematics and need to build up confidence in their own ability to tackle the subject again, with their added life experience seen as a positive contribution. In this skills-based programme, the role of the tutor goes beyond teaching the mathematical skills needed for tertiary study. Individual attention, pastoral care, and concern are all part of the service to provide a pathway to success.

The classroom should be

- be non-threatening, and yet challenging.
- provide security and build confidence.
- allow the build up of trust between student and tutor so that no-one is too shy to ask for help.
- develop a climate where students from widely different backgrounds and experiences can interact and collaborate.
- treat students as individuals, yet make them feel that they are integrated into the university system and are not marginalised in any way.
- it should be encouraging, and yet place responsibility on the student for his or her learning

Jeff Evans (Middlesex University, United Kingdom)

Adult Maths and everyday life: building bridges.

What kind of maths should we teach in order to enable adults to function satisfactorily in their work and everyday lives? A typical adult has a life/lives based on activities that are relatively fully developed and in which s/he is relatively fully involved (compared with a typical child). But in the usual A.B.E. or college pre-calculus course, there will be much variation in the relevant activities that different students are involved in. And further for each student there will be much variation in their activities over their lifetime. Thus, in order to empower our students the mathematics taught must be *flexible, *powerful, and *critical.

In offering some ideas as to how to proceed I shall describe an approach that builds on but moves beyond, both traditional learning transfer theories and situated cognition. For the curriculum, it aims to locate and to describe a shared discourse such as "critical citizenship"; in pedagogy, it aims to emphasise "transfer of strategies"

Summary of Discussions
Prepared by Marilyn Dorman and Joan Mohr, University of Southern Queensland

The session began with a welcome to the participants from both conferences, and an introduction of the two chairpersons. Each presenter had two minutes for their presentation, followed by questions from the audiences in both locations.

Glen Postle: Access to mathematics – design issues.

Glen described the USQ Tertiary Preparation Program which provides mature age students pre-tertiary access to fee-paying students as well as to large groups of students who meet the DEETYA 'disadvantaged' criteria – e.g. remote locations, no previous access to tertiary study, indigenous, persons in prisons etc. He described the TPP program as one of the largest in Australia, with more than 500 enrollments this year. Glen referred to recent studies conducted by staff within the TPP program, aimed at clarifying the mathematics/numeracy expectations of USQ faculty staff, and further commented on the importance of both declarative and procedural knowledge for students. He noted that the emphasis should not be on content 'top-up' but rather on an integrated foundation which encourages mathematical thinking. In support of this perspective he referred to Laurillard's focus on 'authentic assessment'.

Question: Which academic departments were researched in the TPP (Taylor, Galligan, van Vuuren) study?

Answer: All first year units being offered by all departments/faculties of USQ. Reference was made to a similar study at the University of Manchester which also emphasised the value of thinking skills rather than just technical competence.

Glen added that at USQ there was also an attempt to get the TPP program and Foundation Mathematics (an undergraduate unit) to integrate more, using the analogy of the 'mathematical journey' from novice to expert. (ref Novex Analysis)

Question: What other aspects of the design process should be considered?

Answer: Designers should adopt a cognitivist perspective to maximise learning outcomes.

Question: Should instructional designers working on mathematics units/courses have a background in mathematics?

Answer: Not necessarily, although it is helpful if they are sensitive to the key issues when working with the content expert.

Iddo Gal: Empowerment and Numeracy development: Research challenges.

Iddo highlighted the need to explore the mathematics potential in everyday situations – to look for ‘authentic situations’ for learning maths and facilitating empowerment in the learner. Such an approach encourages participation in public discourse, and decision-making in interpreting and solving problems. He said it was not enough to focus heavily on the cognitive side of learning maths. There is a need to employ research approaches or designs that can foster empowerment of all stakeholders, including learners and teachers.

Question: On the issue of empowerment, how significant is gender influence?

Answer: Empowerment relates more to creating a broader perspective of control over their [students’] environment.

Question: What measure do you have, if any of empowerment? Students may feel okay at the bridging level, but does that continue to the higher levels, and are we measuring the right things?

Answer: Basically, we need to develop some resiliency in students to help them to cope with new situations. The concept of empowerment may mean different things in different cultures – perhaps we should have a competency in empowerment!

Moira Statham: The Climate of the Mathematics Classroom.

The mathematics classroom should:

- Be non-threatening yet challenging.
- Provide security and build confidence.
- Allow the build-up of trust between student and tutor so that students are willing to ask for help.
- Develop an environment where students from different backgrounds and experiences can interact and collaborate.
- Treat students as individuals, yet make them feel that they are integrated into the university system and not marginalised in any way.
- Be encouraging, yet place responsibility of the students for their own learning.

Location, liaison, and language are key elements. Students should be helped to feel secure, to draw on their own life experiences, and to develop confidence through early successes. Teachers should use language which relates to students’ own language – use familiar words, but clarify their specific use in the mathematics environment.

Question: What professional routes do students in the Wellesley (pre-degree) Program have?

Answer: They move through level by level, depending on their planned further studies – it is compulsory for lots of students.

On the issue of support for students, Moira explained that support levels might differ according to the level students were at, and their individual need. This included 'second choice' students. A purpose-built classroom would be a welcome addition. In response to an observation that students were often taught procedures, without teaching thinking skills also, Moira observed that one strategy was to encourage collaborative problem-solving, where students often work together.

Jeff Evans: Adult Maths and Everyday Life: Building Bridges

The focus of Jeff Evans' address was the challenge for teachers to develop an approach to maths teaching which would establish a relevance in everyday life – that is, to build a bridge between theory and practice. He raised the issue of facilitating transfer of learning from one situation to another, referring to points made by both Glen and Moira. Jeff observed that learning in a new context is highly specific to that situation, and so transfer [of knowledge/skills], may be difficult.

Jeff emphasised that the mathematics being taught should be flexible, powerful, and critical. A means of achieving this was through a 'shared discourse' – emphasising social interaction. Emphasis should also be placed on individual construction and reasoning, as well as on good teaching. Emphasis should be on 'transfer of strategies' rather than 'transfer of algorithms'.

Question: The learning of content, and teaching students how to learn ... it is impossible to teach both at the one time.

Answer: There is difficulty in calculating exactly what a student takes away with them, not only because of the learning environment, but also because of the other aspects they bring with them. A suggestion is to focus on one or the other, and measure the outcomes.

Question: But we can't explain why it [transfer of knowledge] doesn't happen?

Answer: We need to be careful about what images are invoked when trying to use transfer. We don't always draw on the metacognitive processes when teaching maths. Not many teachers talk about how wonderful maths is.

Comment: On this point, reference was made to the work by Linda Galligan on metacognition with distance education students.