

Theoretical framework for adults learning mathematics

David Kaye

LLU+, London South Bank University

This is a report on the work of Topic Group A, who met twice during the conference to continue discussion of a Theoretical Framework. It includes a summary of past discussions.

I identified three aims for the two Topic Group workshops on “Developing a Theoretical Framework for Adults Learning Mathematics”) at ALM 12:

- To initiate newcomers into the debate about a specific theoretical framework with reference to adults learning mathematics
- To continue the debate with others to confirm, broaden and deepen the concepts we are defining.
- To identify any research directions or research questions that ALM collectively and its members individually can take forward.

The story so far

This topic is at the heart of the teaching and research practice of ALM members and conference participants. How do we define ourselves? At ALM 12 I felt I felt that my task was in some ways that of an ‘elder’ passing on the traditional culture of ALM. At every conference there are new members joining this debate. It is through the annual repetition of this group that the core cultural identity of ALM as a distinct activity is perpetuated and passed on.

To welcome those meeting this topic for the first time, and to remind others of what has gone before, I present here some key quotations from previous papers on this topic.

ALM4 (Wedege, 1998)

I regard ‘adults education and mathematics’ as a complex subject for didactics of mathematics, whether the focus is on teaching, learning or knowledge. Thus delimiting the field of study (subject area and problem filed) is a central part of the research. In my view the complexity is based on at least three vital, inter-connected conditions which have to do with knowing, learning and teaching of adults:

Mathematics teaching . . .

Learning mathematics . . .

Mathematical knowledge and attitudes to mathematics

ALM 5 (Wedege, 1999)

If we look at three classical subject fields in the didactics of mathematics (mathematics teaching, learning mathematics and mathematical knowledge) we have to note that, in ALM, ‘teaching’ includes ‘math-containing teaching’, ‘learning’ includes ‘learning in everyday life’ and ‘knowing’ includes ‘adults mathematical capacities and competencies developed in everyday life and their attitudes to mathematics’.

ALM 5 (Benn, 1999)

If we are looking at Adults Learning Mathematics as a community of practice and research, we might ask what are the aims of research and practice in adults learning mathematics. Research might be the creation of ‘adults learning mathematics’ knowledge: practice of the induction of curriculum knowledge in others. But the distinction is not clear cut. One of the aims of research might also be to improve teachers’ practice and students’ understanding and learning. Is there a clear distinction between theoretical research knowledge and pragmatic empirical ‘really useful’ knowledge? It seems to me that in the moorland of questions concerning adults learning mathematics, research and practice are fundamentally linked.

ALM 5 (Maasz, 1999)

Both practice and research is very interesting for me. I like to hear what other people do in their courses. I like to exchange experiences and to construct and discuss theories about learning and teaching. Lots of prejudice sometimes blocks the formation of a community of practice and research: theory is too abstract and not useful, practice is boring and experiences from practice are singular and not important for all members. ALM is on the way to remove such prejudices by offering lots of positive examples. . . . ALM should be a community of practice and research, and not only research.

ALM 6 (Benn, Maasz, & Wedege, 2000)

But is it dangerous to live with heterogeneity? Sometimes people become lost in moorland and do not find the way back to their home. Other (older) pedagogical disciplines are in a similar situation. Psychology, sociology and philosophy, for example, have different schools or 'invisible colleges' – groups of researchers with one theory or methodology. The most important question is not how to change this situation (to find one theory for all researchers) but how to ensure co-operation between 'schools'.

At present it seems that ALM has a negating philosophy where the emphasis is on what we do not want, rather than on what we do. Among ALM members, there is a fundamental criticism of the conventional wisdom of what it means to learn mathematics, about what mathematics is, and about what it means to teach mathematics. This critique is political as well as educational.

The question for each of us is not whether we each have a theory. It is more, which is your theory, and can you name it? Learners also each have their own theories concerning the nature of mathematics and learning mathematics. What are their theories and how do we as researchers and teachers respect and acknowledge these?

ALM 7 (Benn & Wedege, 2001)

It was stated that different theories offer a larger perspective in practice and research and that interdisciplinarity is a must. Thus we began to make explicit some of the possible theoretical and methodological choices (e.g. What do we mean by mathematics education?) and how these choices do affect our practice.

ALM 8 (Benn & Wedege, 2002)

Several studies examine numeracy in society. They represent, however, different approaches to the subject area, for example: an *objective perspective* (society's requirements of numeracy) *versus a subjective perspective* (adults' individual need for numeracy; or a *numerical skills approach* (numeracy as basic skills) *versus a numerate competence approach* (numeracy as an everyday competence).

ALM 8 (Schwartz, 2002)

I don't believe I am alone in asserting that there are direct linkages between numeracy, empowerment and democracy. In essence, the hypothesis seems to be: if students demonstrate an increase in numeracy skills then there will be an associated increase in empowerment and democracy.

ALM 9 (Wedege, 2003)

By 'problematique' I mean a systematically linked problem field in which questions and answers about the subject field are formulated on the basis of a certain theoretical and /or methodological approach. It was a meta-discussion about the nature of the new research domain and the debate at the conference showed that this is a very complex issue.

ALM 9 (Maasz, 2003)

One aspect of many statements concerned the relation of theory and practice. I had a feeling that it was not always clear what the meaning of "theory" and "practice" was. There were different meanings and some misunderstandings. This is the reason for me to invite you to concentrate on some possible meanings of "theory" and "practice" in the area of ALM.

One of his [Sir Karl Popper's] theses is that practice and theory are always connected – it is impossible to do something like teaching without thinking about it. If this is correct – and I think so – it is not useful to talk about "theory" and "practice" as if there are contradictions or as if it would be possible to do one of them without the other part. They belong together.

ALM 10 (Maasz, 2003)

What are the realistic aims for research in our area of adults learning mathematics? Let us look at the research situation. We have some established academic disciplines from where we import theories and research methods: pedagogics, psychology, sociology, mathematics education, didactics of mathematics, philosophy, information sciences, medicine, biology. A discipline like pedagogics is differentiated in a lot of subdisciplines concentrated on research subjects, such as very young children, teacher training, or adults learning. If the subdiscipline that is working with adults learning wants to start a research project to find out something about the learning process or the chances to improve the quality of teaching some basic decisions have to be made. What background or basic theory should be used? What method(s) of research could be used? Basic theories for pedagogics are in many cases imported from psychology or sociology. At this conference we talk about attitudes and emotions and their role in the process of learning. These are psychological categories. If we listen to presentations about mathematics at the workplace or in everyday life we will hear something about the sociological background, for example a definition "What is a workplace?"

ALM 10 (Safford-Ramus, 2003)

At ALM-7 in Boston, I shared an analysis of doctoral research about mathematics education from the years 1980 to 2000 . . . In the intervening years since ALM-7, I have examined more than sixty of the dissertations cataloged in the database, reading several in their entirety. It has been an intriguing, time-consuming, and rewarding experience . . . For this paper, I report on five of the dissertations that I read in their entirety. The first, by a long-standing member of ALM, is a study in critical education conducted in Friere's native country, Brazil. This is followed by summaries of two dissertations about mathematics anxiety, an ongoing concern for adult tutors, and two about computer usage in adult mathematics instruction, a much-touted tool that is sometimes difficult to implement.

ALM 10 (Coben, 2003)

The research domain of adult numeracy is fast-developing but still under-researched and under-theorised. It may be understood in relation to mathematics education, as well as to adult literacy and language, and lifelong learning generally. Most research on adult numeracy is interpretative and uses qualitative methods, although quantitative studies do exist, most notably in the form of large-scale surveys. Research designs vary widely, including mixed methods, experimental studies, ethnographic studies and practitioner research. Heterogeneity in research design in studies of adult numeracy is healthy and should be encouraged, giving the diversity and under-researched nature of the field –or moorland – of adult numeracy and the myriad issues worthy of investigation, provided that the methods used are ethical and fit for purpose. Practitioners and researchers need opportunities to learn from each other - practitioner/researcher fora and networks such as ALM, ANN [Adult Numeracy Network – USA] and ALNARC [Adult Literacy and Numeracy Australian Research Consortium] have a key role to play; international perspectives are important here.

ALM 11 (Coben, Maasz, Nolte, & Safford-Ramus, 2005)

This session was opened with a presentation by Kathy Safford that summarized the work of two theorists in the United States who are actively examining adult learning although not specifically the learning of mathematics.

Dr Howard Gardner has developed his theory of multiple intelligencies (MI) over more than two decades. . . . The eight intelligencies that have been recognized in Gardner's theory are linguistic, logical/mathematical, spatial, bodily/kinaesthetic, musical, naturalist, interpersonal and intrapersonal.

Dr Robert Kegan has crafted a theory of adult development that describes three perspectives from which teachers and learners view their educational experiences. Kegan and his associates at NCSALL [National Centre for the Study of Adult Learning and Literacy – USA] distinguish three "ways of knowing" that may appear within the adult life span: instrumental, socializing, and self-authoring.

Participants in Topic Group A suggested other theorists who are influencing current research.

Professor Brian Butterworth . . . In his book *The Mathematical Brain* . . . describes several findings concerning the learning of and dealing with mathematics. The book evokes the question of the mathematical capabilities of babies, the differences between street mathematics and school mathematics, and other topics pertinent to adults learning mathematics. . . . His resultant theory proposes that the capability to do mathematical operations is localized within the brain.

Dr Stanislas Dehaene is a mathematician . . . who studies cognitive neuropsychology of language and number processing in the human brain. . . . His 1997 book *The Number Sense: How The Mind Creates Mathematics* . . . is a study of numeration . . . He argues that many of the difficulties that people face when learning mathematics

stem from our primate brain ... He also argues that the human brain does not work like a computer and that the physical world is not based on mathematics, rather mathematics evolved to explain the physical world.

The second session of topic group A concentrated on the future of ALM research. Leading the brainstorming session, Juergen Maasz asked participants to collect their ideas and wishes in response to questions like:

What should be research areas that are helpful for ALM?

What do I want to know about adults learning mathematics?

What could be areas for joint ALM research projects?

[Note – the list of projects was published in the proceedings of ALM-10 and in the ALM newsletter No. 22 March 2005 available on the ALM website]

The ALM 12 event

The ALM 12 session began with a kinaesthetic activity, both to break the ice and to find out how many people had had previous experiences of ALM conferences. The participants in the Topic Group discussion were asked to form themselves into a human bar chart according to the number of times they had attended ALM – 1, 2, 3, or more than 3. This immediately produced a picture of the pattern of attendance at ALM conferences with approximately twelve attending for the first time, five attending two, one attending three and eight attending more than 3.

As anticipated there was a need to provide a background to this on-going discussion. The introduction summarised the main points given above in 'The Story So Far'. The emphasis was put on the fact that this topic group was still defining the boundaries of this field or moorland of study, and was continually encouraging more people to become interested and participate.

I brought in my own interpretation by looking at the name of our organisation as a means of defining our activities. I like to think of this as a focus on our locus.

Adults Learning Mathematics can be looked at in three ways: **Adults Learning**, **Adults Mathematics** and **Learning Mathematics**. The significance of this is summarised in Table 1.

This summary and introduction provided a background against which the participants in the Topic Group were asked:

- Can we build up a field of study of our own?
- If we can promote more research – where should it go?

The participants were divided into four groups, and as far as possible these groups were mixed in terms of experience of attending ALM conferences.

Table 1. Three ways of looking at Adults Learning Mathematics.

Title	Field of Study	Significant Topics
Adults Learning	Adult education The practice and study of teaching and learning in the post-16 sector, including vocational, technical and work-based learning	Theories of adult education, "androgogy", 'Bildning' Social justice Empowerment Entitlement
Adults Mathematics	Mathematics curricula Attitudes to mathematics Philosophy of mathematics	Numeracy Ethnomathematics Maths phobia/anxiety
Learning Mathematics	Theories of teaching and learning Models of mathematics education	Mathematics in context 'Everyday maths' Algorithms Learning preferences Dyscalculia 'Maths anxiety'

The summaries of the discussions, as noted at the time, are shown here.

Group 1

- Is there a need for a framework and what should it be?
- Acknowledge 'complexity' - need not to exclude ideas as areas of study
- What are the differences between children and adult learning? To what extent are they important?

Group 2

- Can we keep focus inclusive (of) adults mathematics
- Trickle up what we know from ABE/ASE (adult basic/special education)
- Special needs students (eg blind and deaf) - language / cultural

Group 3

- Extremes eg Sudanese immigrants - no school education - no formal education
- Cultural difference - no experience of western structure
- How do you stop formal education destroying knowledge?
- Not recognising actual knowledge - mathematical cultures
- Will official culture kill valid mathematical cultures?
- Language - adaptive expertise
- Providing magic formulae "algorithms" eg nurses/electricians formulae not understanding
- Adult numeracy → moving to prepare for further study → moving to traditional
- How (to) bridge divide of maths/numeracy?

Group 4

- How do adults learn math on line?
 - can technology increase access and equality
 - what costs and benefits?
 - does it affect the nature of the math?
- How do we look at development - research it
 - How is adult math development different/same from kids?
- experience?
- ageing?
 - What do adults bring that facilitates learning?
- How learning math changes a self-identity
 - look at identity shifts
- Do we need a curriculum?
 - if we have a starting point on everyday experience/concrete experience and go from there
 - how do teachers trust this process?
- What skills do teachers need?

The second workshop was held on the following day. The aim of the second day was to identify the next steps with the opportunity for participants to add the experiences gained at ALM 12 to the debate. The ideas emerging from this workshop would inform future discussions of the ALM Trustees and next year's conference, particularly the Topic Group A discussion.

The summary of the comments and discussions of the first session is presented under the following headings.

A. Community of Practice ~ Professional Development

- B. Curriculum ~ Knowledge – Formal & Informal
- C. Language ~ Speakers of ‘other’ languages – Sign – Mathematics
- D. Learning Theory ~ Children – Adults
- E. Personal Development ~ Identity ~ Understanding

These categories were used as a basis for further discussions, but there was some concern expressed that useful as categorisation may be, it should not form a limit to what can be discussed.

We found the time of the second session very limiting – given the scope of the issue under consideration. I noted the following as the main new themes or proposals to emerge from this discussion.

- Adult numeracy and social justice
- This was the main theme of the 2005 conference itself. It was given as an example of the meta themes to be considered in the future.
- Framework of previous ALM Proceedings
- A suggestion to look at the past proceedings of ALM conferences and seek to categorise the contents. This could be linked to an analysis aiming to summarise “who we are”.
- Data base of research activity
- This would be an active record of what is being investigated, which would aim to make links between people working in various specialist areas, who could support each other. An example was given of working in the Maori language, working in sign language and working on ESOL courses; though apparently diverse, these adult numeracy contexts are all linked through the issue of the use of language in mathematics.

Conclusion

I re-call going to ALM conferences to find some theoretical answers to questions about teaching numeracy. At Topic Group A sessions the discussion on theoretical frameworks has become the place to raise new questions, and within the annual meetings to bring more people into this fundamental discussion. The answers are continually given by the strength, variety and depth of the contributions that are made to each ALM conference as it criss-crosses around the world.

I presented three aims at the beginning of this paper that the workshop was to meet: the initiation of newcomers; the continuation of the tradition; and the possibilities for future developments. I feel these were achieved, and that defining the theoretical frameworks for adults learning mathematics had been enriched that little bit more.

References

- ALM4** Coben, D., & O'Donoghue, J. (Eds.) (1998). *Adults Learning Mathematics – 3*. Proceedings of ALM4 the Fourth International Conference of Adults Learning Maths - A Research Forum, July 1997. London: Goldsmiths College, University of London in association with ALM.
- ALM5** Coben, D., & van Groenestijn, M. (Eds.) (1999). *Mathematics as part of Lifelong Learning*. Proceedings of ALM5 the Fifth International Conference of Adults Learning Maths - A Research Forum, July 1998. London: Goldsmiths College, University of London in association with ALM.
- ALM6** Coben, D., & Johnson, S. (Eds.) (2000). *ALM – 6*. Proceedings of ALM6, the Sixth International Conference of Adults Learning Mathematics - A Research Forum, July 1999. Nottingham: CEP, University of Nottingham in association with ALM.
- ALM7** Schmitt M. J., & Safford- Ramus, K. (Eds.) (2001). *A Conversation Between Researchers and Practitioners*. Proceedings of ALM7, the Seventh International Conference of Adults Learning Mathematics - A Research Forum, July 2000. Cambridge MA: NCSALL, Harvard University in association with ALM.
- ALM8** Johansen, L. Ø., & Wedege, T. (Eds.) (2002). *Numeracy for Empowerment and Democracy*. Proceedings of ALM8, the Eighth International Conference of Adults Learning Mathematics - A Research Forum, July 2001. Roskilde: Centre for Research in Learning Mathematics, Roskilde University in association with ALM.
- ALM9** Evans, J., Healy, P., Kaye, D., Seabright, V., & Tomlin, A. (Eds.) (2003). *Policies and Practices for Adults Learning mathematics: opportunities and risks*. Proceedings of ALM9, the Ninth International Conference of Adults Learning Mathematics - A Research Forum, July 2002.. London ALM jointly with King's College London.
- ALM10** Maasz, J., & Schloeglmann, W. (Eds.) (2003). *Learning Mathematics to Live and Work in our World*. Proceedings of ALM10, the Tenth International Conference of Adults Learning Mathematics - A Research Forum, July 2003. Linz: ALM and Johannes Kepler Universitat.
- ALM11** Lindberg, L. (Ed.) (2005). *“Bildning” and/or Training*. Proceedings of ALM11, the Eleventh International Conference of Adults Learning Mathematics - A Research Forum, July 2004. Göteborg: ALM and Göteborg University