
Teresa McConlogue, Sally Mitchell and Will Clavering

Beyond templates: exploring mathematical concepts through writing

Teresa McConlogue
Thinking Writing
Queen Mary, University of London (QMUL)
t.mcconlogue@qmul.ac.uk



Sally Mitchell
Thinking Writing
Queen Mary, University of London (QMUL)
s.mitchell@qmul.ac.uk



Will Clavering
School of Mathematical Sciences
Queen Mary, University of London (QMUL)
w.j.clavering@qmul.ac.uk



Introduction

This is the first of two articles on the Developing Students' Learning through Mathematical Writing project at Queen Mary, University of London (QMUL) funded by the Maths, Stats & OR Network (MSOR Network). This project aims to evaluate the Mathematical Writing (MW) course at QMUL and the postgraduate course for teaching assistants which prepares post graduate teaching assistants (PGTAs) for tutoring and marking on the MW course.

The evaluation is being carried out by the staff of the Thinking Writing (TW) initiative which works with academics at QMUL to explore ways of helping students learn through writing and become better writers. Further details can be found on the website: <http://www.thinkingwriting.qmul.ac.uk>.

In this short piece, we give a brief introduction to the issues we are exploring in the evaluation; the later article will provide a fuller account and make suggestions for the development of the mathematical writing approach in future years.

The undergraduate Mathematical Writing (MW) course

The undergraduate MW course was developed from an earlier undergraduate course and in 2007-2008 the revised MW course ran with 71 students. Given at the beginning of the second year, it aims to help students develop a deeper understanding of mathematical concepts. It does this through weekly coursework in which students write explanations of mathematical notation and short essays on mathematical concepts. Coursework tasks can be viewed at:

<http://www.maths.qmul.ac.uk/~fv/teaching/mw/>.

The coursework problems involve students in writing an explanation of notation and symbols and writing a short report on a mathematical topic for non-experienced maths students (typically for a 1st year student). They often concern mathematical proofs e.g. students are asked to write a good version of a bad proof. Students are also given tips on effective writing in mathematics in a 'web book': see website above.

The course is taught through three weekly lectures and an exercise class, at which the lecturer, Professor Franco Vivaldi, is joined by a small number of postgraduate teaching assistants (PGTAs). The PGTAs play a significant role in marking the students' coursework and for this reason a course was devised and run in 2007-8, by Will Clavering, to support them. The full PGTA coursework materials can be viewed at: <http://www.maths.qmul.ac.uk/~fv/teaching/mwpg/>.

Evaluating MW

The evaluation of the course has followed the principles of naturalistic inquiry [1,2]. Hence we are using progressive focusing which means that we did not start with a series of questions but through ethnographic observations, a focus group, interviews and analysis of student work, we expect a focus to emerge. Similarly, we are not triangulating the data but are collecting 'thick description' [3] through observations and interviews and returning to interviewees to check our interpretation of the data. In particular, we have collected a small but rich dataset from five students who have each been interviewed twice, once during and once after the course.

Some early findings

One of the principle aims of MW is to address the problem of learning maths through 'templates', a common approach at A-level and in QMUL 1st year maths courses. When students use templates they do not have to ask themselves conceptual questions or fully understand mathematical notation. In the evaluation, participants reported that the lack of templates in MW was 'hard' and, initially at least, caused them difficulties. Many students were getting low marks in the first coursework, yet despite this, the students we spoke to were positive:

Rukhsana - 'It helps you think which is excellent because then you can understand a whole range of maths not just you know using a formula and doing something or following the paper or finding an example it's much more like how will you construct it yourself.'

Though there were fluctuations as students were set new challenges, marks gradually improved over the course. In the tutorials the PGTAs reported that, as the weeks went by, students were asking better questions and engaging more with the concepts in the course work.

Some of those we interviewed also felt that MW had changed their overall approach to learning and that this had transferred to work on other courses:

Paul - 'You take this stuff into the other modules and you look at the questions in a more exact way and so whether that actually helps you directly or not I think that ultimately it will definitely help you but I'm not sure what immediate results you get from that but I think you do because you have to translate it more exactly. You don't skim any more. You are examining it thoroughly.'

Although students had positive comments on the course, they also raised areas of concern for example, around feedback (given orally and en masse in the Friday lecture) and the web book. Although the web book was an important resource, several students seemed unclear about how it was to be used in tackling coursework and developing understanding.

A further problem arose for some students around reading and writing in English. Some did not have English as their first language. One participant said she was dyslexic and found it difficult to read the web book. Some said they had chosen Maths because they had problems with writing and felt that they were losing marks because of language problems.

Afsana - 'So the explanation is right. I know what I'm talking about but I've got a problem with English so that's why I'm losing marks.'

Conclusion

From our data, then, a complex picture begins to emerge that involves making sense of students' prior learning experiences, their approaches to learning, the organisation, resourcing and pedagogy of the course and its relation to other courses in the degree programme. In our later article, we hope to be able to respond more fully to the issues we have identified; in particular to ask whether the course helps students to move from a surface approach to conceptual deep approach to learning [4] and how it can be improved to make it more effective for next year's students.

References

1. Lincoln, Y.S. and Guba, E.G. (1985) *Naturalistic Inquiry*. Thousand Oaks, CA, London and New Delhi: Sage Publications Inc.
2. Erlanson, D.A., Harris, E.L., Skipper, B.L. and Allen, S.D. (1993) *Doing Naturalistic Inquiry: A Guide to Methods*. Newbury Park, London and New Delhi: Sage Publications.
3. Stake, R.E. (1995) *The Art of Case Study Research*. Thousand Oaks, CA, London and New Delhi: Sage Publications Inc.
4. Case, J.M. and Marshall, D. (2004) 'Between deep and surface: procedural approaches to learning in engineering education contexts.' *Studies in Higher Education*, 29 (5), 605-615.