GRADUATE VOICES

THE NEXUS BETWEEN LEARNING AND WORK

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This work has not been submitted for a higher degree to any other institution. The work is mine and other sources have been identified.

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Abstract

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The aim of this study is to inform curriculum change in the mathematical sciences at university level. This study examines the transition to professional work after gaining a degree in the mathematical sciences. Communication is used as the basis for the analysis of the transition because of the importance of language choices in work situations. These experiences form part of the capabilities that become part of a person's potential to work as a professional. I found a subtle form of power and, of the opposite, lack of power due to communication skills. It is not as obvious as in, say, politics but it is just as critical to graduates and to the mathematical sciences.

There were 18 participants in the study who were graduates within five years of graduation with majors in the mathematical sciences. In-depth interviews were analysed using phenomenography and examples of text from the workplace were analysed using discourse analysis. Descriptions of the process of gaining employment and the use of mathematical discourse have been reported in the thesis using narrative style with extensive quotes from the participants.

The research shows that graduates had three qualitatively different conceptions of mathematical discourse when communicating with a non-mathematical audience: jargon, concepts/thinking and strength. All participants modified their use of technical terms when communicating with non-mathematicians. Those who held the *jargon* conception tried to simplify the language in order to explain the mathematics to their audience. Those who held the *concepts/thinking* conception believed that the way of thinking or the ideas were too difficult to communicate and instead their intention with mathematical discourse was to inspire or sell their ability to work with the mathematics. The *strength* conception considers the ethical responsibility to communicate the consequences of mathematical decisions. Not one of the participants believed that they had been taught communication skills as part of their degree.

Participants gained a 'mathematical identity' from their studies and acquiring a degree gave them confidence and a range of problem-solving skills. Recommendations are made about changes in university curriculum to ensure that graduates are empowered to make a high-quality transition to the workplace and be in a position to use their mathematical skills. Mathematical skills are necessary but not sufficient for a successful transition to the workplace. Without the ability to communicate, graduates are unable to release the strength of their knowledge.

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PUBLICATIONS ARISING FROM THIS WORK

Full texts are attached in Appendix A. (CD)

Wood, L.N. (2004). University Teaching and Learning. *MERGA Review of Research in Australasia 2000-2003*, 219-242. (Chapter 3)

Wood, L.N. & Reid, A. (2005). Graduates' initial experiences of work. *Proceedings of the Australian Association for Educational Research.* [Online]. (Chapter 5)

Wood, L.N. & Reid, A., (2005). Graduate voices: new mathematics graduates in industry. *DELTA05*, 125-131. (Chapter 6)

Wood, L.N. & Kaczynski, D. (2005). University students in USA and Australia: anticipation and reflection of the transition to work. *Proceedings of the 4th International Conference on Researching Learning and Work*. Sydney, December 2005. [Online]. (Chapter 9)

Wood, L.N. & Reid, A. (2006). Conversations with graduates: reflections on learning mathematics. *ICTM3.* [Online]. (Chapter 8)

GLOSSARY

Advanced mathematical discourse: the uses of language in university mathematics learning and teaching and in professional life. (Wood & Perrett, 1997).

Communication: a term used in natural language. Here communication refers to discourse.

Discourse: in the broad sense of a 'communicative event', including conversational interaction, written text, as well as associated gestures, facework, typographical layout, images and any other 'semiotic' or multimedia dimension of signification. (van Dijk, 2001, p. 98). The sort of language used to construct some aspect of reality from a particular perspective, for example the liberal discourse of politics (Chouliaraki & Fairclough, 1999, p. 63); a system of discursive practices that constitute their objects of knowledge (Howarth, 2000, p. 68); and a relational identity whose identity depends on differentiation from other discourses (Howarth, 2000, p. 102).

Discourse analysis: discourse analysis is an umbrella term used to describe a variety of approaches to analysis of language (in the broad sense), most of which have developed since the 1970s.

Genre: genre is a relatively stable set of conventions that is associated with, and partly enacts, a socially ratified type of activity, such as informal chat, buying goods in a shop, a job interview, a poem or a scientific paper. A genre implies not only a particular text type, but also a particular process of producing, distributing and consuming texts. (Fairclough, 1992, p. 126).

Outcome space. the outcome of a phenomenographic study is a hierarchical set of logically related categories, from the narrowest and most limited to the broadest and most inclusive. This is referred to as the outcome space for the research.

Phenomenography: phenomenography examines how different people experience the same phenomenon. (Marton & Booth, 1997).

Hegemony: a mode of domination which is based upon alliances, the incorporation of subordinate groups, and the generation of consent. (Fairclough, 1992, p. 9).

Intertextuality: the condition whereby all communicative events draw on earlier events. One cannot avoid using words and phrases that others have used before. (Jørgensen & Phillips, 2002, p. 73).

Systemic functional linguistics: systemic functional linguistics (SFL) is a theory of language centred around the notion of language function. While SFL accounts for the syntactic structure of language, it places the function of language as central (what language does, and how it does it), in preference to more structural approaches, which place the elements of language and their combinations as central. SFL starts at social context, and looks at how language both acts upon, and is constrained by, this social context. (Halliday, 1994).

Text: any product whether written or spoken, so that the transcript of an interview or a conversation, for example, would be called a 'text'. (Fairclough, 1992, p. 4).

Voice: the language used by a particular category of people and closely linked to the identity, for example the medical voice (Chouliaraki & Fairclough, 1999, p. 63).

ACRONYMS AND ABBREVIATIONS

AMS: American Mathematical Society

ARC: Australian Research Council

AustMS: Australian Mathematical Society

CEQ: Course Experience Questionnaire www.graduatecareers.com.au/content/view/full/1787

CUDOS: Centre for Ultrahigh Bandwidth Devices for Optical Systems. www.cudos.org.au

DEST: Department of Employment, Science and Technology (Australian Federal Government department that controls universities)

GDS: Graduate Destination Survey

HEFCE: Higher Education Funding Council for England

ICMI: International Committee for Mathematics Instruction, a committee of United Nations Educational Scientific and Cultural Organisation (UNESCO)

IT: Information Technology

NCM: National Committee for Mathematics, sub-committee of the Australian Academy of Sciences

NVivo: Qualitative software package. www.qsrinternational.com/

NZ: New Zealand

OHT: Overhead transparency

SAS: Statistical software package. www.sas.com/

SFL: Systemic functional linguistics

SPSS: Statistical software package. http://www.spss.com/

UK: United Kingdom

USA: United States of America

UTS: University of Technology, Sydney

VB: Visual basic (a computer programming language)