Academic identity development of engineering academics in the Australian engineering education community

A research thesis submitted to
the Faculty of Engineering and Information Technology
in fulfillment of the requirements for the
degree of Doctor of Philosophy
by

Anne Gardner

University of Technology Sydney

2015

CERTIFICATE OF ORIGINAL AUTHORSHIP

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Student:

Date:

Acknowledgements

I am sincerely grateful and appreciative of the supervision of Dr. Keith Willey in completing this thesis. It was due to his encouragement that I began this project and the generous sharing of the research journey and ongoing support of me as a researcher has been instrumental in its completion. I am also thankful for the sincere and valuable guidance of my associate supervisor Dr. Timothy Aubrey.

I gratefully acknowledge the proof reading and editorial assistance of Dr. Terry Fitzgerald.

I would also like to thank the members of the Australasian Association for Engineering Education that participated in this research for so openly sharing their journeys to publication.

Finally and especially I thank my husband Greg, for his continuous moral support while I carried out this project and for everything else that I do.

Table of Contents

List of Tables vii
List of Figures viii
List of abbreviations ix
Chapter 1. Introduction 13
1.1 Overview of this study 17
1.2 Personal context 19
Chapter 2. Engineering education as a research field 23
2.1 Australian tertiary education sector 23
2.2 Development of engineering education as a research domain 28
2.2.1 Disciplinary differences in research methods 28
2.2.2 Model of individual researcher development 34
2.2.3 Identity issues in the research field 36
2.2.4 Global overview of recent developments 43
2.3 Summary 49
Chapter 3. Academic identity construction 52
3.1 Theories and conceptualisations of identity 52
3.2 Identity-trajectory framework 61
3.3 Summary 69
Chapter 4. Research Method 71
4.1 Interview protocol 71
4.1.1 Development of the interview protocol 71
4.1.2 Ethical Considerations 77
4.1.3 Piloting of the interview protocol 78
4.2 Sampling 79
4.2.1 Interviewing participants 83
4.3 Data analysis 85
4.4 Summary 87
Chapter 5. Emerging researchers 88
5.1 Emerging researcher summaries 89
5.2 Academic identity-trajectories 102
5.2.1 Intellectual strand 103
5.2.2 Networking strand 105

5.2.3 Institutional strand 108
5.3 Temporal references 114
5.4 Agency 116
5.5 Personal context 119
5.6 Horizons for action 120
5.7 Response to the landscape model 123
5.8 Summary of findings for emerging researchers 126
Chapter 6. Intermediate researchers 128
6.1 Intermediate researcher summaries 129
6.2 Academic identity-trajectories 134
6.2.1 Intellectual strand 135
6.2.2 Networking strand 143
6.2.3 Institutional strand 148
6.3 Temporal references 152
6.4 Agency 154
6.5 Personal context 156
6.6 Horizons for action 157
6.7 Response to the landscape model 159
6.8 Summary of findings for intermediate researchers 160
Chapter 7. Established researchers 163
7.1 Established researcher summaries 164
7.2 Academic identity trajectories 173
7.2.1 Intellectual strand 174
7.2.2 Networking strand 180
7.2.3 Institutional strand 192
7.3 Temporal references 198
7.4 Agency 200
7.5 Personal context 203
7.6 Horizons for action 204
7.7 Responses to the landscape model 205
7.8 Summary of findings for established researchers 207
Chapter 8. Roles associated with writing a conference paper 210
8.1 Roles valued by participants 210

8.1.1 Visualisation of strands of academic identity 219
8.2 Roles that participants regard as valued by their institutions 224
8.3 Summary of findings with respect to roles 226
Chapter 9. Variations in academic identity 228
9.1 How academic identity changes with expertise 228
9.1.1 Intellectual strand development 228
9.1.2 Networking strand development 232
9.1.3 Institutional strand development 235
9.1.4 Development of agency and horizons for action 240
9.2 How strand interaction changes with institution 242
9.3 Mapping participants area/s of activity on the engineering education research landscape 244
9.4 Summary 257
Chapter 10. Recommendations 259
10.1 Recommendations for individual engineering education researchers and reviewers 259
10.1.1 As an author 260
10.1.2 As a reviewer 262
10.2 Recommendations for Faculties of Engineering and Universities 263
10.3 Recommendations for professional associations 265
10.4 Implications for further research 267
10.4.1 Alternative methods of data collection 267
10.4.2 Sampling of female academics 268
10.4.3 Other aspects of academic practice 269
10.4.4 Other cohorts in the engineering education community 270
10.4.5 Influence of prior industrial experience on academic participation in a research domain 270
10.4.6 Characterising identity development in typical engineering research domains 271
Chapter 11. Conclusions 272
References 277
Appendix I: Categorisation of participants as either an emerging, intermediate or established researcher 292

Appendix II: Interview protocol..... 294
Appendix III: 2012 AAEE conference paper review criteria 299
Appendix IV: Papers published during the course of my candidature in chronological order of publication 302

List of Tables

Table 2.1: Levels of rigor in inquiry in engineering education (after Streveler, Borrego & Smith 2007).....35
Table 2.2: Titles of selected JEE editorials since 2005 44
Table 4.1: Participants' pseudonyms, levels of experience and types of university....83
Table 8.1: Roles that participants identified as most valued by them 214
Table 8.2: Roles participants perceive as most valued by their institution.....225
Table 9.1: Levels of rigor in inquiry in engineering education (after Streveler, Borrego & Smith 2007).....250
Table 9.2: Table for Researcher Self-evaluation 255
Table 10.1: Percentage of female academics (all levels) in engineering in Australian universities 269

List of Figures

Figure 2.1: Research goals and objectives (Jesiek et al. 2009) 37
Figure 3.1: The interweaving of strands of academic identity (McAlpine & Amundsen 2011, p. 178) 62
Figure 4.1: Sources of your identity (Ferdman 2004, p. 53) 73
Figure 4.2: Graphic used in interviews to stimulate thinking about roles associated with writing about research 74
Figure 4.3: Engineering education landscape model 76
Figure 5.1: Emerging researchers' self-location of their 2012 AAEE conference paper on the engineering education landscape model 125
Figure 6.1: Intermediate researchers' self-location of their 2012 AAEE conference paper on the engineering education landscape model 159
Figure 7.1: Established researchers' self-location of their AAEE 2012 paper on the engineering education landscape model 206
Figure 8.1: Identity-trajectory strand interaction for emerging, intermediate and established researchers 222
Figure 9.1: All researchers' self-location of their 2012 AAEE conference paper on the engineering education landscape model 248
Figure 9.2: Amended engineering education research landscape model 249

List of abbreviations

AAEE Australasian Association for Engineering Education

ACED Australian Council of Engineering Deans

ADTL Associate Dean Teaching and Learning

AJEE Australasian Journal of Engineering Education

ALTC Australian Learning and Teaching Council (superseded by OLT)

ANET Australian National Engineering Taskforce

AQF8 Australian Qualifications Framework Level 8

ARC Australian Research Council

ASCE American Society of Civil Engineers

ASEE American Society for Engineering Education

ATN Australian Technology Network

Curtin Curtin University

DEEWR Department of Education, Employment and Workplace Relations

DVC Deputy Vice Chancellor

EJEE European Journal of Engineering Education

ERA Excellence in Research for Australia

EU European Union

FEED Future Engineering Education Directions

FIE Frontiers in Education

FoR Field of Research code

Go8 Group of Eight

HE Higher Education

HILDA Household Income and Labour Dynamics in Australia survey

IJEE international Journal of Engineering Education

IRU Innovative Research Universities

JEE Journal of Engineering Education

L&T Learning and teaching

LSAY Longitudinal Survey of Australian Youth

NCVER National Centre for Vocational Education Research

NRC National Research Council

NSF National Science Foundation

NVivo proprietary software for analyzing text and video files

OLT Office of Learning and Teaching – part of the Australian Government Department of Education and Training

PBL Project Based Learning

PhD Doctor of Philosophy

REES Research in Engineering Education Symposium

SEFI European Society for Engineering Education

SMEC Science and Mathematics Education Centre

SoTL Scholarship of Teaching and Learning

STEM Science, Technology, Engineering and Mathematics

STEMed Science, Technology, Engineering and Mathematics Education Centre

Swinburne Swinburne University of Technology

TAFE Technical and Further Education

RMIT Royal Melbourne Institute of Technology

US United States of America

USQ University of Southern Queensland

UTS University of Technology, Sydney

VC Vice Chancellor

VET Vocational Education and Training

Abstract

The field of research that an academic participates in is seen as central to the development of their academic identity. In the case of engineering academics that become engineering education researchers there are additional complications in reconciling this change with their academic identity. Part of the difficulty that engineering academics have with educational research paradigms is that they are so different to the typically positivistic perspective of most engineering epistemologies. A further complicating factor is that engineering education is an emerging research area in Australian universities and as such there are few formal training pathways into it and little consensus as to the standards and norms of practice. Yet engineering academics have and continue to make this transition - how they develop an academic identity in this research field is the focus of this study.

The research approach is interpretive using the identity-trajectory as a theoretical framework because it pays attention to the context-specific characteristics of working as an academic. Interviews with a range of engineering academics about preparing a conference paper and their response to the peer review process illustrated how various aspects of their research work contribute to the development of the intellectual and networking strands of their academic identity, the effect of their university environment on this development, and included the ways that engineering academics interpret how their past experiences contribute to their present situation and/or their future intentions. By focussing on the individual, this conceptualisation of academic identity aligns with the common experience of engineering education researchers and with the premise that development of the field is a function of the development of the individual researchers within it.

The engineering education research landscape model presented in this study was a successful stimulus for dialogue about the nature of the research field by allowing participants to identify where they belong on the landscape. Such discussions will help both the community and individuals to articulate and understand observed changed in their own and their peers' research as expertise is developed, as well as provide a language for researchers to plan, discuss and evaluate this development.

The continued importance of participation in engineering education conferences for the intellectual and networking strands of academic identity for members of this research community is apparent for researchers at all stages of development, although in different ways.