

Framing the Academic Identity of Emerging Researchers in Engineering Education*

ANNE GARDNER^{1,**} and KEITH WILLEY²

¹ Faculty of Engineering & IT, University of Technology Sydney, PO Box 123, Broadway, NSW 2007, Australia.

E-mail: anne.gardner@uts.edu.au

² Faculty of Engineering & Information Technologies, University of Sydney.

Our research investigates the developing academic identity of engineering academics within the Australasian Association for Engineering Education (AAEE) community. This paper draws on data from interviews with nine ‘emerging’ authors with a first degree in engineering, from three types of Australian universities where they discuss their 2012 AAEE conference paper and the peer reviews of their paper. Identity-trajectory was used to analyse interview transcripts by focussing on the various elements of this framework of academic identity development. The findings and discussion focus on those aspects of the reviews and the authors’ circumstances that appear to either enable or constrain their development as engineering education researchers. The study finds that authors belonging to a discipline-based educational research group made substantial changes to their papers before final submission and we argue that these research groups support these authors in developing their academic identity as an engineering education researcher.

Keywords: peer review; engineering education research; engineering education researcher; academic identity

1. Introduction

The field of research that an academic participates in relates to their academic identity. For academics that change that field of research the question then arises as to how they reconcile this change with their academic identity. Engineering education research is still emerging as a recognised research area in Australian universities [1, 2] and a similar situation exists in other parts of the world [3]. While many engineering academics hold research qualifications and expertise in their own engineering field, they are faced with developing new perspectives and expertise when moving into educationally related research.

Despite the need to develop new perspectives and expertise, very few engineering academics in Australia undertake formal research courses, including a higher degree, in engineering education—the traditional way of socialisation into a research domain [4–6]. In the absence of formal training, experience is the usual means of gaining expertise. This experience is gained through intentional engagement with the engineering education research community. In the Australian context a common form of this engagement is through contributing a paper to the annual conference of the Australasian Association for Engineering Education (AAEE). Feedback through peer review of conference papers is part of a defacto socialisation process into engineering education and as such, should be aimed at assisting authors to acquire the standards and norms of the discipline and develop researchers’ judgement [7].

** Corresponding author.

Both European [8] and American [9] authors comment on the significant volume of engineering education research publications from Australia. Jesiek et al. also highlight Australia’s “cohesive and well-connected regional community of researchers” [9, p. 84]. This suggests that even without significant institutional support or formal study pathways, some engineering academics in Australia have been able to transition to becoming engineering education researchers. At the 2012 AAEE conference, 53% of authors from the Australasian (Australia and New Zealand) engineering community had a first degree in engineering. This figure illustrates how examining the transition from engineering academic to engineering education researcher is relevant to the majority of stakeholders in this community. Other relevant stakeholders are universities, faculties of engineering, and professional associations.

2. Background

For engineering academics, along with the engineering disciplinary norms, which include expectations about research quality [10], when we participate in engineering education research we do so as engineering identities. The difficulty of changing this identity is highlighted by Wenger who says that changing an academic identity:

“... demands more than just learning the rules of what to do when. It requires the construction of an identity that can include these different meanings and forms of participation . . . The work of reconciliation [of differing identities] may be the most significant challenge faced by learners who move from one community of practice to another . . .” [11, p. 160]

Yet for all its significance, Manthunga notes that “very little attention has been paid to the impact it [changing a community of practice] has on researchers’ identities” [12, p. 132].

Handal argues:

“People who belong to a community of practice do not form their identities solely in negotiation with this community. They bring their ‘luggage’ from other communities to which they have historically belonged.” [13, p. 59]

Some of the difficulties experienced by engineering academics in becoming engineering education researchers are due to past engineering ‘luggage’ that hinders adoption of more relevant ways of investigating educationally related phenomena.

Stierer emphasises the influence of disciplinary characteristics and summarises the aspects of the new research paradigm to be learnt:

“Approaches to research design and reporting, the meaning and place of ‘theory’, implicit judgements as to what ‘counts’ as a researchable problem, issues that are foregrounded and backgrounded, and assumptions as to appropriate structure and ‘voice’ in scholarly writing, are all tinged to a greater or lesser extent by the norms and traditions of the discipline.” [14, p. 6]

Weller followed new lecturers as they began to read higher education research, as distinct from their disciplinary research, and reported that the difficulties these academics had with this research were “more complex than the overcoming of linguistic differences in an unfamiliar discipline but relate to lecturers’ wider conceptions of their academic identity” [15, p. 93]. Weller [15] argues that the need to discuss different methods is not just about understanding what the language of higher education means but also how it facilitates the necessary renegotiation of academic identity by academics when first engaging with this different research paradigm.

Jesiek et al. suggest that their data “reveals both an overall lack of clarity and continued sense of ambiguity about the identity and status of engineering education research” [16, p. 39]. Their participants “generally agreed on the value of conferences and similar events as sites for learning, sharing results and collaborating” and that this learning was about “best practices and standards” [16, p. 46]. These researchers suggest that their participants “demonstrated a preoccupation with their ambiguous status as participants in an emerging field” [16, p. 48] and that research-related goals are supported by “the cultivation of a disciplinary identity for engineering education researchers” [16, p. 49]. This suggests that those engineering academics who think of themselves as (i.e. identify with) the research area of engineering education are more likely to achieve their ‘research-related goals’.

While Clegg would classify much of what is

published in engineering education outlets as belonging to the field of “disciplinary teaching research”, she says, “It is difficult to analyse the emergence of research into higher education without also considering the trajectory of academic development” [17, p. 667]. Researchers such as Jesiek [16], Borrego [18] and Beddoes [19] from the USA and Williams and colleagues from Europe [8] have identified a need to investigate how engineering academics negotiate their development in the emergent and interdisciplinary field of engineering education research.

Streveler, Borrego & Smith [20, cited in 21 and 22] propose a developmental trajectory of engineering academics into engineering education research, as shown in Table 1. The different levels are characterised by the degree of engagement with theoretical frameworks, data collection and analysis methods and the anticipated audience for dissemination of results. In their latest explanation of this framework, Borrego and Streveler [3] change their wording slightly by referring to a “type of inquiry” rather than a “level of inquiry” and delete the numbering of levels in response to arguments that the framework implies there is only one pathway, that Level 4 activity is inherently more valuable than activities at other levels and is the only level of activity that can be regarded as ‘rigorous’. They more fruitfully propose a cyclic process linking educational practice and educational research [3, p. 459]. Even if the developmental trajectory suggested in Table 1 is accepted, the movement of an individual from one level to another will require not only cognitive changes but also a renegotiation of their academic identity.

Brew’s work [23, 24] highlights the importance of academic identity in framing how an academic thinks about their research. How an academic writes about their research has also been linked to their academic identity. According to Taylor [25, p. 39] “Research has often been seen as central to academic identities”. The role of researcher is “key to identity, learning and belonging for most academics” [26, p. 122]. These roles make an important contribution to the disciplinary identity of academics, for whom writing is also “the key site of contemporary scholarly practice and the performance of scholarly identity” [27, p. 434]. Lea and Stierer also explored how “identity work is being enacted in day-to-day professional practice” [28, p. 610] through interviews with academics in which they discussed participants’ texts and the significance of these texts for their academic practice. Furthermore, Clegg [29] also reports on the interweaving of the personal self and the academic or intellectual self. Her research participants experienced enacting the latter in their reading and writ-

Table 1. Levels of rigor in inquiry in engineering education (after [20])

Level of inquiry	Attributes of academic at that level
Level 0: Teacher	Teaches as taught
Level 1: Excellent teaching	Uses accepted teaching theories and practices
Level 2: Scholarly teaching	Assesses performance informed by best practice and makes improvements
Level 3: Scholarship of teaching and learning	Engages in educational experimentation and makes results public, open to critique and evaluation
Level 4: Rigorous research in engineering education	Is public, open to critique, asks why or how questions about learning rather than what or how much, ties questions to learning, pedagogical, or social theory and interprets results of the research in light of that theory, pays attention to design of the study and methods used

ing, and expressed an “overwhelming sense of self in the act of writing” [29, p. 334]. Interviewing engineering academics who write about their engineering education research is a way to engage them in self-narrative with the potential to demonstrate aspects of their academic identity. The texts examined and discussed were specifically produced for the research domain of interest, namely an AAEE conference and peer reviews of the conference paper.

The research reported in this paper explores aspects of the academic identity of active members of AAEE to characterise the identity transitions required by engineering academics as they move into the engineering education research community. Arguably emerging and/or novice researchers have the furthest to ‘go’ in this transition and thus are an interesting group to focus on. While this paper reports on the identity development of nine ‘emerging’ authors, further publications from the broader study will describe the corresponding findings from more experienced researchers to illustrate changes in academic identity with expertise.

3. Theoretical framework

McAlpine and various colleagues [30–35] have proposed an identity-trajectory framework to describe the development of identity: “Identity-trajectory emphasizes the desire to enact personal intentions and hopes over time; to maintain a momentum in constructing identity despite challenges and detours; and to imagine possible futures” [30, p. 139]. This conceptualisation of identity acknowledges the central nature of individual agency and the influence of personal circumstances to the decisions people make about their academic work. These decisions are a result of each person’s past and current personal context, agency and academic development which interact to create their ‘horizons for action’. These are defined by what each person regards as possible and desirable.

The academic elements of this identity-trajectory consist of three intertwined strands: intellectual, networking, and institutional, which interact asynchronously such that each trajectory will vary

“individually in length size and impact, and will change over time” [30, p. 139]. We argue that to investigate engineering academics’ development as educational researchers we need a model that acknowledges the changing and discursive nature of identity construction which is accounted for when using identity-trajectory by, for example, paying attention to the context-specific characteristics of working as an academic, or by studying the way that engineering academics interpret their past experiences as contributing to their present situation and/or their future intentions.

The intellectual strand represents “contributions to one’s disciplinary specialism or field. The intellectual strand leaves a trail of artefacts, e.g. publications, citations, papers, course/curriculum design” [32, p. 179]. The networking strand represents the range of

“... local, national, and international networks one has been and is connected to, and ... includes (a) research and publication collaborations with others; (b) cross-institutional course/curriculum design; (c) work with professionals ... and (d) membership of disciplinary organizations [such as AAEE] and on journal boards.” [32, p.179]

The networking strand has both *interpersonal* and *intertextual* elements. Interpersonal elements of networking include interactions with colleagues either face-to-face or through personal communication channels e.g. email, Skype. Intertextual elements of networking include interactions with various texts especially reading to create “... links between papers which ‘spoke’ to each other and to their own research” [35, p. 11]. The intellectual and networking strands strongly interact with each other with the networking strand “establishing the intellectual location for one’s contributions” [32, p. 180] and so are largely focussed beyond the individual institution where an academic may be employed.

In contrast the institutional strand represents the interactions of the academic in their workplace. McAlpine and Amundsen [32, p. 180] found that institutions can “support or constrain an individual’s networking and intellectual strands” and that this strand accounts for “... how the structural

features of the workplace mediate, positively as well as negatively, the development of the networking and intellectual strands of academic work” [35, p. 14]. The importance of the institutional support in regard to research is reported by other researchers [36–38] who found that efficacy is an important factor relevant to faculty productivity. They argue that “because institutions gain from productive faculty, it follows that institutions will benefit from investing resources to give faculty the tools they need to be efficacious in doing research” [37, p. 60]. They also found that departmental support was consistently and strongly predictive of efficacy for research which is consistent with Wood’s findings that:

“Departmental support was also an important factor in predicating efficacy, which further underscores the implication that faculty members need to see their departments and institutions as supportive of their efforts and development of research skills and tools.” [38, p. 60]

In our context for example one form of institutional support for the networking and intellectual strands would be by providing funds to attend the annual AAEE conference.

The strands acknowledge the influence of the interplay between the individual (both cognitive and metacognitive processes in the intellectual strand and importance of agency) and the social (networking strand), and the individual and the structural (both in the institutional strand and the structures of knowledge) in developing identity. The aptness of the identity-trajectory concept for this research is that the strands acknowledge these tensions in relation to dominant aspects of the academic context. Another significant aspect of the framework is that the journey of each academic is just that—their individual trajectory, the details of which will differ from everyone else’s since, as Taylor reminds us “. . . there is no such thing as a standard academic career . . .” [25, p. 30]. However, there are sufficient commonalities in the stages of progress to make some generalised observations.

4. Method of our study

Our study focussed on engineering academics who are ‘active’ members of AAEE. In this project we are defining engineering academics as ‘active’ members of AAEE if they authored a paper for the 2012 AAEE conference AND at least one of the three previous years’ AAEE conferences. The author list from these conferences was available from the proceedings. Participants were classified according to what type of university they work for (Group of Eight (Go8), regional, or metropolitan unaligned, as described in Table 2); and their level of expertise in engineering education research (emerging, intermediate, or established).

A participant’s level of expertise as an engineering education researcher was determined by a number of indicators including the number of specific types of publications they had written in the last four years (conference papers, journal papers, book chapters) along with other indicators of research activity such as being the project leader of a grant where the funding is provided through a nationally competitive process, whether they are supervising research students working on educationally related topics, and whether they were currently serving in an editorial role for an educationally related journal. Using this system, participants fell into three broad groups: emerging, intermediate, and established researchers. The emerging researchers were the group that had co-authored less than ten AAEE conference papers since 2009, no more than two journal papers in this time frame, no books, were not project leader for any externally funded projects, not supervising PhD students in educationally related topics and were not serving as editor or associate editor for any educationally related journals.

This paper reports the results from the nine participants with a first degree in engineering who represent emerging researchers. The pseudonyms for these participants are listed in Table 2, along with an outline of the type of university where they were employed at the time of the interview. These participants have experience in typical engineering research areas including hydrology, structural engineering, combustion, mechanical design, control systems, and environmental engineering.

A document analysis was conducted comparing each participant’s draft paper submitted for review for the 2012 AAEE conference, to the final version of their paper. The two reviews of each paper were also examined. A semi-structured interview was conducted with each participant in their campus office, or an alternative location nominated by them. Each interview took approximately one hour and occurred in the timeframe between three weeks and five months after the deadline for submission of the final version of the paper to the conference. During the interview participants were asked to re-read the reviews they received on their paper, comment on how helpful they had found these reviews in preparing the final version of their paper, and discuss any changes they had made between the draft and final versions. This generated discussion about the reviews themselves, about the changes the participants had actually made to their papers that were prompted by review comments, about their educational research in general, and about how they write about their research.

Participants were also presented with the engineering education research landscape model shown

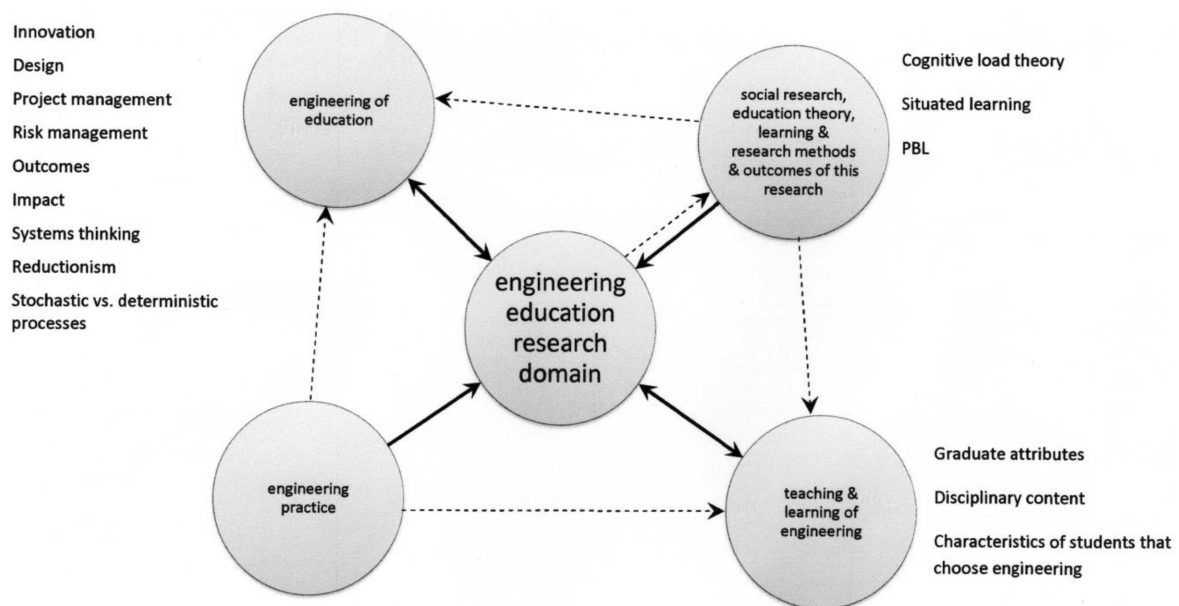
Table 2. Participants' type of university

Type of university	Description	Participants
Group of Eight [Go8]	The 'Group of Eight' (http://www.go8.edu.au/home) is a coalition of research intensive universities which tend to be the oldest universities in Australia	Adele Evan Mark Tom
Regional	Regional universities are those with their main campus in a regional city or town rather than a state capital city. As well as on-campus students, these universities are characterised by significant numbers of external/distance students	Alex Wayne
Metropolitan unaligned	The metropolitan unaligned universities are those based in a state capital city, but not included in the Go8 or the Australian Technology Network	Ian Mike Terry

in Fig. 1. This model was developed by the authors of this paper from examination of the range of papers submitted to the 2010, 2011 and 2012 AAEE conferences. One 'neighbourhood' in this landscape is the teaching and learning of engineering. This encompasses what we do in the classrooms, or workshops, or at university generally with engineering students enrolled in our subject. We like to think that this is influenced by engineering practice, another 'neighbourhood' encompassing professional engineers practising their profession in industry. We also like to think that the teaching and learning of engineering and research into the teaching and learning of engineering is influenced by the methods and outcomes from social research particularly in learning theories, so this forms another neighbourhood on our landscape. The final area on the landscape model is what we call engineering of education, and that's where we tend to use the same skills and ways of thinking and looking at things that we've adopted

or learned because we've been trained as engineers, on our subjects and in our research on our subjects. This might be for example treating issues in our subjects as problems to 'solve' or designing an activity, product or artefact to promote a desired outcome then evaluating its application and subsequently refining its design.

This model is not meant to definitively describe the engineering education research landscape, but was rather devised to provide a basis for members of the community to reflect on, consider and articulate their area/s of activity. Participants used a coloured adhesive star to locate their 2012 AAEE conference paper on this model, and then explained why they had stuck their star/s in the position they did. This information was intended to be used in two ways. The first of these is to use responses from individual participants to provide additional information about their academic identity since "... the need to research particular issues grows from the contexts in which the researcher operates ... " [39, p. 11], so

**Fig. 1.** Engineering Education Research landscape.

the area that they publish in is likely to be one that they identify with. The second intention is to use responses from all the participants to investigate the range of different areas that members of the AAEE community are working on and the characteristics of researchers at different levels of expertise. This second use of the data will be addressed in a future publication.

Transcripts were created from audio recordings of each interview, which were then coded in NVivo 10 for a priori themes relating to elements of the identity-trajectory model (intellectual, networking and institutional strands, personal context, time-related narrative, evidence of agency, and horizons for action).

Quotes from participants indicate their pseudonym and the type of university at which they are employed. Some quotes were edited slightly to preserve the anonymity of our participants, while being careful to maintain the integrity of meaning.

5. Findings

Our researcher classification system was supported by responses from our participants where they self-identified as being new to engineering education research:

“I’m really, really out of my depth, but that’s okay. . . There’s something there for me to learn, and that will be great.” [Adele, Go8]

“My background is not as a researcher, it’s something I’m just learning to do.” [Alex, regional]

“. . . trying to identify whether or not I’m doing it correctly . . . I also haven’t been teaching for very long so I need to learn more about all the different fields.” [Evan, Go8]

“. . . in that paradigm, I very much class myself as a beginner.” [Tom, Go8]

In relation to the reviews there are two aspects to the feedback: the decision and the comments. Authors used both to interpret the reviewers’ opinion of their paper. Of the nine authors we are discussing in this paper, five had papers with the decision to ‘accept with minor changes’ and four had papers with ‘accept subject to major changes’ as the decision. A comparative examination of the reviewed version and the final published version of each paper (Table 3) shows that Adele, Evan, Mike, Ian and Mark made minor changes to their papers after review, while Alex, Wayne, Terry and Tom made more substantial changes. The interesting finding here is that Alex and Wayne made substantial changes to their papers even though the decision was ‘accept with minor changes’ and Ian and Mark made minor changes even though the decisions on their papers were ‘accept with major changes’.

We will first comment on each participant and

their response to their paper’s review before discussing the main themes identified.

Adele has a fractional appointment at a Go8 university which she began after significant experience in industry. Adele’s paper was accepted subject to minor changes and there were very minor changes between the reviewed version and the published version of this paper. These changes related to formatting, abbreviating terms and numbering tables. There are slight differences in the Background sections but these amounted to tightening the writing rather than any change of ideas or the way in which they were expressed or described. Both reviews of this paper were overwhelmingly positive and pointed to the need for the minor abbreviation and table numbering changes which were made for the final version. One reviewer did attempt to engage at a deeper level by asking questions about the categories in the survey but there was no response to this in the final paper. While the quality of the originally submitted paper was high, which elicited the positive reviews, for many of the review criteria the only response from the reviewers was one word: “Excellent”. While positive, this did not assist the author in further improving their paper, and Adele commented she would have appreciated some elaboration on this one word to find out what was ‘Excellent’ about it so that she could do it again: *“I actually find, sometimes, excellent, as the sole comment, . . . more frustrating. Because you think, well, could you actually tell me why it was excellent so that I know what I did well? . . . so that I can do it again?”*

Adele also mentioned that if reviewers have difficulties with something in her paper she would appreciate knowing exactly where in the paper the problem is i.e. the more specific reviewers can be, the better: *“. . . a particular comment—where is that relevant? Which section? . . . is it there, or is it two pages over that really needed that clarification? That’s what I find frustrating, . . . knowing exactly where their particular comments are relevant to”*.

Adele placed her star on the arrow pointing to the

Table 3. Comparison of review decision with changes made to draft paper

Participant	Review decision: Accept with minor/major changes	Changes to published paper were minor/major
Adele	Minor	Minor
Alex	Minor	Major
Evan	Minor	Minor
Mike	Minor	Minor
Wayne	Minor	Major
Ian	Major	Minor
Mark	Major	Very minor
Terry	Major	Major
Tom	Major	Major

social research neighbourhood (see Fig. 2) on the landscape model. She commented that this was an unusual area for her, with her previous educational papers fitting between teaching and learning and engineering of education.

Alex also placed her star in the social research neighbourhood of the landscape model: “. . . because it's very much looking at social research theory and how can we put it into that educational domain.” This paper is related to her PhD which she began 12 months prior to the interview. Previous to that her publications were more aligned with the teaching and learning area. Like Adele, Alex came to academia from industry, but without research experience in her engineering speciality, and is now working at a regional university. Alex began a PhD “because I decided I'd probably be sticking around academia for a little while and if you're going to do that you need to have a PhD”, but only after finding a research area that she was interested in. Both reviews of Alex's paper have a generally positive tone even though the theoretical nature of the paper and the theory discussed are not commonly found in AAEE conference papers: “It's a funny paper because it's a discussion paper or a theoretical background paper. . . It's not a collect some data and analyse it and here's my results type paper.” Both reviews also ask for an illustration of how the theory could be applied to the engineering education domain. This prompted what we regard as substantial changes to the last page and a half of Alex's paper where she completely deleted a table and its explanatory paragraphs and replaced them with suggested ways of using the theory in engineering education. Alex found suggestions from the reviewers helpful in improving the paper: “So what I did do, and what the reviewer suggested was outline how I would apply this theoretical background to a project. . . Which makes a lot more sense when you're then reading the paper. . . So yeah, it certainly did give me the direction that I needed to complete the paper the way I wanted to.”

Evan had recently (in the previous six months) changed from part-time tutor to full-time academic at a Go8 university, so has not been an academic for very long. This change coincided with enrolling in a PhD because “I'll need to do a PhD to progress. . .”. Evan made minimal changes to his draft paper—two instances where a short phrase was added to clarify the rest of the information in that sentence, as requested by his Reviewer 1—before final submission stage, and did not address most issues raised by the reviewers, which he conceded in his interview: “I think I made a few tweaks and just read over it, but I don't think I made huge changes”. This behaviour is consistent with his comments that his main reason for publishing was to meet the expectations of being an academic: “because I am an academic then I must

publish”. He placed his star in the teaching and learning area of the landscape (see Fig. 2) since his paper describes a teaching and learning project Evan was involved in: “It's a project I ran, just one where it was my responsibility and I figured I need it published”.

Like Evan, Mike placed his star in the teaching and learning area of the landscape (see Fig. 2). He locates his educational research—not just this paper—there because “. . . it informs my practice. I don't like the idea of educational research for its own sake. . . if engineering education and research doesn't inform practice in Australian universities, then it's missed the point. . .”. Mike is an academic of approximately twenty years standing, currently working at a metropolitan unaligned university. The reviews on Mike's paper were contradictory e.g. one reviewer expressing reservations about the methodology while the other reviewer commented “the methodology strikes me as rock solid”. While an experienced author may be able to discern feedback from such contradictory reviews, it is more difficult for an emerging researcher to interpret and learn from these contradictions. Changes to the final version of the paper include short responses to some of the issues/questions raised by the reviewers, however, many of Reviewer 1's concerns remain unaddressed. This may be in part because of the difficulty in addressing issues of methodology after a study has taken place or because they are out of the control of the author, as in Mike's case: “the first [review] I wasn't so happy about, possibly because he brought out things which I think were separate to what I could control here. . .”.

Wayne's reviews were very brief, mainly mentioning typographical errors and data presentation issues such as the possibility of changing the graphs to tables. Consequently, Wayne's response to the reviewers' comments in his final submission was to reformat some graphs in a table. We can understand that Wayne did not find his reviews very helpful and Wayne's experience raises questions in regard to the level of expertise of reviewers in the AAEE community. “Thinking of my experiences of publishing in the education conferences, as opposed to the [typical engineering research field] papers. . . I've had 100 per cent success with getting things accepted in the education conferences. . .”. The decision of ‘accept with minor changes’ and the comments Wayne's paper received combined with his previous ‘success’ at educational conferences contribute to his perception that he is a competent educational researcher. Interestingly despite the positive reviews the changes to Wayne's paper from the reviewed to the final version were more substantial than the changes made by Adele, Evan and Mike on their papers. Wayne wrote his paper with another engi-

neering academic and his interview suggests that the changes in the final paper came more from his co-author (an ‘established’ engineering education researcher at another Australian university) than the reviews: “*certainly [the co-author] and I had a bit of back and forth*”. His previous educational papers would fit in the teaching and learning area but this current paper sees him starting to move towards the social research vicinity (see Fig. 2), a move he said is largely driven by his co-author mentor.

Ian wrote this paper to comply with dissemination requirements associated with project funding from his university and volunteered that writing conference papers was for him all about building a “*track record*”. The review decision of Ian’s paper was ‘accept with major changes’. Both reviewers called attention to grammatical, punctuation and formatting errors, which were addressed in the final version of the paper. Ian said that he appreciated this feedback—possibly because English is a second language for him. Reviewer 1 commented on two other aspects of the paper which Ian addressed by deleting one phrase from a sentence in one part of the paper, and adding some proposals for future work. Reviewer 2 provided a much more detailed and useful review than Reviewer 1. This reviewer challenged some of the conclusions in the reviewed paper, which Ian dealt with by removing the unjustified conclusions from the final version. Reviewer 2 mentioned ten issues in relation to the argument of the paper—three of these issues were addressed in the final paper, one issue was addressed by removing the phrase in question, but there did not appear to be a response in the final paper to the remaining

issues mentioned by this reviewer, and hence we would not say that the ‘major changes’ asked for were actually delivered. Ian located his paper in the teaching and learning part of the landscape model (Fig. 2).

As in Ian’s case, Mark’s paper describes work undertaken with internal university funding and while Mark acknowledges the usefulness of a conference paper as “. . . *something you put on your CV*” the paper helped to clarify ideas and insights into the project: “*We didn’t set out to write a conference paper. We set out to try and think about how do we solve this problem? Then the conference gets announced and you say oh yeah, we can tell people about what we’re doing on that particular problem . . .*”. Mark’s paper was accepted subject to minor changes. Reviewer 1 wrote that “*the results are of importance to any engineering educator dealing with reflective practice*”. This positive tone is in contrast to Reviewer 2 who wrote a short paragraph concluding that the paper was not really relevant in an engineering education conference and suggested a general learning conference might be more appropriate. Reviewer 2’s other main criticism was with the “*careless*” English expression of the reviewed paper. The only changes made for the final version of the paper were the typographical errors mentioned by Reviewer 1 and Mark conceded that “*the extent to which the paper was revised in view of the review was quite small*”. On the landscape diagram he placed his star on the trajectory heading towards the social research circle. Mark has many years of experience as an engineering academic and has had a management

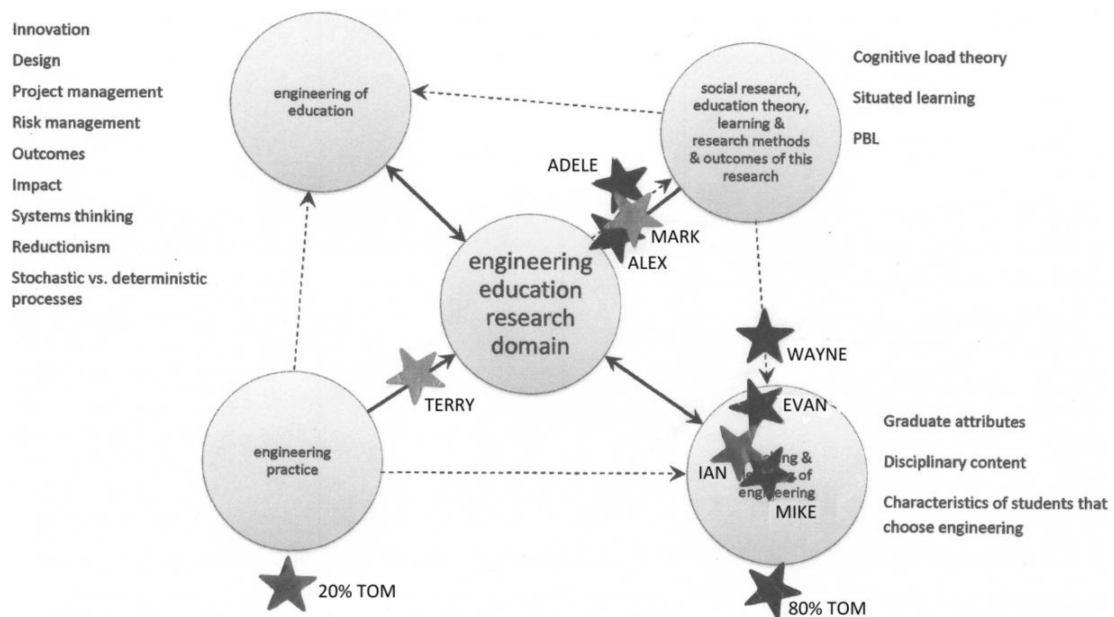


Fig. 2. Participant located stars on the Engineering Education Research landscape.

role in the past in his Faculty. He indicated that in his future work he is aiming to do more of the three areas of teaching and learning, engineering of education, and social research; and less of engineering practice.

Terry's area of teaching and mainstream engineering research is a practice-oriented aspect of engineering and his identification with this area is illustrated in locating his star on the engineering practice trajectory, as shown in Fig. 2, even though his paper is essentially about evaluating practice in the subject that he teaches. Terry has significant experience teaching in this area and works at a metropolitan unaligned university. Substantial changes were expected in Terry's paper since the decision was 'accept with major changes'. Reviewer 1 expressed serious misgivings with the methodology and its description. His final paper did include a fuller description of the details of the method used but did not address a major questioning of the appropriateness of the data collection method, or the English expression and formatting deficiencies noted by reviewers. For a paper with a 'major changes' decision it is noteworthy that much of the reviewed version remains unchanged in the final version—this may come down to Terry's attitude that: “. . . *whether they say major changes or minor changes, to me I don't think it's a huge difference*”.

Tom had not previously published an educationally related paper but has significant research and publication experience in his own engineering speciality. On the landscape diagram Tom placed one star in the teaching and learning vicinity with a value of 80% and one star in the vicinity of engineering practice with a value of 20%. Tom's paper for the 2012 AAEE conference was 'accepted with major changes' which was in contrast to the 'reject' decision his paper received in 2011. Tom's final paper had substantial changes compared to the reviewed version, including a change in structure to improve the description of the event which was the focus of his paper. The detailed discussion and reformatting were in response to reviewers' comments which suggested that more detail of the evaluation evidence was required. So we would agree that Tom did make major changes to his paper, but most of these changes were Tom's ideas: “*I actually think it's a more interesting paper as a result of that re-organisation, but that was my idea. Didn't come from the reviewers.*”

6. Discussion

In this section we discuss how the responses of these emerging researchers illustrate the various aspects of identity-trajectory and highlight aspects of their

academic practice that either enable or constrain their development as engineering education researchers.

6.1 Academic strands

As previously described in the theoretical framework section of this paper, the academic elements of identity-trajectory consist of three interweaving strands: intellectual development, networking, and institutional. Participants' explanations of their responses to peer review of their conference paper illustrate aspects of these strands.

6.1.1 Intellectual strand

The intellectual strand is referenced by the comments that many participants make relating to research perspectives, methodologies and tools which is perhaps not surprising in a group transitioning to a different research paradigm. As suggested by Borrego [40], to assist the development of emerging researchers making the transition to engineering education research, reviewers and mentors need to focus on their understanding of methodology, especially data collection and data analysis. Examining the reviews for the papers written by these emerging researchers, we could see that reviewers often asked for issues of methodology to be addressed, especially in relation to type of data collected and how it is analysed:

“. . . *they were saying that there's an unacknowledged possibility of the Hawthorne Effect.*” [Evan, Go8]

“*There was one comment here [in a review] about the use of the extracts from focus groups. They [reviewer] weren't convinced that that was a way to show results. I'd seen other papers that had done that. So whether it was useful or not, it made me think . . .*” [Terry, metropolitan unaligned]

Amongst these emerging researchers, the dominant view is that the only really 'rigorous' way to conduct research is to use quantitative methods. They then experience difficulties when they realise the limitations of quantitative methods in helping them to understand the types of phenomena they want to investigate. The “*raw data*” is in the form of “*numbers*” and “*some sort of evidence*” referred to below is, in this participant's mind, unquestionably quantitative in nature to qualify as 'evidence':

“. . . *so you've got numbers, whatever, you've got the raw data that is there and you've got to look through it and—ultimately what you're trying to do is identify patterns. . . how you can compare one variable versus another and ultimately then see if you can find a pattern which then explains the overlying thing that you are investigating.*” [Wayne, regional]

“. . . *I think it's important. It's very hard to make conclusions otherwise. There's a lot of things within education which feel right but may not be right and without some sort of evidence to back it up then it's*

hard to know which way you should really act . . . I think generally though that it [statistical analysis] is needed.” [Evan, Go8]

These quotes from our participants provide evidence of the difficulty of the transition from engineering researcher to engineering education researcher. The dominance of quantitative research perspectives and methods has also been noted by Beddoes:

“Despite being an interdisciplinary research area . . . positivist contributions from fields like psychology are . . . more readily accepted without great effort on the part of authors than are critical qualitative approaches. . .” [10, p. 8]

This preference for quantitative research has been attributed to our formal training as engineers which influences expectations and norms for engineering education publications where generally, quantitative and positivist research is dominant [18, 40–43]. However, although we may start from a positivistic, quantitative perspective, there is evidence that engineers can learn to incorporate methods from other research traditions:

“Research on primarily U.S. engineering education researchers indicates that they are more comfortable with quantitative research approaches, but are open to qualitative methods when faced with the complexity of studying human beings in classrooms and similar settings . . .” [40, p. 23]

Such dissatisfaction is evident in the following comment on using surveys for data collection where the participant can see a limitation in statistically analysing survey results, but is still looking to “measure something real”:

“If you look at my surveys here, the mean is always bigger than three, maybe sometimes it’s up to four, which is sort of agree. So it’s always above neutral. . . . So you’ve got this mean around 3.6, around four, but it’s a standard deviation of one, which means that there is a big spread . . . and I don’t know how you get around that kind of thing. So that’s a problem when you come to numerical stuff. If this was an experiment it wouldn’t be a very good experiment, because it’s sort of telling you a trend, but there is a lot of noise . . . it all comes down to their perception. It’s nothing real. But I don’t know how you measure something real.” [Mike, metropolitan unaligned]

Alex and Terry, both working at universities with engineering education research centres, are our atypical cases in that they are using qualitative research methods on a regular basis. Alex knows this is different to the standard paper submitted to an AAEE conference:

“It’s a funny paper because it’s a discussion paper or a theoretical background paper and again, it’s coming from the PhD work that I’m looking at. It’s not a collect some data and analyse it and here’s my results type paper.” [Alex, regional]

We get the sense that this change in how engineering academics think about educational research and research methods is a process. Most of our emerging researchers do not use a theoretical framework which is in contrast to our intermediate researchers who tend to compare their results to a nominated framework, and our established researchers who typically have a variety of frameworks that they can apply in their research.

6.1.2 Networking strand

As mentioned earlier, the networking strand has both *interpersonal* and *intertextual* elements. It encompasses the academic community beyond the participant’s university, with the interpersonal including the AAEE community and reviewers and the intertextual element including the authors of the literature they read and cite. Our emerging researchers refer to elements of their intertextual network:

“I’ve also just recently enrolled in a PhD so reading more literature and trying to absorb it and understand what it means and analyse it. It is something I’m trying to get better at and become better at . . .” [Alex, regional]

*“. . . I found a textbook that was *Methods in Qualitative Research* or something like that. It’s basically a book of what’s the problem you have? Here are some recommended methods, and this is how you apply them. So it’s a perfect book that every time I’m doing qualitative research why did I use it, I get that book, I quote it, sort of as such-and-such suggests this is the ideal tool for this situation.”* [Terry, metropolitan unaligned]

Peer review is an element of this ‘intertextual networking’ [10] and is shown to have contributed to the intellectual development of most of these emerging researchers. The following quotes from participants highlight how interaction with the peer review has resulted in a change in their thinking or practice i.e. has resulted in some change to their intellectual strand:

“The reviewers picked up on things, weaknesses that I already knew were in the paper . . . There was one comment in particular . . . I thought that . . . useful, and actually it changed the way I thought about it . . . it gave me the, ‘Oh now I know what I’m going to do with this paper’. So it certainly did give me the direction that I needed to complete the paper the way I wanted to.” [Alex, regional]

“Look, having other people’s views on what you’ve written is useful. Whether it be agree or disagree or otherwise, it provides some level of providing another perspective . . . or an idea that you really should be thinking about something else . . .” [Mark, Go8]

Another way that peer reviews extend an author’s intertextual networking strand is through the process of reviewing other authors’ conference papers. Several participants commented that they learn from reading the papers they are asked to review,

i.e., that this type of intertextual networking contributes to the development of their intellectual strand, as well as reading the reviews of their own paper:

“It makes you learn about things that because you now have to read a paper you actually read a bit more. . . . So it is good reviewing because it just makes you read papers that you sometimes just don’t get time the read—well, you do have the time if you really made the time but you don’t. This just forces you to sit down and read some papers, which is always good.” [Terry, metropolitan unaligned]

“... it’s good... to read other people’s work to get an idea of what’s out there. . . . Also to get an idea of how other people write. . . . I’ll criticise something then realise I’ve done it myself in my own paper.” [Evan, Go8]

“When I say review I mean I’ve actually reviewed other people’s papers but you play that same role. In fact, reviewing other people’s papers is very useful when you come back to your own paper. You then go—put the same hat on and look at it from that perspective, yeah. So actually yeah, you learn both ways. What you apply to your own work you can then apply to other people’s and vice versa. What you learn by reviewing other people’s work comes back to what you do with your own.” [Alex, regional]

Alex and Evan’s comments in particular illustrate the potential learning benefit from reviewing other papers for a novice researcher.

Peer review for the conference is not the only aspect of the networking strand illustrated by these emerging researchers, the interpersonal element of the networking strand was also illustrated. Wayne brings attention to his interpersonal network by conceding that the changes in his final paper came more from his co-author (an experienced engineering academic at another university) than the reviews:

“... certainly [the co-author] and I had a bit of back and forth. . . . If I was the sole author I would not have done that because I thought the graphs told the story, but I guess this is why you share with other people and they have different perspectives.”

However, our emerging researchers commented much more on the intertextual element of their networking strand than the interpersonal. We suggest this is a reflection of their status as emerging researchers which we expect will change as their expertise develops and they participate more in the research domain, meeting more fellow researchers at other universities both in Australia and overseas.

Many participants could articulate the links for them between participating in the conference, a significant networking event, and the development of their research. For emerging researchers this is mainly about learning about the research domain:

“I also learn about what others do and I guess that’s by attending conferences and not just about the writing. . . .” [Evan, Go8]

that writing a paper “. . . means I go to conferences, so therefore I learn—but also it forces me to look into the background of what I do to better understand it. What other people have done and I guess you don’t really want to submit a paper if you don’t understand the background. Probably also that because there is the outlet of the paper that I look more into what I do. I do investigate, I look at the statistics more carefully, I look at the values about what’s happening I guess. I guess when you explain to someone else what you do it helps you to understand what you don’t know, not what you do know.” [Evan, Go8]

So, the stuff I do with the XXXX room, that came out of reading someone’s paper. I thought, that’s interesting, and then they came here and I heard them speak, and I thought, that’s interesting. I was able to quiz them. . . . about how that really worked—because you said this in your paper, but come on, tell me how that really worked. You think, okay, I can work with that, that’s translatable to—and that’s what I like about conferences, is that you have the ability to quiz people about what they’ve written, and try and pick out what’s really, really relevant to you, which is easier to do verbally. . . . [Adele, Go8]

The comments in this section and the previous one on the intellectual strand demonstrate how strongly the intellectual and networking strands interact with each other with the networking strand “establishing the intellectual location for one’s contributions” [32, p.180]. These two strands are largely focussed beyond the individual institution where an academic may be employed. However, the institutional environment is also important in supporting or constraining the development of academic identity.

6.1.3 Institutional strand

Institutionally related comments were overwhelmingly related to the pressure to write papers that ‘count’ towards the university’s ERA ranking. This was seen in a negative light by most participants along with the changing environment within universities in which the work that academics do is dictated more by administrators than by the needs of research or teaching:

But I think the university really values numbers. It’s again, another issue that I have—always struck me—centres of higher learning use the most base measure to measure their quality. The number of publications and the amount of dollars that you’ve put in grants, which is—because it’s easy to do. [Mike, metropolitan unaligned]

It’s very important to the university that we are researchers and that we have research publications and reportable research publications, whatever that means. . . . Being a researcher is so important. . . . it seems to me to be a lot more emphasis is put on the research outputs than the teaching outputs. Again probably because it’s more easily measurable and easy to quantify. . . . It’s interesting because being a regional university with a focus on teaching, you would think we’d have found a better way of doing it by now. Yet there’s still this emphasis on research. If you want to be promoted, you need to research. [Alex, regional]

“Well, essentially, the university values academic publications . . . The number count, the quality count. They actually don’t care about . . . dissemination . . . I actually don’t think the university cares too much about the impact that we make on engineering education. I think they just care—well, they just care about the metrics . . . it’s the how many people, how’d you get cited, was it peer reviewed . . . it’s more to do with what we call the administrivia of the university these days . . .” [Adele, Go8]

Most participants commented that despite producing publications for the university to count, engineering education related publications were seen to be second-class and in some places not considered as ‘real’ research which can be a disincentive for researchers to continue. This perception of the research area as not real research means that authors in that area are also looked down on as not capable researchers which can impact on identity constructs as well:

“. . . the school operates a sort of database for research categories and for collecting information and whatever. Engineering education is not one of the options for recording information—or recording performance—research performance on that . . . it’s more through ignorance rather than design. They’re not saying oh well, we’ve thought about engineering education and we’re not going to do it. Or we’re not going to put it on our list of important things. It’s just that it never even crossed their mind in the first place.” [Mark, Go8]

“We get presentations from our Office of Higher Degrees in Research about what is a reportable . . . anything that has learning or teaching associated with it, they tend to view fairly cynically when they’re trying to determine whether it’s real research. If you were testing concrete beams or something, it must be real research. But if you’re not they seem to apply almost different standards because they can’t quite cope with qualitative and the quantitative difference, I suspect . . . this seems to be a common thing. Maybe we see it in Engineering Education because we see both sides of the coin. We see the technical researchers and what they do, and say well we’re just as rigorous, but we seem to have different standards applied to us . . . we have to justify our status much more strongly.” [Alex, regional]

Some universities actively support engineering education related research with two universities having already established a discipline specific research centre. This institutional support has benefits for both the development of authors’ networking strand (supporting them to attend the conference) and/or their intellectual strand (providing resources at their university to support developing expertise):

“The school will fund you to go to AAEE conference, at the moment. So they funded four or five of us to go and we wouldn’t get funded to go to another conference . . . [Head of School] funds four to five people every year to go to AAEE, which he doesn’t fund any other conferences. We all got \$2000 this year.” [Mike, metropolitan unaligned]

Alex’s developing identity as an engineering educa-

tion researcher is supported at the regional university where there is a named research group in the engineering faculty for disciplinary education research. The research group gives institutional authority to the development of Alex’s intellectual and networking strands i.e. her intellectual, networking and institutional strands would be mutually supportive. Similar arguments are reported in the study into institutionally supported identities of engineering students [45] and into institutionally supported (or not) interdisciplinary identities of engineering students and academics [46]. Alex acknowledges her development as a researcher which includes better appreciation of what reviewers are saying *“I’ve improved myself as a writer and researcher . . .”*

Similar to Alex, Wayne and Terry also made major changes for their final paper. Wayne works at the same university as Alex, and Terry works at a metropolitan unaligned university which also has a disciplinary specific educational research group. Even though Wayne and Terry’s interaction with these research groups may be different to Alex’s, having an active research group on campus would provide institutional authority to them developing their intellectual and networking strands of identity in engineering education:

“. . . the previous discipline leader was actively encouraging people to do research into education. Our previous dean was quite keen on it as well . . . So I guess you do have support because (a) there’s people here I can talk to about it and (b) it is actually encouraged by people at senior levels.” [Terry, metropolitan unaligned]

Actually for Terry we suggest that wanting to be seen to be an active member of the research group provided some of the motivation for him to write this paper for the AAEE conference: *“. . . I’ve explicitly been told if you’re a part of a research group you’re going to find it easier to get promotions . . .”*

The institution can also influence whether academics engage in engineering education because of the other individuals who work there. This is demonstrated by Alex’s choice of research area for her PhD:

“I came from industry before I came here so I had no research background when I came here. So I’m developing it through engineering education . . . I guess when I started as an academic it was clear that I had to develop a research area. I would look around. I’ve got a construction background so I thought about construction type research. It came down to who I wanted to work with I think, as well as my interest . . . I became quite passionate about my teaching and wanted to improve it. So that stemmed an interest in what’s going on in the research area in that. But then also I get on very well with [engineering colleague at the same university] who’s running the [engineering education research group] . . .”

So I was very happy to work with all those people as well as it follows my interest as well. Construction interested me as well but there was no one I wanted to work with at this university in the construction area. Which was a big disincentive for a long time until I discovered this whole engineering education thing. So yeah, that was a big factor. Being a novice researcher I obviously had to have a mentor of some sort to get into the whole research thing. The construction mentors just didn't—or I didn't see eye to eye with them so I couldn't see myself working with them."

And Mark's comment that the type of research he is doing now is a function of his collaborator who works at the same university that he does:

"... it's partly to do with the particular research collaborations that I've got at the moment..."

For Evan (Go8) and Mike (metropolitan unaligned) their educational research is inextricably linked to their practice of teaching engineering students which is illustrated on the engineering education research landscape (see Fig. 2) where they placed their stars in the 'teaching and learning of engineering' circle. The final papers from both of these authors did not address all the issues raised by their respective reviewers. We also note that these academics work at universities without disciplinary educational research groups and neither seem to have a strong mentor, as Wayne does.

However, the institutional influence is not necessarily uniform even at the one institution i.e. the local Department level environment can have a stronger influence for an individual academic than the University view (if there is one). Note that while Alex may benefit from the local Faculty-based research group she still feels her work is under-appreciated by the university-wide structures such as the Office of Higher Degrees in Research. The following three comments are from different academics in different engineering departments at the same university. One appears to have no trouble having his engineering education research accounted for, while the others in different Departments struggle to find validation of their publications or grant proposals:

"... the only question my university asks in relation to a paper—if you want to have it counted by the bean counters—was it peer reviewed or not? That's the only question they ask... So, in that sense, yeah, the bean counters are counting AAEE papers, for the University. In terms of telling the world this is what our academics have done, yeah, they [count them]. They're peer reviewed... the other reason is that the government actually gives a small amount of funding to the universities for each paper that they publish... that's what the University cares about." [Tom]

Evan is in a specific unit at the same university with "primarily education specialists so their research requirements are less, but their teaching ones are

higher". He commented that in regard to the work of the unit being valued "some is; some isn't; probably not so much the research at this point."

Mark at the same university commented that:

"... one of the issues that's faced is this thing about the importance or role of engineering education, both within the institution as a legitimate area to do research in... The legitimacy of engineering education as something worth researching. Which arises in various aspects from whether there is somewhere to record your efforts... where you might seek research funds, so for example, if you seek research funds from... the Office of Teaching and Learning—or its predecessor... the University's Research Office refuses to deal with those submissions, because it's not research. So you float around the University looking for someone important to sign your application... they haven't got a mechanism for receiving your application, signing it and then passing it on... the Research Office have got a very good means of putting things in front of someone important to sign off as a university signatory. But it's not research like ARC or... industry funding sources. So that's a bit of a battle. I don't know if other universities are similar."

Tom's view is different to Evan and Mark's experience. This may be due to their different agency in regard to their academic practice, that is their ability to leverage institutional structures in their favour, or just that Tom has not been working in this field as long as Mark so has not met the same barriers yet.

6.2 Temporal references

The previous researcher comments have shown that the intellectual, networking and institutional strands are interdependent. Another aspect of the identity-trajectory framework is the temporal frame of reference i.e. that this development of the academic strands occurs over time. Our engineering academics make the importance of a timeframe apparent by the use of past events in framing their current situation. Interpreting past events and experience and incorporating them into their personal narrative is demonstrated by researchers from all university types:

"I came from industry before I came here so I had no research background when I came here. So I'm developing it through engineering education... I guess when I started as an academic it was clear that I had to develop a research area. I would look around. I've got a construction background so I thought about construction type research. It came down to who I wanted to work with I think, as well as my interest... I became quite passionate about my teaching and wanted to improve it. So that stemmed an interest in what's going on in the research area in that." [Alex, regional]

"... but I worked in industry before coming back to uni. Only over the last few years have I been teaching..." [Evan, Go8]

"But I know that one thing that I have struggled with in the last 15 years is that when I was at university, I was very, very good at knowing what to do and I did it... I'd left school at Year 10 and done TAFE and then... where

I worked put me through university. So I was very focussed. I knew I was here to get a degree. Not wasting time . . . I'd been at TAFE and we'd spent a lot of time saying why are we doing this? By the time I got to uni, the students were saying the same thing.” [Mike, metropolitan unaligned]

“ . . . I've had a strong research background before coming here where I've been doing research only for over a decade, doing nothing but research . . . so my introduction was down in the practice side of things. Well it was just I guess welcome to education research kind of thing . . . I did a little bit of research and got a little bit of evidence to go with it so it wasn't just a show and tell paper. But that's where I started . . . So whereas there's a whole richness to this environment of social interactions, how does that affect the team dynamics, how does it affect the team performance results and the interplay we've got with the distributed teams, the localised teams, and how I've done that just has so many questions that you can ask . . . So that's why I've found myself in that area . . .” [Wayne, regional]

“Actually, I don't know if this is of any use to you but my PhD was actually in probabilistic design, which is where you treat all of your variables as distributions, and that's to design quality products and things like that. So quality control is something that's in my mind and so I guess I just think a bit that way.” [Terry, metropolitan unaligned]

and also looking forward to what is planned for the future:

“I've done largely quantitative and a smattering of qualitative and it's really necessary at some point I've got to force myself to use a much more purely qualitative method to collect some information.” [Wayne, regional]

“Where I've come from what I was doing previously, dabbling—I shudder when I think back to like the Adelaide AAEE Conference [2009] . . . I'm trying to think what I was writing about . . . It was very much a show and tell . . . It's been an interesting progression since then. One of these days I'll line up the papers and go, yeah. To be able to see the progression. . . To say well I have moved on. . . sometimes you think, oh I'm not where I want to be. But then I am closer than I used to be.” [Alex, regional]

“I mean next year I might put something into the conference. I remember, what's his name, Allen Johnston, he's a guy who runs consulting courses on academic success; I think he gave a ratio of one journal paper for every three conference papers or something like that. So I might review that at the end of this year and think about what I want to do next year.” [Terry, metropolitan unaligned]

6.3 Agency

Another important aspect of identity-trajectory is an individual's agency. This relates to their ability to set a goal and intentionally move towards it despite institutional or personal constraints. Our participants demonstrated agency in a variety of areas within the structures of their universities, in relation to their academic practice.

We could argue that choosing to site their academic practice in engineering education demonstrates agency since it is not a mainstream research

area for engineering academics. Evan and Alex have recently enrolled in PhD's in this research domain. Both cite the need to have a PhD to progress in academia and identified engineering education as an area aligned to their interests:

“I started doing some casual tutoring because I had my own business and I'm not very good at marketing so I needed some extra income and I figured it was something I could do and then I just enjoyed it and felt that there was room for improvement, so I thought I could contribute to the area. So I started getting more involved in different projects found a niche and then I'll need to do a PhD to progress.” [Evan, Go8]

“I've sort of said, okay I'll play the game, I'll enrol in a PhD. But I'm going to do something I'm interested in and aligns with the teaching I'm doing . . . I decided I'd probably be sticking around academia for a little while and if you're going to do that you need to have a PhD. I get sick of people . . . who look down their nose at you somehow. You're somehow inferior because you don't have that PhD. Somehow you can't be as good. So if nothing else I want to be able to say, look I've got the piece of paper, go away. Obviously it's something you have to do if you're going to be in this industry. It took me a while, I resisted doing it for a whole lot of personal reasons for a long time. It just wasn't the right time . . . Now is the right time—well is it ever the right time? But it's a better time than it was. I'm interested in engineering education hence now let's enrol in the engineering education PhD if that makes sense.” [Alex, regional]

While Evan and Alex are both enrolled in PhDs in engineering education their different responses to the reviews of their papers may be explained by the way they see themselves. Both reported undertaking their postgraduate program because it is expected that an academic has a PhD. While compliance with this expectation seems to be the main issue for Evan, Alex sees her PhD as intentional development of a 'possible self' identity [47] as an engineering education researcher which aligns with where she located her star in Fig. 2.

For others their agency is enacted by prioritising their teaching or administrative role over their research since:

“If you want to be promoted you have to research.” [Alex, regional]

This type of agency reflects the finding that:

“. . . managing one's own and others' competing intentions occasionally involved resisting work practices as well as the expectations of others.” [35, p.7]

“I do what I think is the right thing to do. Not necessarily the thing I should do. So I don't necessarily get ahead because I don't publish, because I don't do all the things that I know I should be doing . . . I'm not sure why now my attitude has changed, that I do what I think is the right thing to do, rather than—and I look for reasons to justify why that's the right thing to do. Rather than doing the things that I really know I should be doing.” [Mike, metropolitan unaligned]

Adele exhibits another type of agency by intention-

ally working with people from different backgrounds on projects that will stretch her knowledge and skills:

“I work with people who often have quite different views on the world, so you get really different perspectives. That’s actually something I find—like [local engineering colleague] and I have just completely—we teach in completely different parts of the curriculum, but that’s actually really powerful, because we actually—when we do work together, we have quite different views on it, so often that means I get forced to look at things differently. Whereas if I was just doing my own thing, I think you sort of get—you know, you just get, that’s what I’m going to do and I’m going to be comfortable. But working with other people can really sort of challenge you and take you out of your comfort zone.” [Adele, Go8]

Wayne demonstrated agency by finding an experienced researcher at another university to co-author his paper and in doing so act as a research mentor.

Other participants demonstrated agency in the way they responded to the reviewers’ comments:

“. . . we ignored that review, because it was of no help whatsoever. . . .” [Mark, Go8]

“I probably would have thought differently if the second person said very much the same thing. . . .” [Terry, metropolitan unaligned]

“The reviewers picked up on things, weaknesses that I already knew were in the paper. . . . There was one comment in particular. . . . I thought that. . . . useful, and actually it changed the way I thought about it. . . . it gave me the, ‘Oh now I know what I’m going to do with this paper’. So it certainly did give me the direction that I needed to complete the paper the way I wanted to.” [Alex, regional]

Variation in the quality of reviews does not always help emerging researchers improve their paper—contradictory comments from reviewers can be difficult to interpret but also allows the author to use the positive review to support their decision to ignore the negative review.

Tom’s experience was interesting as his paper was rejected for the 2011 AAEE conference, he demonstrates agency by reworking it for the 2012 conference, for which it was accepted, rather than accepting the initial rejection. His reasoning for resubmitting the paper was that:

“. . . as an author, I rejected the reviewers. That’s not unusual for me. I’ve routinely rejected the reviewers’ recommendations. I’ve numerous times written to editors in chief, and had reject recommendations turned into publish. . . . I go right to the top. I tell the Editor in Chief, this decision is wrong. This is why it’s wrong. You should publish me. I’ve had numerous reversals of decisions. I was writing one this morning actually before you came.”

“So I’m fairly confident in my—a person who has a fair amount of confidence, and value my own opinions. I’m not bashful. So when I got 2011, I thought you. . . . You are just thinking research, research, research. Research is fine. I want this other category; I insist there is this other category. So I resubmitted, and I was quite willing

to spin the paper the way it needed to be, to fit the criteria. That’s how determined I was to present the paper.”

“The core problem is I don’t have a research finding. So in that sense that whole debate is artificial, being totally frank and sincere. I’m being forced to—I’m being evaluated on a playing field that I don’t wish to enter. I want to compete on a different playing field, please.”

Our emerging researchers demonstrated agency in various ways in line with their personal intentions.

6.4 Personal context influencing decisions on academic work

McAlpine [8] highlights that attention to personal contexts is essential to understanding the academic experience. Personally related references were often intertwined with references to the past, since it’s their personal history participants are talking about. Most participants had an emotional reaction, either positive or negative, to the reviewers’ comments, but personal circumstances have, more importantly, influenced some participants’ decision to pursue an academic career and its timing. For example, Alex waited until her husband had finished his PhD before she began hers, and then chose to work in an area of interest with someone that she wanted to work with, and Adele’s fractional appointment at the university was in response to her significant leadership role in a national professional association. For other participants their personal relationships were evident in their comments such as Wayne describing a competition between himself and his wife, and Tom commenting that his daughter would like the coloured stars used in the landscape model.

“I started doing some casual tutoring because I had my own business and I’m not very good at marketing so I needed some extra income and I figured it was something I could do and then I just enjoyed it and felt that there was room for improvement, so I thought I could contribute to the area. So I started getting more involved in different projects found a niche and then I’ll need to do a PhD to progress.” [Evan, Go8]

“I’m the bloke they go to if they want something proof read, or if they want something written, some programming done. Mostly proofing, I’ve done a lot of proof reading for people here. . . . It’s not just proof reading, it is proper editing I’ve done as well because I guess I’ve got a wide interest base, so a wide knowledge base, so I’ve got a fairly good grasp of most things I come across, and I’ve always been excellent at English and my wife and I have competitions—we’re both really good at our grammar and spelling and all those things that make up correct writing. So yes, I’ve been useful with that and occasionally, if people want something, if they want a computer code written or whatever, I’ve done so much programming for my research that it’s easy for me to bash out something for someone in 15, 20 minutes and away they go and they’ve got a graph or they’ve got some numbers or whatever it is that they were needing.” [Wayne, regional]

“Should get my daughter to do this for me. She’d be right into the coloured stickers.” [Tom, Go8]

It was difficult to separate the personal comments because they were usually intertwined with another aspect of the model such as referencing the past, agency of horizons for action. This reinforces to us how pervasive the personal aspects of our academic life are.

6.5 Horizons for action

Horizons for action are generated through personal agency from past experiences and the intertwining of the personal and the academic strands. For most of our participants the horizon for action mentioned relates to their envisaged participation in engineering education as a researcher and author. The limit/s they impose on themselves as researchers are based on and in their view of themselves as engineering academics and the engineering research paradigm and are strongly linked to the development of the intellectual strand of their identity-trajectory:

“I don’t know where AAEE is going in future. I don’t know where I’m going in terms of contributing to it . . . I think if it was going to become a significant part of my research effort, I would have to go into this sort of field, and become some sort of expert in engineering education research, which involves the sort of methodologies that I can see that you are using. Which I respect—I have friends who have got PhDs in Sociology and Philosophy and other areas. So I respect those methodologies, I just don’t happen to know too much about them myself. So I would need to go in that sort of area to become a more deeply engaged engineer education researcher. But I’m probably not going to . . .” [Tom, Go8];

“Probably, only because I think it’s too difficult for me to go into that area. I’m not sure that I could go into that area. I could say I’d like to go into this—use some of the same modelling and simulation type stuff to be able to inform. But the trouble with all the—this is the problem I see with modelling, when you get into this area and water research—is the non-modelists say well, this is a model. It’s not real. the problem with the model is it will only ever tell you what you’ve told it.” [Mike, metropolitan unaligned]

“If I was moving to education research in general I’d probably feel as though I need to have a high level of qualifications in education to understand the theoretical background of things like that. So although there is the opportunity there, I don’t necessarily know if I’m likely to take it, simply because I’d say, well, where am I going to publish. If there was a journal of interdisciplinary education research then I’d say, oh okay, that’s the area. But to publish a paper like that in just a generic education research journal it would just be a lot of work to make sure I’m familiar with the theories within that journal and stuff like that . . .” [Terry, metropolitan unaligned]

We find it interesting that these three participants intend to stay in engineering education because if they were to move into general education research they would have to learn about learning theories and different methodologies—which implies that

they think they don’t need to be familiar with broader research perspectives to undertake research in engineering education. For Tom, Mike, and Terry, above, as well as Ian and Evan their educational research is inextricably linked to their practice of teaching engineering students. The final papers from these authors did not address all the issues raised by their respective reviewers. We also note that Terry is the only one of these academics that works at a university with a disciplinary educational research group and none of them seem to have a strong experienced researcher to mentor them, as Wayne does.

Contrasting with this finding are Alex, Adele, Mark and Wayne i.e. the participants who located their stars on the trajectory towards the social research vicinity on the landscape model (see Fig. 2). It is interesting to note that Alex, Adele and Mark are all collaborating with a colleague with some type of social science discipline background and Wayne was working with an established researcher as a mentor. We speculate that working with these colleagues has broadened their horizons from the engineering disciplinary base. This reinforces the potential of the networking and institutional strands to impact the intellectual strand since for Mark his collaborator is within his university while for the others their collaborator is outside their own university.

Another horizon referred to by our emerging researchers relates to their perception of how being identified as being active in the engineering education field will impact on their chances for promotion:

“I have accepted that I will not ever be a professor, and I’m actually okay with that . . . I don’t know whether he [new Head of School] actually understands the reality, because you know, I’ve been a 60 per cent fraction with a full-time teaching load for 10 years, who never had any protected teaching time . . . So, all the new male staff that have been put on in the last six years have all had a half teaching load for two years. I never had that. It actually—I would be better off being a crappy teacher, because I would get less teaching. So, I’m now 80 per cent and I’m teaching two courses full-time. So, I will have taught 1,000 students this year, and I’ll teach the same next year—more than that. I’ll teach probably 800 in the first semester and 500 in the second semester. So, the reality is, I’m effectively now teaching focused without being called teaching focused, and my head of school is okay with that. But I think he still thinks I can get promoted . . . I don’t know, I think women are actually better at saying, you know what, stuff it, I like it [teaching]—which is really good until they go through a school restructure and then you’re vulnerable.” [Adele, Go8]

“But the Head of School in my performance review said that I should focus on one thing or the other, either in my [typical engineering] research or in my education and that that would allow me to strengthen my position. So

not in the school, but strengthen my research . . . So now it's making me think well, I don't think I should be putting all my eggs in the education basket because if they make me redundant then I've got no [typical engineering research area]. I may not be able to get an education research role at my age now at somewhere else." [Mike, metropolitan unaligned]

Both Adele and Mike believe that being identified as active in engineering education will impact negatively on their chances of promotion and security of employment. For Mike this perception is acting to limit his activity in engineering education as a research area.

These findings support the results suggested in our earlier studies [48–50] and highlight the importance of quality reviews and the need for new researchers to collaborate and/or be mentored by someone with more experience. Not all participants received quality reviews on their paper, indeed, we reviewed all of our participants' papers ourselves and found aspects of each that we would have included in a review if we were writing it, but which were not mentioned in the formal reviews provided. Positive reviews of poor research can also stifle development and reinforce emerging researchers' misconceptions about the quality of their work (for example Wayne's comment about his 100% acceptance rate). To foster improved research, it is important that reviewers have both the knowledge and skill to challenge authors in a constructive way, although we acknowledge that regardless of the quality of the review there are some authors who will not make the recommended changes to their paper. We suggest that more transparency in the review process would assist reviewer development by for example, once the review process is complete, making all reviews for a particular paper available to the reviewers who reviewed it, or making exemplary reviews available to reviewers. This would allow reviewers to compare opinions and hence facilitate the development of a shared understanding of the standard of work acceptable in the community. It would also allow reviewers to see how other academics write reviews and so induct them into the review process which would otherwise typically occur during their postgraduate studies.

There were several strong voices from these participants opposing what they saw as a move to make the annual AAEE conference exclusively focussed on research:

"I got this overwhelming feeling that the people in the audience didn't feel connected to AAEE as an organisation, because they are all practitioners and AAEE seems to be running an agenda of engineering education research, which is not necessarily related to improving practice." [Mike, metropolitan unaligned]

"Now I think there is a place in the conference to people to report on practice. If you're reporting on practice, the

purpose and the design and the method and blah, blah, blah, is irrelevant . . . this is all very well if you happen to want to write a research paper. But if you want to write a—if you want to tell the people about something else, which could be quite interesting to a lot of people at the conference, then it doesn't—it tells those people that they're not valued at the conference. I'm not sure if that was the intention or not. This conference seemed to take the view that we wanted to—that they were trying to move to a more research based place, and downplay the practice aspect. I think that was—my understanding as when—that by providing this, they're—what they were trying to do is to draw out the—and give preference to the research." [Mark, Go8]

Most of these emerging researchers wrote papers about their teaching practice. These types of papers are about what we do (practice) while others are about how we think about what we do (research). How we think about what we do may change what we do and what we do may influence how we think about what we do i.e. they have a symbiotic relationship, and we believe our national conference should continue to be an outlet where both such papers are included. However, whether the paper is ostensibly about practice or research, it should demonstrate the characteristics of good scholarship as argued by Tom:

"A lot of these distinctions around this is research . . . the second category was being disparagingly described as a paper that was—this is what we did and the students liked it. That was the box for that category of paper, that we might call scholarly teaching practice. Well, perhaps that's the case in the really weak ones? That they just say this is what did and the students were happy, so can I have a paper please? That's poor scholarship . . . So as an editor, I'd have no qualms in kicking that out. Say come back next year when you've learnt how to write properly. Give us a decent motivation; give us a decent literature review. Give us some reason for why you think your program was a success, other than the fact that you improved your student evaluation surveys. That's what I would say to the authors of such a paper, and hopefully they would come back next year and they'd have a much better paper." [Tom, Go8]

7. Concluding remarks

Using identity-trajectory to focus on emerging engineering education researchers has provided useful insights for several stakeholder groups in the AAEE community. We argue that these findings can be transferred to international contexts where existing engineering academics develop their educational research identity through participating in activities of the research community (such as a conference) rather than by undertaking a formal course of study.

Reviewers are asked to note that authors appreciate detailed and specific feedback, even though not all authors will act on all feedback provided. So while high quality reviews won't act as an enabler

for everyone, poor quality reviews are likely to constrain emerging researchers. Focussing on how authors describe their research methodology will continue to be a learning opportunity for developing authors and reviewers.

Universities may note that authors who made substantial changes between the reviewed and final versions of their paper were those working at universities with a research group in engineering education. We found that these research groups act to provide institutional support to the development of both the intellectual and networking strands of academic identity and hence act to enable academics' development as educational researchers for potential publication and grant outcomes in the institution's interest. Institutional environments also impact our researchers' horizons for action, although this effect is mediated by the individual's agency.

For AAEE conference organisers and the community at large we argue that the practice versus research dichotomy is likely to be counterproductive to both growing the numbers in the community and developing the expertise of members in the community. This is because innovative practice is a typical pathway for engineering academics venturing into or transitioning to engineering education research. Exclusivity or gatekeeping will exclude emerging researchers from developing their three academic identity strands. Conferences provide opportunities for intellectual strand development through practice (research methods and writing papers), receiving feedback from peers, learning by the example of established researchers and taking part in conversations to develop the language required for active participation in the community. Reading papers to reference builds an emerging researchers' intertextual network, while meeting conference participants especially more capable researchers, builds their interpersonal network. Finally, the opportunity to publish advances their institutional strand. Hence we suggest that the discussion be framed around inclusion while aiming for quality scholarship in both practice-based and theory-based publications. The entry-level regional conferences such as the annual AAEE, ASEE and SEFI provide a valuable forum to support the transition of practitioners and the continued development of researchers' expertise.

Acknowledgements—We acknowledge those members of the AAEE community who responded so openly to this research.

References

1. R. King, *Addressing the Supply and Quality of Engineering Graduates for the New Century*, Carrick Institute (ALTC). Sydney, Australia, 2008, retrieved from <http://www.olt.gov.au/resource-addressing-supply-quality-engineering-graduates-uts-2008>

2. L. Kavanagh, L. O' Moore and L. Jolly, Mad as Hell and not taking it anymore?: job satisfaction amongst engineering educators in Australian universities, *Proceedings of the 2012 Conference of the Australasian Association for Engineering Education*, Melbourne, Australia, pp. 3–5, December, 2012.
3. M. Borrego and R. Streveler, Preparing engineering educators for engineering education research, in A. Johri and B. Olds (eds), *Cambridge handbook of engineering education research*, Cambridge Press, New York, 2014, pp. 457–475.
4. M. Thompson, Disparate academic environments: an emergent framework of socialization, *The Qualitative Report*, **8**(3), 2003, pp. 408–434.
5. J. Weidman and E. Stein, Socialization of doctoral students to academic norms, *Research in Higher Education*, **44**(6), 2003, pp. 641–656.
6. J. Hakala, Socialization of junior researchers in new academic research environments: two case studies from Finland, *Studies in Higher Education*, **34**(5), 2009, pp. 501–516.
7. K. Fitzpatrick, Peer-to-peer review and the future of scholarly authority, *Social Epistemology*, **24**, 2010, pp. 161–179.
8. B. Williams, P. Wankat, P. Neto and C. Tiago, Is engineering education research global? The answer may surprise you, *121st ASEE Annual Conference & Exposition*, 15–18 June, 2014, Indianapolis, USA.
9. B. Jesiek, M. Borrego, K. Beddoes, M. Hurtado, P. Rajendran and D. Sangam, Mapping global trends in engineering education research, 2005–2008, *International Journal of Engineering Education*, **27**(1), 2011, pp. 77–90.
10. K. Beddoes, Using peer reviews to examine micropolitics and disciplinary development of engineering education: a case study, *Discourse: Studies in the Cultural Politics of Education*, **35**(2), 2014, pp. 266–277.
11. E. Wenger, *Communities of Practice*, Cambridge University Press, New York, 1998.
12. C. Manathunga, Post-colonial perspectives on interdisciplinary researcher identities, in A. Brew and L. Lucas (eds), *Academic research and researchers*, Open University Press, Glasgow, 2009.
13. G. Handal, Identities of academic developers: critical friends in the academy? in R. Barnett and R. Di Napoli (eds), *Changing identities in higher education: voicing perspectives*, Routledge, Abingdon, 2008.
14. B. Stierer, An analysis of 'hybrid' scholarly journals: new spaces for developing distinctive ways of knowing? *Annual Conference of the Society for Research into Higher Education*, December, 2008, Liverpool, UK.
15. S. Weller, New lecturers' accounts of reading higher education research, *Studies in Continuing Education*, **33**(1), 2011, pp. 93–106.
16. B. Jesiek, L. Newswander and M. Borrego, Engineering education research: discipline, community, or field? *Journal of Engineering Education*, **98**(1), 2009, pp. 39–52.
17. S. Clegg, Conceptualising higher education research and/or academic development as 'fields': a critical analysis, *Higher Education Research & Development*, **31**(5), 2012, pp. 667–678.
18. M. Borrego, Conceptual difficulties experienced by trained engineers learning educational research methods, *Journal of Engineering Education*, **96**, 2007, pp. 91–102.
19. K. Beddoes, *Practices of Brokering: Between STS and Feminist Engineering Education Research*, Unpublished PhD dissertation, Virginia Tech, Department of Science and Technology Studies, Blacksburg, Virginia, December, 2011.
20. R. Streveler, M. Borrego and K. Smith, Moving from the "scholarship of teaching and learning" to "educational research": an example from engineering, in D. R. Robertson and L. B. Nilson (eds), *To improve the academy*, **25**, Anker Publishing, Boston, MA, 2007, pp. 139–149.
21. M. Borrego, R. Streveler, R. Miller and K. Smith, A new paradigm for a new field: communicating representations of engineering education research, *Journal of Engineering Education*, **97**(2), 2008, pp. 147–162.
22. K. Smith, Cooperative learning: lessons and insights from

- thirty years of championing a research-based innovative practice, *41st ASEE/IEEE Frontiers in Education Conference*, Rapid City, South Dakota, 2011.
23. A. Brew, Conceptions of research: a phenomenographic study, *Studies in Higher Education*, **26**(3), 2001, pp. 271–285.
 24. A. Brew, *Research and teaching: beyond the divide*, Palgrave Macmillan, London, 2006.
 25. P. Taylor, Being an academic today, in R. Barnett and R. Di Napoli (eds), *Changing identities in higher education: voicing perspectives*, Routledge, Abingdon, 2008.
 26. L. McAlpine, M. Jazvac-Martek and A. Gonsalves, The question of identity: negotiating roles and voices in evolving academic systems, in R. Barnett & R. Di Napoli (eds), *Changing identities in higher education: voicing perspectives*, Routledge, Abingdon, 2008, pp. 113–123.
 27. R. Barnacle and I. Mewburn, Learning networks and the journey of 'becoming doctor', *Studies in Higher Education*, **35**(4), 2010, pp. 433–444.
 28. M. Lea and B. Stierer, Changing academic identities in changing academic workplaces: learning from academics' everyday professional writing practices, *Teaching in Higher Education*, **16**(6), 2011, pp. 605–616.
 29. S. Clegg, Academic identities under threat? *British Educational Research Journal*, **34**(3), 2008, pp. 329–345.
 30. L. McAlpine, C. Amundsen and M. Jazvac-Martek, Living and imagining academic careers, in *Becoming an academic: International Perspectives*, L. McAlpine and G. Akerlind (eds) Palgrave Macmillan, London, 2010.
 31. L. McAlpine and L. Lucas, Different places, different specialisms: similar questions of doctoral identities under construction, *Teaching in Higher Education*, **16**(6), 2011, pp. 695–706.
 32. L. McAlpine and C. Amundsen, Making Meaning of diverse Experiences: Constructing an identity through time, in *Doctoral Education: Research-based strategies for doctoral students, supervisors and administrators*, L. McAlpine and C. Amundsen (eds), Springer, London, 2011.
 33. L. McAlpine and G. Turner, Imagined and emerging career patterns: perceptions of doctoral students and research staff, *Journal of Further and Higher Education*, **36**(4), 2012, pp. 535–548.
 34. L. McAlpine, C. Amundsen and G. Turner, Constructing post-PhD careers: negotiating opportunities and personal goals, *International Journal for Researcher Development*, **4**(1), 2013, pp. 39–54.
 35. L. McAlpine, C. Amundsen and G. Turner, Identity-trajectory: reframing early career academic experience, *British Educational Research Journal*, doi: 10.1002/berj.3123
 36. P. Hardre, A. Beesley, R. Miller and T. Pace, Faculty Motivation to do research: across disciplines in research-intensive universities. *The Journal of the Professoriate* **5**(1), 2011, pp. 35–69.
 37. J. G. Bailey, Academics' motivation and self-efficacy for teaching and research. *Higher Education Research and Development*, **18**(3), 1999, pp. 343–359.
 38. F. Wood, Factors influencing research performance of university academic staff. *Higher Education*, **19**, 1990, pp. 81–100.
 39. P. Clough and C. Nutbrown, *A Student's Guide to Methodology*, 3rd edition. Sage Publications, London, 2012.
 40. M. Borrego and J. Bernhard, The emergence of engineering education research as an internationally connected field of inquiry. *Journal of Engineering Education*, **100**(1), 2011, pp. 14–47.
 41. M. Borrego, E. P. Douglas and C. T. Amelink, Quantitative, qualitative, and mixed research methods in engineering education, *Journal of Engineering Education*, **98**(1), 2009, pp. 53–66.
 42. E. P. Douglas, M. Koro-Ljungberg and M. Borrego, Challenges and promises of overcoming epistemological and methodological partiality: Advancing engineering education through acceptance of diverse ways of knowing, *European Journal of Engineering Education*, **35**(3), 2010, pp. 247–257.
 43. M. Koro-Ljungberg and E. P. Douglas, State of qualitative research in engineering education: Meta-analysis of JEE Articles, 2005–2006, *Journal of Engineering Education*, **97**(2), 2008, pp. 163–175.
 44. K. Beddoes, Using peer reviews to examine micropolitics and disciplinary development of engineering education: a case study, *Discourse: Studies in the Cultural Politics of Education*, 2012, DOI:10.1080/01596306.2012.745735
 45. K. Tonso, Student engineers and engineer identity: campus engineer identities as figured world, *Cultural Studies of Science Education*, **1**, 2006, pp. 272–307.
 46. L. McNair, C. Newswander, D. Boden and M. Borrego, Student and faculty interdisciplinary identities in self-managed teams, *Journal of Engineering Education*, **100**(2), 2011, pp. 374–396.
 47. H. Markus and P. Nurius, Possible selves. *American Psychologist*, **41**(9), 1986, pp. 954–969.
 48. L. Jolly, K. Willey, G. Tibbits and A. Gardner, Conferences, reviews, and conversations about improving engineering education, *Research in Engineering Education Symposium*, Madrid, Spain, 2011.
 49. K. Willey, L. Jolly, G. Tibbits and A. Gardner, Investigating research quality and the review process: some suggestions for improvement, *1st World Engineering Education Flash Week, 39th SEFI Annual Conference*, Bernardino and Quadradro (eds), September 27–30, 2011, Lisbon, Portugal.
 50. K. Willey, L. Jolly, G. Tibbits & A. Gardner, Gatekeeping or filtering?: investigating the connection between peer review and research quality, *AAEE Annual Conference*. Fremantle, Australia, 2011.

Anne Gardner, PhD, MEngStud, BE (Hons)(Civil), is a Senior Lecturer in the Faculty of Engineering and Information Technology at the University of Technology Sydney. Anne's research in engineering education has included work on improving the understanding of the learning associated with, and assessment of, collaborative learning and flipped learning environments, including the innovative use of self and peer assessment processes and the provision of feedback. This work has been focussed around providing students with opportunities to develop professional judgement. Recently she has conducted research to characterise the renegotiation of academic identity for engineering academics who are transitioning to research in engineering education. Anne has received national recognition for her work in educational research and development including the Engineers Australia Engineering Excellence Award, the Australasian Association of Engineering Education (AAEE) Teaching Excellence Award, the AAEE Award for Excellence in Research Design (twice) and an Australian Learning and Teaching Fellowship.

Keith Willey, PhD, BE(Hons)(Electrical) is an Australian Learning and Teaching Council Fellow, and works for the University of Sydney in the Faculty of Engineering and Information Technologies. He began his academic career in 2002 after 20 years in industry. In the area of education, Keith's research interests include the learning and assessment associated with working collaboratively and in teams, the social construction of meaning and standards, the impact on student learning and professional development (affective and *cognitive*) of self and peer review, collaboration, feed-forward,

learning activities and assessment design. His commitment to developing high quality teaching and learning practices is supported by his educational research published in journal articles and peer reviewed papers. Keith is also the Project Manager and lead developer of the collaborative learning and self and peer assessment software tool known as SPARKPLUS currently being used by faculty at over 20 Australian and international universities.