

Authors' perceptions of peer review of conference papers and how they characterise a 'good' one

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INTRODUCTION

Peer review has been the focus of an ongoing study at the 2010, 2011 and 2012 conferences of the Australasian Association for Engineering Education (AAEE) [1 – 3]. We found that the opportunity to use the peer review process to induct people into the field and improve research methods and practice was being missed with almost half of the reviews being rated as 'ineffectual'. The results also highlight the lack of a shared understanding in our community of what constitutes quality research. The study has been extended to explore the AAEE authors' perspective/s of the potential of peer review to support their development as researchers.

This is particularly relevant to our community as engineering education research is still emerging as a recognised research area in Australian universities [4, 5]. Another complicating issue is that most scholars who identify with this emerging field are engineering academics [6] who may hold research qualifications and expertise in their own stereotypical engineering field but are faced with developing new perspectives and expertise when moving into educationally related research [7].

As a result of engineering education research being both emerging and interdisciplinary there is a wide variety of views as to what quality research looks like [6, 8]. The implication for authors is that their work can generate divergent opinions which can be difficult to interpret and/or reconcile for the final version of their paper.

A broad objective of this research is to help members of the AAEE community to better understand themselves and their peers as they struggle with the new ideas, methods etc involved in social/educational research compared to positivist perspective of most engineering research. In better understanding themselves and their peers this transition can hopefully be better supported. More specifically the findings of this project can inform future strategies of professional associations such as AAEE and SEFI in regards to both supporting members in becoming engineering education researchers and in managing their annual conferences to that end.

1 BACKGROUND

Part of the difficulty that engineering academics have with becoming the interdisciplinary researchers they need to be is that social research is so different to stereotypical engineering research. Jones notes that in consensus-based disciplinary classification schemes "*high paradigmatic fields have high levels of agreement among their practitioners with regard to issues such as appropriate research topic and methods*", such as engineering, while "*low paradigmatic fields have less agreement in relation to*

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appropriate research questions and even less agreement on appropriate methodology for addressing these questions" [10, p.11], such as education. Alise [11] showed that there are differences between academic disciplines with regard to preferred research methods with engineering in the disciplinary classification more likely to use quantitative methods and education in the classification more likely to publish research using qualitative and mixed methods.

Researchers attribute this preference for quantitative research to our formal training as engineers which influences expectations and norms for engineering education publications where generally, quantitative and positivist research is dominant [6, 8, 12, 13, 14]. 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... [6, p. 23].

Thompson suggested that *"through interactions with faculty members graduate students are encouraged, reinforced, and rewarded for their display of attributes salient to the academic discipline, and thus academic environment"* [15, p.428]. So postgraduate and, to a lesser extent, undergraduate engineering education acts to socialise participants to the context of engineering research which is different to the context of educational research. For engineering academics wanting to change their practice to engineering education research, not only do they have to negotiate the differences inherent in a different type of discipline, they usually don't have the socialisation process of being a graduate student to become familiar with them. This process is, instead, undertaken through engagement with the engineering education research community, and peer review is an important instance of this engagement.

2 DATA COLLECTION AND ANALYSIS

This study focuses on engineering academics with engineering qualifications, who are also '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 (available in the proceedings) was used to identify thirty-eight potential participants. Nineteen of these authors accepted our invitation.

Participants were classified according to what type of university they work for (Group of Eight (Go8), Australian Technology Network (ATN), regional, or metropolitan unaligned) as described in Table 1, and their level of expertise in engineering education research. A participant's level of expertise as an engineering education researcher was determined by the number of specific types of publications they had written in the last four years (conference papers, journal papers, and/or 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, supervising postgraduate research students working on educationally related topics, and 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.

After ethics approval, semi-structured interviews were conducted with each participant in their campus office, or an alternative location nominated by them, and took approximately an hour. During the interview participants were asked to explain the various roles they enact in bringing their research to publication (e.g. learner, collaborator, editor) and explain any changes they had made between the draft and final versions of their 2012 AAEE conference paper, especially in response to the paper's reviews. This generated discussion about their research, how they write about their research, and the peer review process.

Transcripts were created from interview audio recordings which were then coded in NVivo 10 for inductively generated themes [16]. This analysis began with the transcript of the first interview and continued as each interview was conducted. It was through this parallel interview/analysis method that we noticed the frequency that participants mentioned 'quality assurance' as a reason for having peer reviews of conference papers. This prompted us to specifically ask in the remaining interviews what the participant meant by 'quality' in a conference paper. Our analysis became focussed on their answers to the following questions:

- What is the purpose of peer review?
- What do we mean by quality in the context of a conference paper?
- What are the characteristics of a quality review on a conference paper?

Quotes from our participants are included as the major data source in this research. Participants are indicated by a pseudonym, their level of expertise and the type of university they work at.

Table 1: Categorisation of participants by expertise and university

Type of university	Description
Group of Eight [Go8]	The 'Group of Eight' (http://www.go8.edu.au/home) is a coalition of eight research-intensive universities located in state capital cities, which tend to be the oldest universities in Australia.
Australian Technology Network [ATN]	The ATN is an alliance of five universities, each located in the capital city of a mainland state of Australia. These universities badge themselves as practice-based and their research is focussed on the needs of industry and the community.
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.
Metropolitan unaligned	The metropolitan unaligned universities are those based in a state capital city, but not included in the Go8 or the ATN.

3 FINDINGS AND DISCUSSION

3.1 Purposes of peer review

All participants gave multiple reasons for having a peer review process. Their responses are listed below with the number of participants who referred to that reason given in brackets:

- to provide feedback to authors to help them to improve their paper (11),
- to assure the quality of papers in the conference proceedings (11), and hence
- lift the profile of engineering education community and the conference (5),
- to keep out inappropriate papers ie gatekeeping (5),
- to comply with government regulations for what is 'counted' as a publication (3),
- to provide validation to authors that their paper meets the required standard (1) and,
- to have members of the community engage with each others' papers (1).

The value of the numbers in brackets in the list of bullet points above are not significant in themselves, but indicate how commonly participants mentioned that reason for having peer review. Together the list indicates the range of reasons that participants mentioned, rather than attributing relative importance to each aspect.

However, we can see that providing feedback to authors to improve the paper was seen as a reason for peer review equally as frequently as the quality assurance aspect of peer review. This view was shared across emerging, intermediate and established researchers at all university types:

I guess the purpose of that is to ultimately assist the author to do a better job and improve the final paper. [Alex, emerging, regional]

...the review process should be about making the paper better... and that's my approach, when I review a paper. It's about making it better. [Adele, emerging, Go8]

I suppose one of the main purposes of the review is to improve the quality of the conference papers. [Nathan, intermediate, metropolitan unaligned]

...the other option is hopefully to improve the quality of the papers. [Rob, established, ATN]

Our participants told us that having a peer review process drives authors to write better papers and design better research which will lift the profile of the engineering education community and the AAEE conference:

I think the reviews should be there so that total [word deleted] doesn't get published. Because they do become public documents of the society. They're there for people to access and use however they will in the future... [Mark, emerging, Go8]

...if you don't have a proper review process you just don't write the papers as well. You don't think as much about your own papers, you don't review the literature in such a deep way, you don't construct your argument so well, and so on... So the depth of the quality of the research is much improved by having a really effective review process. So, in terms of the profile of engineering education research, I think it's really vital that we do this. This is something that we can do as a community that will help catch up the lost ground compared to the more technical disciplines that aren't doing this. [Therese, intermediate, ATN]

...there are so many people going to engineering education conferences thinking that oh, all I have to do is talk about how I teach. I struggle with people coming into it trying to make them understand that the same rules and standards apply to the technical researchers, to the educational research... so the reviews are great for people coming into the area to be reminding them of the process and ensuring that they are actually conscious of what's happening, so that we're not just having papers presented at conferences and people getting recognition for putting up something that's not new or innovative or adding something to the community. [Erica, established, regional]

While participants mentioned the gatekeeping function of peer review the views ranged from the pragmatic:

At one level it's eliminating papers that are clearly inappropriate and I've had those experiences in the past, particularly from overseas delegates. [Rob, established, ATN]

to the more sinister aspects where peer review is seen as potentially censoring/blocking new ideas or research methods. We note that this was more commonly an issue for established researchers, who are more likely to be using a variety of perspectives and methods in their research:

... and the review process is - well it is sort of gatekeeping in a sense...first of all we keep out ideas that we're not comfortable with. We don't want people to upset the apple cart too much. So there's definitely an element of that. [Stuart, established, Go8]

I think as well - not just improving the quality - but I think they can focus the work that's done, and I don't know if that's necessarily a good thing. But certainly the criteria that we used ...in 2012, tended to focus on one type of work over another... [Will, established, metropolitan unaligned]

Three participants mentioned that we have peer review because peer reviewed conference papers are counted under government requirements as contributions for determining the funding paid to universities, and hence valued by our universities:

...the other reason is that the government actually gives a small amount of funding to the universities for each paper that they publish. There's different dollars for different categories, obviously journal and conference. But in both journal and conference, there's peer reviewed, non-peer reviewed. [Tom, emerging, Go8].

One of our participants commented that peer review validates for the author that their paper meets a standard. While this is feedback to the author it is not feedback to improve the paper but an indication that the paper has met the standard:

...make sure that the quality of the work is of a standard - is of a level where it can be sort of benchmarked against other people's work - sort of give you confidence that what you do is not rubbish... [Steve, established, ATN]

Another identified role of peer review is to motivate members of the community to engage with each others' papers:

I think it's a very important part of engaging the community with each other's papers. ... suddenly I find myself reading five papers of a different field and thinking that's a great idea, that could help with this... So I think reviewing conference papers is a very important part of mixing the ideas throughout the

community ... I think it's an important part of sharing of ideas and absorbing those ideas into your own work after the conference has finished. A large part of what I retain from a conference will come from the papers that I've reviewed. **[Therese, intermediate, ATN]**

Although peer review is required to meet government and institutional requirements for papers to be acknowledged as a research publication, we argue that our engineering education community needs to do more with the peer review process than this gatekeeping and compliance. In the absence of the typical postgraduate socialisation process, feedback in peer review should be aimed at assisting authors to develop the standards and norms of the interdisciplinary field and develop researchers' judgement by for example, challenging them to reflect on their perspective, data collection, analysis, and interpretation of findings. Similar arguments have been developed in relation to peer review in the domain of science education research [17, 18, 19]. Our participants see the provision of feedback to improve the paper as equally as important as assuring the quality of papers at the conference. We ask reviewers therefore to keep this function of peer review in mind when writing their reviews, as well as thinking about the review process as a professional development opportunity for themselves. Since reviewers are typically sourced from the whole community rather than just those who submitted conference papers, the review process is also a way to keep everyone involved in the conversation. In this way the peer review process can be used to build a sense of community to ultimately improve the body of work and hence the standing of the research domain.

3.2 Characteristics of a quality conference paper

The two most commonly mentioned reasons for peer review both relate to quality. This motivated us to find out what our participants actually mean by quality in relation to a conference paper. As with the question of what reviews are for, participants usually mentioned multiple characteristics of quality which allowed us to identify the following aspects of a 'good' paper:

- the paper would be of benefit to others:

... you should say something that's of importance to the audience that you're presenting to. That's the most fundamental thing... **[Tom, emerging, Go8]**

... I try to think of a conference paper - what use is this to somebody? What do I want to get out of this conference paper, other than just racking up the publication count? **[Sam, intermediate, regional]**

- the paper cited literature which provided background to the work and identified a question to be addressed:

Not just listing other studies but saying how they relate to the paper and using them to identify a "hole" in the literature. **[Ian, emerging, metropolitan unaligned]**

...how well is it grounded in ongoing discussions? In other words, referencing literature... there's literature in engineering education, there's literature in education in general, there's literature in cognitive psychology - whatever and whatever... but I think of them more in the context of a paper, as what discussions am I drawing on in order to then make my point? In that way, what discussions am I contributing to? ... **[Will, established, metropolitan unaligned]**

- sound methodology is described

I'd be looking for whether it was sound in what they've done, their methodology... **[Mike, emerging, Go8]**

...it's the quality of the design and of the methodology. So does the issue align with the question, align with the approach...Is the logic train within the methodology and the approach sound? Or are there big gaps? **[Will, established, metropolitan unaligned]**

- there is a clear explanation of what was done and the structure supports the explanation

...the quality of your exposition. So for a suitably knowledgeable person, how easy is it for them to pick up my paper, read it, understand it and perhaps even implement it, if they felt inspired to do so. **[Tom, emerging, Go8]**

...you've thought through the way your paper is structured and the way your presentation is going to be structured, so that it's going to be useful to other people. **[Sam, intermediate, regional]**

- conclusions are supported by evidence:

In a lower quality paper authors will “... *make conclusions which aren't supported by anything... and I think some evidence, whether it's statistical or not, still needs to be provided otherwise it's just an editorial.*” [Evan, emerging, Go8]

... *the person's not just expressing their opinion, they've actually done a bit of work to substantiate it. That's probably really what it is.* [Terry, emerging, metropolitan unaligned]

- the language was of a professional standard

...*carefully crafted and polished language* [Ian, emerging, metropolitan unaligned]

Can I read it and understand what the authors are actually saying? Regardless of the quality of what they're saying, can I actually read it and go I can follow the logic? I can follow what you're actually saying. Or, is it just so badly written that it takes me a longer time to break it down?...I think the most important aspect of quality is the level of writing. [Will, established, metropolitan unaligned]

In the previous section we called on reviewers to keep the purposes of peer review in mind when they write reviews on draft papers. We now call on authors to assess their own papers as to whether they possess the characteristics of a high quality paper as outlined in this section. As in all assessment processes though, the expected standard of performance then becomes the issue to be clarified. That differences in the expected standard exist in our community is evidenced by the comment of an established researcher in respect of her draft paper compared to the reviewers' decisions:

...*sometimes I'll put in a paper and I'll think oh, that's going to get hammered. It's crap, but I've run out of time and at least using the reviewing process will give me an opportunity to re-write it. Then it's really sad when it comes back with this is good, accept that - you think what? How did that happen?* [Erica, established, regional]

3.3 Characteristics of a quality review

Our participants both write reviews and receive reviews on their own papers, so when discussing the review process they often alluded to characteristics of what makes a 'good' review. This is not 'good' in the sense of positive, but rather is useful to the author. These characteristics include:

- starts with a positive statement about some aspect of the paper:

... *but saying something really positive like that at the start, you're just more open to what they're saying after it. If you start straight away on a negative, it just taints your view of how you read everything else.* [Sam, intermediate, regional]

So when my reviewer had written the focus of the paper is very clear within an interesting question posed, I was eating out of his hand and everything else he said about the paper I just thought yes, yes, yes. So that really helped set my mood up for being open to the critique that came after that first very nice comment. [Therese, intermediate, ATN]

- suggests relevant references:

Perhaps we could look up on who to read. That would be brilliant sort of feedback and that's the sort of feedback that would be very well received and definitely acted upon. That would instil a level of curiosity. You'd think, okay, there's a lot of people we haven't read. Let's follow this up. [Neil, intermediate, Go8]

Sometimes you get recommendations to look at a different body of work, which are really useful, and that purely depends on the reviewer. [Sam, intermediate, regional]

- critiques methodology and data collection:

...*often the feedback is around your methodology and your data collection... there are so many different ways and different methodologies of collecting data and writing it up and analysing it, often you're a bit blinkered I think sometimes in how you try to present it, or how you synthesise it. So it's good...as an author and as a reviewer as well, to try to critically analyse what other people have done.....your feedback from a reviewer might tell you... why haven't you looked at this and where's the evidence, or what's the actual outcome here?* [Steve, established, ATN]

- frank about weaknesses in the paper:

...the reviews that say well I just plain don't understand this is actually quite valuable because it means that you can address it... every paper where I've had fairly strong critique I've recognised that the final paper has been just so much stronger based on that feedback ... it's that wakeup call that you need...
[Erica, established, regional]

- specific in suggesting solutions to paper deficiencies:

*But it's often very difficult when they make a general statement, and you think, well, which bit of the text are you referring to?...I have to say, with all the papers I got, it was, okay, you've made 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, is knowing exactly where their particular comments are relevant... **[Adele, emerging, Go8]***

*...specific advice on what to do regarding specific problems... But when you get reviews that just say, this is bad, this should be better... this doesn't do this, and point out the problems... without suggesting any solutions, then that's not very constructive... **[Neil, intermediate, Go8]***

- reviewers should explain their opinion:

*... then you get, excellent... I actually find ... excellent, as the sole comment, actually sometimes more frustrating. Because you think, well, could you actually tell me why it was excellent so that I know what I did well? What was good about it, so that I can do it again? **[Adele, emerging, Go8]***

- critiques written expression, spelling and grammar:

*I think the chance for someone to step back unemotionally and assess the clarity of the statement, clarity of the argument ... certainly it gives another perspective where you think you've expressed it as clearly as it needs to be, but someone else obviously doesn't understand it, some aspect of it, and so it's good to then in your re-writing try to make it so much more generally understandable that anyone should be able to read it, as long as they've got a half decent background in the field. **[Wayne, emerging, regional]***

A common comment from emerging researchers in relation to reviews was their difficulty in interpreting what the reviewer meant. This highlights the need for reviewers to clearly articulate their thinking. Authors will find it difficult to improve their paper in line with a reviewer's comments if these comments don't clearly explain what the reviewer means. Established researchers also referred to interpreting reviewers' comments but usually it was in the context of interpreting reviews for their less experienced colleagues, rather than reviews on their own papers.

4 SUMMARY

This paper examines the individual's experience of the peer review process to explore implications for the wider engineering education research community. A thematic analysis of interview transcripts showed that providing feedback to authors in reviews was mentioned equally as frequently as the role of quality assurance of the conference papers.

We used responses from participants from various levels of expertise and types of universities to identify what were for them the elements of a quality conference paper and a quality review. For a conference paper these included that it should be relevant, situate itself relative to existing literature, state the purpose of the research, describe sound methodology used with a logically developed argument, have conclusions supported by evidence and use language of a professional standard. A quality review should start on a positive note, suggest additional literature, critique the methodology and written expression and unambiguously explain what the reviewer means.

The lists of characteristics of a good paper and a good review share elements such as attention to relevant literature and methodology. There is also substantial overlap between how our participants characterise quality papers and reviews and the review criteria used for the AAEE conference, and for such publication outlets as the European Journal for Engineering Education (EJEE) and the Journal of Engineering Education (JEE). This suggests some level of agreement in the community about the elements that indicate quality. However, we need to continue discussions about what we mean by 'sound' methodology and 'good' evidence as well as establishing some shared language and understanding of the standards required in regard to the review criteria.

The results of this study represent the first steps in improving our shared understandings of what constitutes quality research in engineering education for our community, and how we might better convey that in offering constructive advice to authors when writing a review of a conference paper. Since the peer review process has implications for the development of individual researchers in the field and hence for the field overall, it seems reasonable to ask reviewers to pay attention to how they write reviews so that they create the potential for engineering academics to successfully transition into this different research paradigm.

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