Conferences, reviews and conversations about improving engineering education.

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Abstract*: Peer reviews are supposed to ensure the quality of published work and are also applied to confer=ence papers with the same aim. But numerous studies have demonstrated that reviews cannot be considered objective or reliable. Even if they were they do not provide the opportunity to refine and develop ideas that conferences such as REES promote. We began by examining how well reviews of papers submitted to the 2010 conference of the Australasian Association for Engineering Education helped authors to improve and found them to be often inadequate. The literature reveals that this is true for peer review generally. We conclude with some suggestions for how ideas might be shared, developed and disseminated through scholarly conversation while avoiding most of the pitfalls of the review process.*

Context: what do we get out of conferences?

It has been said that peer reviewed papers are a kind of "conversation in slow motion" (Origgi 2010) which regulates the quality of scientific work and disseminates ideas. For many of us, conferences are a stage on the road to publication which offer one way to try out ideas before too much is invested in them, and to speed up the conversation. From the point of view of the community in our field of engineering education, where the members are primarily trained in engineering rather than education, conferences are important places to share strategies and to encourage more systematic and well-grounded research. The importance of the conversational function of conferences has been acknowledged in previous REES meetings through an emphasis on using sessions for discussion rather than presentation. But the use of such discussions for improving practice and refining knowledge carries with it a significant gatekeeping dimension. Who gets to decide what topics are worth raising, what methodologies are considered valid and what voices should be heard? As we know, this is the function of peer review, where those who are deemed to have expert knowledge in the field regulate acceptance or rejection. But as we are all well aware, the flaws in such a system include the potential exclusion of new ideas and approaches and the reduction of a field to endless repetition of what is already well known. It can be difficult to try out new ways of thinking that don't match current orthodoxy or to import ideas from other disciplines. This is particularly unfortunate in the case of conferences, where face to face real-time conversation is actually possible, if ideas can get ver the initial hurdle of being allowed into the conversation.

For well over a decade there has been substantial disquiet over the adequacy of peer review as a mechanism to regulate scientific enquiry (Goodstein 2000) with some studies suggesting that on any

measure, peer review fails to improve manuscripts and disseminate important research findings (Fitzpatrick 2010, Lipworth and Kerridge 2011). There are now international conferences on the subject of peer review (see for instance www.iiis2011.org/wmsci/Website/AboutConfer.asp?vc=27) and its inadequacies. Even if peer review did have the capacity to improve scientific conversation, it would be a rather one-sided conversation, since authors have limited right of reply. The review process does not really allow for the conversation to change ideas on both sides, but is more often a hurdle to be overcome. We are of the opinion that work in our field can be improved by conversations, debate and publication, but we want to know what role peer review fulfills currently and we want to consider what kinds of mechanisms are likely to maintain and improve standards while allowing the conversation to go on. Finally we want to consider how such mechanisms might be instituted in this community of engineering education research.

Frameworks: Epistemological considerations

Fitzpatrick (2010) points out that the peer review process for published work is based on the implicit assumption that one or two reviewers can decide on the truth or otherwise of what is submitted. She is of the opinion that the authority and prestige conferred by this assumption undermines reviewers' ability to exercise what Origgi (2010) calls "epistemic vigilance"; a reflexive and critical stance on the reasons, biases and pressures that make some topics emerge and thrive and not others. This requires a reviewer to be aware of how their opinions, no matter how well informed, relate to the rest of the field and all possible alternatives and to take personal responsibility for their views. Yet studies which show that agreement between reviewers happens no more often than predicted by chance (Rothwell and Martin 2000, Peters and Ceci 2004) raise questions about the reliability of reviewers and their ability to maintain standards.

Nor are reviews better at developing community through conversation. Anonymity can shield reviewers from responsibility and foster half-hearted, carping and even dishonest reviews (Fitzpatrick 2010). The habit of allowing reviewers to add private comments for the editors' eyes only further excludes the author from equal participation in the conversation.

The existence of various forms of "open review", whereby a paper is "published" online for comment and feedback and only "reviewed" formally once a consensus has been reached on its worth, is just one alternative to existing review procedures that indicates that the way we review now is not essential to quality control (Fitzpatrick 2010). Instead of one or two reviewers having the freedom to play out their biases we need debates about what is good and interesting. Instead of a single round of comment, we need the ongoing development of ideas in conversation. We decided to allow authors in our local engineering education community to review their reviews in order to see how well the system was operating and what authors felt was helpful or otherwise.

Methodology: Constant comparative analysis of responses to reviews

The Australasian Association for Engineering Education (AaeE) has been actively pursuing improvement in engineering education research quality, including examination of the quality of the peer review process. For the first time at the 2010 conference authors were asked to use an online tool ($SPARK^{PLUS}$) to rate the quality of their reviews and this de-identified information was discussed with delegates in an open forum at the conference.

In the analysis that follows we consider only the reviews of papers that were accepted into the "Research' category (n= 66 reviews two each for 33 papers), since clearly expressed criteria were provided for these papers and were available for authors and reviewers from the beginning of the review process. These criteria are listed in Figure 1. In this category 23 authors (70%) responded to the invitation to assess and comment on their reviews and we have considered all of these here. The online tool used to collect these assessments comprised seven questions rated on a Likert scale (strongly disagree to strongly agree - see Figure 1) but we will concentrate here on the answers to the open-ended questions, for what they tell us about what authors feel about the review process.

Table 1: Review Criteria for AaeE 2010 'research' papers

1. Context and research questions	
Excellent	The situation being investigated is clearly and concisely described and generates the research questions in a logical manner. The paper shows evidence of familiarity with the research literature in engineering education and where appropriate more widely. The research questions make clear what the researcher wanted to know about the situation and are questions that can generate valid and reliable answers.
Good	Covers all points above but less clearly and systematically. The description of the situation may lack relevant detail OR the use of existing literature may be sketchy or tokenistic OR the questions may lack clear logical connection with the situation and literature and/or may not be susceptible of clear answers.
Poor	More than one of the faults referred to above.
2. Theoretical frameworks	
Excellent	The research is clearly situated within overarching explanatory frameworks appropriate to the research questions and the situation being researched. The concepts of the theoretical frameworks are used to structure the data gathering and/or analysis.
Good	Shaky or partial links between the theory and the research questions and data.
Poor	No or token use of theoretical frameworks or theory that is not well chosen for the research questions. Misunderstood theory.
3. Methodology	
Excellent	The methodology describes the logic of the connection between what the researcher wanted to know and the data gathering process, making clear the strengths and limitations of the methods chosen. Well chosen and imaginative data gathering methods.
Good	Adequate but limited (?pedestrian) choice of methods. Sketchy rationale.
Poor	No rationale for choice of methods. Poorly chosen methods.
4. Findings and Conclusions	
Excellent	The findings are well argued on the basis of the data presented. Alternative explanations are considered and their rejection explained.
Good	Good connection between data and conclusions.
Poor	Findings do not account for all of the data presented or are not well supported by the data.
5. Discussion	
Excellent	This section returns the reader to a consideration of the starting point of the research. It may discuss how the findings clarify the original situation of interest, throw new light on the theoretical stance taken or the methodological adequacy of the research and/or make recommendations for engineering education research more widely. Answers the 'so what?' question.
Good	Points out the relevance of this research for understanding the original situation but makes limited reference to wider application.
Poor	Fails to connect the results of the research with the wider research environment.

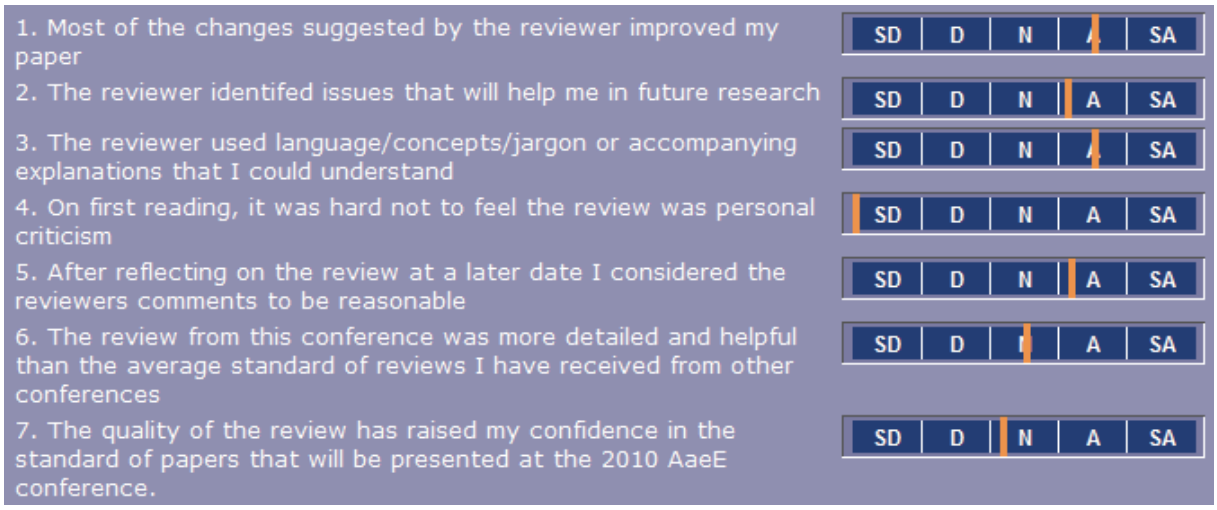

Figure 1: Likert scale questions for authors in regard to the reviews they received at AaeE 2010.

Reviews and author responses were entered into NVivo9 and coded for recurring themes using the constant comparative method to build up a codebook for analysis. The coder had not been involved in the original review process although he had been a co-author on one of the papers submitted. He did not submit an author response and thus represents someone with experience of the community but no direct former involvement in the review process which might have biased his reading of the texts. He was trained in content analysis methods and results were discussed with the other researchers on the project when analysis was complete.

Findings: paper review process inadequate to its aims

Although the provision of criteria was meant to make it clear to reviewers what the expectations of the conference organizing committee were, only 4 reviewers made explicit reference to them. Instead reviewers seemed to respond to the papers on the basis of what they decided was important (Table 2), such as grammatical errors. The lack of epistemic vigilance this indicates is embodied in the comment *"There are other typo's* [sic] *(e.g. 2nd last line on page 5 – leaning should be learning)"*. A reviewer who can point out typographical errors while making one has not, in our view, stopped to reflect on their own role, even if they are used to commenting on language usage as a result of some journals' requirements for reviews.

Table 2: Categories of explicit advice given by reviewers AaeE2010

Type of advice	No. of reviews
Gaps in logic	39
Typographical/grammar errors	34
Inadequate data handling	27
Identifying relevant literature	17

A further feature of these reviews was lack of specificity. Relatively few (17 out of 66) pointed out where authors might go in the literature to improve their argument, and only 12 quoted from the paper under review to make clear either what was wrong or how it needed to be corrected. If the aim of review is partly to improve practice, then reviewers need to be specific about how to do so. Authors who took the opportunity to make open-ended comments about their reviews also identified this (Table 3) as a failing in the reviews (Willey et al 2011). Counterproductive reviews were those which discouraged authors by not giving advice and ineffectual ones were those which failed to meet the authors desire to improve their work by commenting on how this might be done.

Table 3: Categories of author responses to open-ended questions

Category	No. of author responses
Counterproductive	3
Ineffectual	14
Cruel to be kind	1
Positive Benefit	10

A further distancing of the reviewers from the authors can be seen in their mode of address. When referring to themselves reviewers most often used the first person (sometimes in the royal plural) but occasionally using third person forms such as "the reader", as common practice in some fields (erroneously thought to be more objective) requires. 24 of the reviews avoided referring to themselves at all, giving a God's-eye depersonalized opinion. In addressing the author third person forms "the author should consider…" predominated over second person "you should…" English conversation does not allow for the use of third person between interlocutors, so we have to assume that this is not being treated as a conversation by the reviewers. In addition the distancing implied by the depersonalized forms is another indication of a lack of epistemic vigilance since the first condition of self-reflection is self-awareness. A reviewer who refers to themselves in the third person (or not at all) is not offering an opinion but expressing a truth, and this we know they cannot do.

Recommendations: possible alternative procedures

Peer reviewed publication is a process of central importance to scientific inquiry. It is a process that is the standard method of communication allowing researchers to inform others of their work, and a process by which a conversation between researchers occurs (Origgi 2010). Peer review also performs a gatekeeping function, supposedly ensuring quality research is published (Lipworth & Kerridge 2011; Fitzpatrick 2010) and thereby improving the quality of research. The problems we have identified here relate to the adequacy of peer review for these purposes. We especially question the relevance of applying standard norms of peer review to conference presentations which ought, we contend, to foster conversation and debate. The discussion of peer review for publication offers us some alternatives that might usefully be applied to conferences.

The model suggested by Fitzpatrick (2010) is that of peer-to-peer social media. In electronic media there is no scarcity of space and thus no rationale for filtering before publication. Instead, an arena is created where everything can be accepted and the participants in that space either take up the offering or not, help refine it through debate and disseminate it around the community. This is filtering by the many rather than the few and examples exist of such systems working in science and engineering (the arXiv repository for instance, Fitzpatrick 2010). The examples Fitzpatrick discusses may or may not go on to paper publication but such a space could also be productive in raising the quality of conference discussion. Review of abstracts or papers could be replaced by online discussion. Over some weeks that discussion would identify the issues of most interest to the community. The conference could then be organized around discussion sessions on those themes. This is similar to the way REES works now but the community vets the discussion, not a few fallible reviewers. There is ample evidence that such processes actually raise the level of debate as long as a few basic principles are adhered to. The forum must not be manipulable by a few gatekeepers. Participation must reach a critical mass and for most academics that means it must be built into institutional reward systems. We have to start arguing that this kind of activity be included in the impact measures of our work. And finally there has to be some quality control - but of participants not submissions. Fitzpatrick (2010) suggests this may be done by participants vouching for newcomers.

Attendance at conferences is a valuable part of developing ideas because it allows for conversation and debate. The review process can tend to limit such debate, and this is particularly unfortunate in an interdisiciplinary field such as ours. We look forward to discussing the alternatives we have put forward here with you.

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First call for Papers

2011 Research in Engineering Education Symposium

October 47, 2011 in Madrid, Spain

Dear Colleague,

It is my pleasure to invite you to participate in the **2011 Research in Engineering Education Symposium** to be held October 4 - 7, 2011 in Madrid, Spain. The main theme of the conference is Engineering Education Research. All studies aiming to contribute to our understanding of Engineering Education are welcome. Within this broad theme, the following sub-themes have been identified:

- Teaching and Learning in EE
- Innovation and Technology
- Gender and Diversity
- Curriculum Evaluation and Accreditation
- Classroom Experiments
- Transition from School and into Industry
- Methodological issues in EE

Within each category we aim to invite one “state of the art presentation”. Contributions can include research reports, work in progress and case studies.
As in previous years, we are seeking contributions that represent high-quality research activity across a diverse range of research traditions and will contribute to engaged conversation during the conference.
Abstracts and full papers will be blind-reviewed and will be published on a CD, with an ISBN. This will not preclude revised and extended papers to be published in a journal following the conference.
This message is to get the conference dates in your diary and to make you aware of the publication dates.

One page abstract and Expression of Interest	**28 February**
Review and acceptance	31 March
Full paper	**31 May**
Review and notification	30 June
Final versions	**31 July**
Publication to participants	31 August

Submission of abstracts will be at: http://www.easychair.org/conferences/?conf=rees2011. You will need to create an account at Easychair if you don't have one already. Easychair was used for REES 2009, so you can use the same account as before. Just click on the link above. If you have any problems with Easychair, please contact Emilio Jose Fernandez at: ejfernan84@gmail.com

The conference venue is Hotel Santo Domingo (http://hotelsantodomingo.es) which is situated in the heart of Madrid. It is 20 to 30 minutes by taxi to Barajas Airport, 9 minutes to Atocha railway station, 18 minutes to Chamartin railway station, and is close to several underground stops (line 2 at the door of the hotel and lines 3, 5 and 10 within 5 minutes walking).

The conference website is at http://grou.ps/reen/home

- Preliminary Program
- Registration Form
- Conference General Information and Fees
- Payment information form

We look forward to your participation.
Sincerely,

Wilmar Hernandez, *REES 2011 General Chair* Associate Professor
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Research in Engineering Education Network

We are delighted that REES 2011 will be hosted by the Universidad Politecnica de Madrid. REEN is becoming an increasingly important platform for sharing and building knowledge in and about engineering education research. REEN (Research in Engineering Education Network) grew out of REES (Research in Engineering Education Symposium) and was established to address the need for an international forum for scholars interested in discussing and advancing research in engineering education. Our mission is to provide an *independent, international and inclusive* forum to advance scholarly discourse on research in engineering education. We aim to provide a vibrant and welcoming community in order to nurture developing researchers and through collaboration and sound methodological approaches address the challenges within Engineering Education.
In working towards making this vision a reality, a series of goals has been developed.

REEN aims to promote:

- the development of new knowledge and increased understanding of engineering education;
- the development of research competencies in the field of engineering education;
- the sharing of knowledge and experiences among researchers in the field of engineering education;
- the sharing of and mutual respect for different approaches to research, different ways of knowing and different knowledge bases; and
- meaningful collaboration between engineering education researchers working in different parts of the world.

I urge you all to join us in stimulating and diverse conversations, debates and the development of future collaborations.

Caroline Baillie, Chair of the REEN Governing board
Professor of Engineering Education
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