

Emergent themes in critically reflective conversations on (humanitarian) engineering teaching practice

Chang, Rosemary^a; Daniel, Scott^a; Dixon, Claire^a; Newbound, Mark^b;
Toifl, Melissa^b; Rayburg, Scott^b.

Swinburne University of Technology, STEM Practice Academy^a and

Faculty of Science, Engineering & Technology^b

Corresponding Author Email: rchang@swin.edu.au

BRIEF ABSTRACT

This paper reports on a participatory project that brought together five engineering educators for collaborative, agile professional development and research. Informed by Brookfield's (2017) approach to "critical conversation groups", five staff with a shared interest in humanitarian engineering came together with an academic developer to engage in facilitated, critically reflective conversations. The project explores an organic group-directed reflective process for academics' professional development, and asks: How would the reflective process evolve, what directions might we take, and what would be our lived experience as co-researcher/participants on this shared conversational journey? The meta-reflection, reported here, reveals three emergent themes: facilitative teaching and embracing our humanness; from immersive learning to transactional teaching; and empathy in human-centred engineering. Consistent with a methodology that values co-researcher/participants' voices, the paper is presented in script format, which includes individual CRPs' names.

KEYWORDS

Critically reflective practice, teaching, academic development, participatory research

Background and Introduction

Engineering educators face a rapidly changing world with pressing, complex problems—as do the academic developers who assist them to develop their teaching approaches. Both these groups share a goal of supporting learners to become engineers who make positive contributions to the world. Educators have diverse backgrounds and needs, arguably even more so in the context of humanitarian engineering, and so we were interested in exploring an approach in academic development that could be agile and responsive to diverse needs.

We looked to the concept of academic practice. Historically, academic development has adopted a training and development model, however sometimes this approach can lean towards courses and workshops that are de-contextualised from participants' practice. By contrast, in this project we were interested in models suggested by the lens of academic practice. We drew on Boud and Brew's (2013) argument for a model of academic development that is "grounded in the social practices of academic work and those who undertake it" (p. 209). Indeed, as a social practice, academic staff co-construct academic practice together with colleagues and learners. Steven Kemmis and colleagues (2014) (extending Theodore Schatzki's work (e.g. 2001, 2012) present practice in terms of "*practice architectures...* [which are] the *sayings, doings, and relatings...* that hang together" (p. 31, italics in original). In this project, we are interested in reflecting on and extending the sayings, doings and relatings of academic practice in relation to teaching.

Method

Drawing on practice theory, we commenced a collaborative project using critically reflective conversations as a method to develop understandings of academic teaching practice. The intention was to collaboratively engage in reflection for professional development, rather than to enact immediate change in teaching and learning. Informed by Brookfield's (2017) "critical conversation groups" (p.115-116), five academic staff with a shared interest in humanitarian

engineering, particularly the Engineers Without Borders (EWB) Challenge, came together with an academic developer to engage in critically reflective conversations. The project explores the question: How might the reflective process evolve, what directions might we take, and what would be the lived experience of the participants on this shared conversational journey? The conversations drew on a critical approach to reflective practice, particularly reflection-on-action (Schön 1983), and the “forethought” and planning of “reflection-for-action” (Thompson & Pascal, 2012, p. 317), and were conducted with a deliberately participatory stance (Kemmis, McTaggart & Nixon 2013). All participants were co-researchers who collaboratively determined the conversational direction (to serve their professional development needs) and, in turn, the research and writing. Thus, in the conversations and report writing we deliberately used an organic and exploratory approach (in the tradition of Laurel Richardson’s (2000) seminal work on writing as a method of inquiry). To that end, the “emergent themes” reported here are literally themes that emerged through our process of conversing and writing.

The method for Stage One of the project, reported here, involved three iterative cycles of generative conversations, which were audio-recorded, transcribed, and used to prompt further reflections between meetings. The academic developer facilitated each conversation, the research, and participated as a “critical friend” (Costa & Kallick 1993). The conversations did not follow pre-set topics, as in focus group or semi-structured interview methods. Instead, topics within the broad remit of academic practice were generated by co-researcher/participants (CRPs) through consensus. In the first meeting, CRPs chose to explore their experiences teaching the EWB Challenge (EWB 2019a) and facilitating EWB Design Summits (EWB 2019b), and to raise topics for future discussion. Transcripts were produced (26,160 words total), which CRPs reflected on between meetings in a process of iterative analysis. That is, CRPs used transcripts to inform the agenda for the subsequent conversation. From the second meeting, CRPs’ reflections began with a focus on humanitarian engineering but expanded to engineering education more broadly, and we are currently considering exploring further in a Stage Two of the project. While projects of this kind may be uncommon in the AAEE community, there are precedents such as auto-ethnography (Guyotte & Sochacka 2016; Sochacka et al. 2016) and within engineering education specifically (Thompson, Chua, & Joslyn 2014).

Trustworthiness and research quality

The concept of trustworthiness is central to this methodology. By using a “critical friend” and building on other methodological precedents (e.g. Brookfield 2018; Richardson 2000), we argue for the trustworthiness of this study. Walther et al. (2013) framed research quality in engineering education by adapting notions of reliability and validity to the processes involved in interpretivist research. For example, by using verbatim transcripts of our reflective conversations, rather than our separate idiosyncratic recollections, to prompt subsequent reflections we improve the *process reliability* of our research. Likewise, by grounding our participatory approach in the relevant literature about reflection-on and -for action (Schön 1983; Thompson & Pascal) we can argue for the *theoretical validity* of our research processes.

In this work, we were interested in comparing and contrasting our different experiences of teaching the EWB Challenge. Therefore, the fact that we, as participants, have very different backgrounds, as well as the commonality of the EWB Challenge, is arguably a type of purposeful sampling to generate different perspectives, and thus would be a form of *procedural validation* in Walther’s framework.

By being transparent in this paper about these different backgrounds (as detailed in the Appendix), we give the reader some insight into the different lenses we each bring to the conversations and reflections described here. This helps establish the *communicative validity* of our work. Finally, its *pragmatic validity* is established by this process being meaningful for us as participants. By sharing our process and reflections with the wider engineering education community, it is our hope that we can further contribute to the *pragmatic validity* of our work.

This paper shares a meta-reflection on CRPs' experiences and processes of learning as educators through reflective conversations. The companion paper shares initial, complementary findings from the project, by focusing on how physically and culturally immersive in-country learning experiences (such as the EWB Design Summit) can be a catalyst for designing learning experiences at scale in domestic classrooms for the EWB Challenge, particularly in relation to learner empathy (Chang et al. (in press)).

What follows here is a multi-vocal report on the preliminary insights developed through this project. In the next section, we share reflections on our lived experiences of the process and a brief indication of how the conversations evolved. This is followed by themes that emerged in the reflective process and report writing, which again are deliberately exploratory, rather than presenting an argument. We offer emergent themes in: facilitative teaching and embracing our humanness; from immersive learning to transactional teaching; and empathy in human-centred engineering. As the voices and reflections of individuals are fundamental in the methodology, individual CRP's names are indicated in the text using a script format.

Reflections on the Process

Rosemary: I lead academic development initiatives in the Swinburne STEM Practice Academy. I proposed a bespoke activity of critically reflective conversations on academic practice. My intention was to leverage staff expertise, unconstrained by off-the-shelf courses or workshops. I brought together staff with expertise in courses for humanitarian engineering in two separate degree programs, with distinct approaches to learning and teaching.

As I hurried to our first meeting, after collecting recording equipment from the library, I felt excited about what we might uncover through these conversations.

Scott R: Joining the group has been a true revelation. I have not had opportunities to interact and reflect with people from outside the unit before, particularly people who are also interested in effective teaching practices, and who understand the key needs of students undertaking the EWB Challenge. In the group, conversations occurred spontaneously and were free-flowing with all participants actively engaged. In this way, new and diverse ideas and opinions were explored, and the group came up with a number of issues for further consideration.

Melissa: For me, the conversations highlighted that each of the participants had different experiences with teaching and engaging students in the humanitarian engineering space, particularly with the EWB Challenge. These conversations have allowed me to critically reflect on the strategies that I have used for teaching, engaging with, and motivating students in the past. Exploring the different teaching strategies and ideas that were presented throughout the conversations has enabled me to re-evaluate and extend my teaching practice.

Mark: I agree with Melissa. What was unique about the reflective conversations we have had is that there were people from different subjects with a wide variety of experience with similar teaching material that also included in-country involvement with the EWB Design Summits. There was also a moderator present (Rosemary) with academic knowledge around teaching practice. In-subject reflection at universities (reflection with a teaching team), from my experience, has ranged from none at all, to regular meetings with the subject's teaching staff. The value of this forum was to escape established thinking patterns and get fresh perspectives. I liked hearing about the approaches coming from Claire at the Academy, for example her exercises around mindfulness, which were radically different from anything we have contemplated (see Chang et al. (in press)). And I liked how Rosemary was able to add knowledge from current research around methodology. For example, when we were discussing peer-reviewing exercises, she talked about research that had been done in the area, giving details about methods and their effectiveness.

Scott D: Having worked in international development and facilitated a number of Design Summits, I am wary of stagnating in my teaching practice and so, echoing the comments

above, one of the benefits of this process has been to hear about different approaches and practices, and to be challenged to describe and justify my own. In particular, like Mark, I am hoping to incorporate mindfulness exercises into my teaching practice.

Emergent Theme 1: Facilitative teaching and embracing our humanness under complex conditions

Claire: These reflective conversations have been a really helpful experience for me on a number of fronts. First, it has been valuable to share, listen and reflect with peers about experiences teaching similar curriculum to improve my own practice. Furthermore, these conversations have happened in parallel with developing my Teaching Philosophy including practice principles. Reflecting on our emergent conversations has highlighted dominant values and reinforced the aspects of my teaching practice that I would like to focus on and extend.

Reading through the transcript, I've been struck by the importance of role modelling and embodying the mindsets and culture that we'd like learners to embrace. As facilitative teachers (explored in Rogers & Freiberg (1994)), rather than simply 'telling' our students to empathise with others, sit in the 'problem space', challenge assumptions, be open to ambiguity and uncertainty, be creative, be vulnerable and embrace failure as a learning opportunity, and so on, we need to 'show' them all of these things. In addition to designing content and activities to support this learning, I believe we need to approach our practice more holistically, and 'be' the culture and mindset. As teachers we should be the complex, creative, curious, imperfect, human living a values-led approach to practice and life. In short, teaching human-centred approaches requires us first to authentically embrace our own humanity and humanness.

Scott R: Claire makes some excellent points here. The challenge in living up to this ideal is the way that universities are structured, especially with the reliance on sessional (i.e. casual, non-tenured) staff (who often get little training or professional skill-building time) and workload models (for ongoing staff), which fail to account for the time it takes to both develop one's self and one's course materials at the same time. This will require a cultural shift by universities themselves as well as the staff (both permanent and sessional) who teach within them. Should we be able to create such a shift, no doubt the outcomes would be truly profound.

Claire: After 16 years working in industry, last year I made the decision to follow my passion and move into teaching. I contemplated teaching at primary, secondary and tertiary levels, eventually settling on tertiary after a series of rapid prototyping experiences. Whilst it wasn't a strong factor in my decision, I found it odd that if I were to become a primary or secondary teacher, I would have needed to complete a two-year full-time Masters degree in teaching. On the other hand, I required no such qualification to teach at a tertiary level. I'm passionate about developing my skills as a tertiary-level educator and fortunate to have support through my job to do so. Given higher education is one of Australia's biggest exports, it seems logical that we could strengthen our position through more investment in dedicated academic development support to improve teaching quality. With that said, I think there's a lot we can do individually as educators to direct our own professional development, particularly through reflective practice.

Scott D: I too find it curious that teaching at primary and secondary levels requires rigorous certification, whereas there is no equivalent tertiary requirement. Having originally trained and worked as a secondary teacher, with some primary experience as well, I've been pleased to see qualifications like the Graduate Certificate in Teaching and Learning becoming more normalised in universities (e.g. listed as "desirable" in selection criteria), and even more pleased to realise how much professional benefit it has been for me to undertake one. In addition to the extrinsic motivation of having it valued in job applications, I see its value as an extended device for reflection and for engagement with curated resources and literature.

Emergent Theme 2: From Immersive Learning to Transactional Teaching

Scott D: I joined this series of reflective conversations towards the end, having missed the first meetings while facilitating an EWB Design Summit overseas. On those study tours, we ensure that a substantial amount of time is dedicated, each day if possible, to supporting students to reflect on their wellbeing, their expectations and assumptions (and how they have been challenged), their experiences in such a novel context, and how all of that has affected their evolving understanding of the human-centred design process, and Cambodian society and culture. That is, reflecting on learning and practice is a fundamental aspect of the Design Summit student experience. This is enabled by the strong team connectivity and rapport, and the recognised importance of making space for this reflection to take place.

Half of the co-authors on this paper are currently employed as sessional staff, some of them long-term. I recall Mark's comment in the data: "I've been tutoring for ten years, and this is the very first time I've ever done anything like this before. Otherwise, it's just you go in and do your job, you know?" (Meeting 3; 20:28 min) Here Mark observes that these conversations were a first for him—the first time he'd had a dedicated opportunity to meet with colleagues, explain and reflect on his different teaching beliefs and practices, and compare them with others teaching a similar curriculum. For me, the contrast of having come from the Design Summit, where reflection-on-practice is a daily activity, to a more traditional structure where opportunities for reflective practice, and other professional development opportunities for sessional staff, are very few and far between, was striking. It opened up bigger questions about how universities generally value research over teaching, and the increasing casualisation of the tertiary teaching workforce.

Mark: Most staff, including myself, come to uni without any teaching qualification. We learn and improve mostly by trying out approaches and seeing how they work. But there is a whole world of research and thinking around teaching methods that we are unaware of, and there are very few opportunities for the people engaged with this knowledge to share their understanding so that teaching staff can improve what they do. As Scott D touched on, this is a big issue for casual staff, who typically have no training, no opportunities to formally develop skills, and very little incentive to seek training given the insecure nature of their employment. Yet these are the people at the coal face of classroom student interaction at universities.

Claire: Scott D's juxtaposition of immersive learning grounded in critical reflective practice and the increasingly transactional nature of tertiary teaching is powerful. It highlights for me an issue at the core of this trend in workforce casualisation: academic development. In a sense, our tertiary teaching staff are doing the immersive learning too, in that they are often thrown into a classroom to sink or swim. What's often missing though is the support, through critical reflective practice or otherwise, to become a confident and competent swimmer. There's a fine line between 'immersion' and 'submersion'!

Rosemary: Mark and Scott D, you point to profound ways in which location influences your practice. Kemmis (2009) would categorise casualisation as part of the "mediating conditions that structure how [practice] unfolds" (p. 22). As Scott D points out, in the case of sessional staff, this negatively impacts on your access to professional development. Your observations have implications for practice across the sector, as the number of casual academic teaching staff in Australia was estimated at over 67,000 in 2017 (Hil & Lyons, 2017, p. 44). Ironically, ongoing and fixed-term academic staff experience different but similarly adverse conditions, where high workloads and overwork constrain their opportunities to extend academic practice. It will be of no surprise to this audience that in 2017, respondents from ongoing and fixed-term

staff reported working an average of 14.6 hours of weekly unpaid overtime, in addition to the standard 38-hour week (Evans, 2017, p. 27). I am very interested to note in terms of practice architectures, these “relatings” (Kemmis et al., 2014) or the key socio-political dimensions of your work have resonated in your critical reflections (Thompson & Pascal, 2012).

Emergent Theme 3: Empathy in Human-Centred Engineering

Melissa: One of the most interesting aspects of the conversations for me has been around the role of emotion and empathy in human-centred engineering, and how to keep students engaged with this—not only throughout a project but also in their broader studies and beyond. As students face other challenges or disengage with a project for various reasons, empathy is often overridden by seeking the easiest solution just to get the project done. This has led me to realise that there is a need to challenge students more by creating conversations and classroom activities/situations directly and indirectly around human-centred approaches, as a way to keep students engaged with the need for empathy throughout a project. Overall, reflective conversations are a valuable tool for exploring values and ideas. They allow us to self-evaluate our teaching methods and strategies and challenge us to think beyond our current teaching style. This ensures that we seek to continually improve how we teach effectively as well as lead, inspire and motivate students as they solve problems that are becoming increasingly complex.

Scott R: I agree with Melissa. If our students lack empathy, or at least fail to develop it for the people they are meant to be designing for, it leads to poor outcomes for the students and for the project as well. It is a tricky issue, as I observe that many engineering students tend to avoid the more social aspects of their learning, instead preferring to focus on the technical. Ultimately, we need them to become experts in both if they are to be successful, and empathy can be a good pathway to achieving this.

Mark: The question of how to build empathy touched on by Melissa and Scott R was an issue we kept circling back to in our discussions. I think it's a particularly difficult topic not just for students but for educators. It is far less problematic to get across information than to communicate its significance. Most university education that I've been involved with only focussed on the former. However, one subject I taught on sustainable urban design had a “city as classroom” approach that required students to go out and explore given areas and talk to people. I remember a student who came across a social worker, by chance, who emphasised the need for social housing for the area's disadvantaged people, an encounter that flipped the way the student thought and also the way I started approaching the sustainability issues in class. Scott D's suggestion of getting students outside and communicating with people (described in the companion paper) recalled this approach. I think it's good, for students and for teachers too, because we also get mired in the theoretical. Practices that can push our own boundaries to consider more real contact with people and places would help us develop as educators.

Claire: Leo Tolstoy also recognised the importance of pushing ones' boundaries, and is reported to have said, “Everyone thinks of changing the world, but no one thinks of changing himself.” If we want to teach human-centred approaches to our future engineers to support them to tackle increasingly complex challenges and ‘change the world’ for the better, we must start with ourselves. Reflective conversations, as part of broader critical reflective practice, are a valuable way to build self-awareness, connect with values, and explore how our values are reflected in our actions as facilitative teachers.

Conclusion

Rosemary: Through these meta-reflections, which we developed in an interpretivist tradition, we show some of the directions that a critical conversation group can cover. Key to this methodology, we also share CRPs' lived experiences—our surprises and passions, our keen interests and concerns. These are facets of lived experience that influence academic practice in crucial ways, and therefore warrant attention. Our conversations began in humanitarian engineering and moved into engineering education more broadly to teaching philosophy, academic development for sessional academic staff, and empathy in human-centred design.

Scott D: However, reflective practice does not have an endpoint. There is no destination, only the journey. This paper represents one milestone in our collective journey of sharing and reflecting on our own diverse teaching practices and experiences. We hope to continue this exploration, and offer this paper as a device and prompt for other engineering educators to share and reflect on their experiences and approaches to teaching, as a pathway to continued academic professional development.

References

- Brookfield, S. (2017). *Becoming a critically reflective teacher*. San-Francisco: Jossey-Bass.
- Chang, R., Daniel, S., Dixon, C., Newbound, M., Toifl, M., Rayburg, S. (in press). "Teaching people design-talk": Critically reflective conversations on cultivating learner empathy in humanitarian engineering. 30th Annual conference for AAEE, Brisbane, December 10-12.
- Costa, A. & Kallick.M. (1993). Through the lens of a critical friend. *Educational Leadership*, 51(2), 49-51.
- Evans, M. (2017). Thousands of uni staff have their say: State of the uni. *Advocate*, 24(3), 28–29.
- EWB, Engineers Without Borders. (2019a). EWB Challenge: <<https://ewbchallenge.org/>>
- EWB, Engineers Without Borders. (2019b). Design Summit: <<https://www.ewb.org.au/designsummit>>
- Guyotte, K.W. & Sochacka, N.W. (2016). Is This Research? Productive Tensions in Living the (Collaborative) Autoethnographic Process. *International Journal of Qualitative Methods*, 15(1), 1-11.
- Hil, R., & Lyons, K. (2017). A post neoliberal academy? *Arena*, 147(April), 44–47.
- Kemmis, S. (2009). Understanding professional practice: A synoptic framework. In B. Green (Ed.) *Understanding and researching professional practice*. Rotterdam: Sense Publishing.
- Kemmis, S., McTaggart, R., & R. Nixon. (2013). *Doing Critical Participatory Action Research*. London: Springer.
- Kemmis, S., Wilkinson, J., Edwards-Groves, C., Hardy, I., Grootenboer, P. & Bristol, L. (2014). *Changing practices: Changing education*. Dordrecht: Springer.
- Richardson, L. (2000). Writing: A method of inquiry. In N. K. Denzin & Y. S. Lincoln (Eds.), *The SAGE handbook of qualitative research* (Vol. 2). Thousand Oaks, CA: SAGE.
- Rogers, C. & Freiberg, H. (1994). (Ed 3) *Freedom to learn*. New York, NY: Maxwell Macmillan.
- Schatzki, T. R. (2001). Introduction: Practice theory. In T.R. Schatzki, K. Knorr-Cetina & E. von Savigny (Eds.), The practice turn in contemporary social theory (pp. 10–21). London: Routledge.
- Schatzki, T. R. (2012). A primer on practices. In J. Higgs, R. Barnett, S. Billett, M. Hutchings & F. Trede (Eds.), Practice based education (pp. 13–26). Rotterdam: Sense Publishers.
- Thompson, J., Chua, M., & Joslyn, C. (2014). Engineering Education as a Spiritual Vocation. 121st ASEE Annual Conference and Exposition, Indianapolis, IN, June 15-18.
- Thompson, N., & Pascal, J. (2012). Developing critically reflective practice, *Reflective Practice: International and Multidisciplinary Perspectives*, 13(2), 311-325.
- Walther, J., et al. (2013). Quality in Interpretive Engineering Education Research: Reflections on an Example Study, *Journal of Engineering Education*, 102(4): 626-659

Appendix: Co-Researcher/Participant Backgrounds

In interpretivist research it is important to have insight into the worldviews of the researchers interpreting the data, as well as the relevance of the participant sample to the research study, to help the reader make sense of the analysis and conclusions. In this reflective practice work, the authors are both participants and interpreters in the research process, and so it is doubly important to be transparent about their backgrounds and experiences. We include brief biographies below.

Rosemary Chang has an MEd in tertiary education, and is earning her PhD researching the affective experiences of creative practice through the lens of mindfulness. She leads academic development in Swinburne University's STEM Practice Academy, enabling academics to innovative and evaluate their teaching practices. She entered universities lecturing in Japanese, and has run a boutique education research consultancy. In 2012, with colleagues she gained a government OLT Citation, and an AAEE Award for supporting Engineering Education engagement.

Scott Daniel has a PhD in engineering education research. Prior to his PhD, he trained as a high school teacher and then worked in teacher education in Australia, Vanuatu, the United States, and Namibia. He has been on the Board of EWB Australia since 2017, and has facilitated seven Design Summits in Cambodia, India, and Malaysian Borneo. He has also facilitated one iteration of the EWB Challenge, in the STEM Practice Academy. His current research is in how students learn about co-design and socio-technical thinking in the context of humanitarian engineering.

Claire Dixon has a BE(Civil) and BCom, and is Engineer in Residence at the STEM Practice Academy. With skills in facilitation, human-centred design and innovation, she has over 15 years of industry experience across the public, private and not-for-profit sectors. She is passionate about supporting future engineers to work collaboratively to tackle complex issues such as sustainability. In 2012, she founded Smart Seeds, a global innovation program to upskill graduates in innovation and solve real infrastructure challenges (smartseeds.org). Claire has been involved with EWB Australia since 2008, including establishing GDH's corporate partnership and as a member of the Board of Directors. She has facilitated three EWB Design Summits in Cambodia and Malaysia.

Mark Newbound has a PhD in conservation biology from the University of Melbourne and an Honours degree in agricultural science from La Trobe University, which included research in Papua New Guinea and rural China. For the past 10 years he has been teaching at various universities in Melbourne, principally for subjects covering environment and sustainability issues, with roles including lecturing, subject design, subject coordination and tutoring. He joined Swinburne University in early 2018 to deliver EWB Challenge tutorials.

Melissa Toifl has a MSc (Environmental) and has worked in industry and research for over 15 years specializing in the water area with projects on wastewater, greywater, stormwater and recycling. She has been involved with developing standards and protocols for greywater recycling and stormwater. Melissa has been at Swinburne for 5 years working on a range of research projects and teaching the EWB Challenge for the past 3 years. She maintains her industry relationships and works in the private stormwater sector.

Dr Scott Rayburg is a senior lecturer in civil engineering at Swinburne University. He has been teaching the EWB Challenge since 2011, and was the recipient of a university teaching excellence award in 2017 for his work teaching 1st year students. His research focus is on sustainability and improved liveability for urban environments in the face of ever-increasing pressures such as population growth, climate change, water scarcity and species loss.

Copyright statement

Copyright © 2019 Chang, R.; Daniel, S.; Dixon, C.; Newbound, M.; Toifl, M.; Rayburg, S.: The authors assign to AAEE and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to AAEE to publish this document in full on the World Wide Web (prime sites and mirrors), on Memory Sticks, and in printed form within the AAEE 2019 conference proceedings. Any other usage is prohibited without the express permission of the authors.