

Why Philosophy

Since 2007 there has been a flurry of papers and books on philosophy and engineering and attempts to develop what some authors call a philosophy of engineering education [1]. Because engineering educators, indeed most educators tend to ignore the philosophical basis of their work it is appropriate to ask-why this new found interest in philosophy? It is tempting to answer because there is no escape. It is part of human nature to philosophise at some level or another if philosophy is taken to mean the activity of reflective thinking. For some of us the fundamental questions that have occupied the persons we recognize as philosophers are not considered either fundamental or for in-depth reflection; for others questions such as “Why do we exist?” or “what is the purpose of our existence?” or “what is truth?” are of profound importance. Nevertheless the opinions and values that we have inform our behaviour and our reactions to the behaviour of others. Moreover as Sherren and Long pointed out long ago in *Engineering Education* they inform our teaching [2]. Our beliefs and values are our drivers and to understand them and how they are formed is at the heart of philosophical urge in human thinking. The method of philosophy takes us out of the realm of casual opinion on which much educational policy and action is based into disciplined reflection. That is – why philosophy.

At the present time, for a variety of reasons some engineers and engineering educators are questioning whether the philosophical premises that have driven the structure and content engineering curriculum since the end of the second –world war are appropriate for the 21st century. They ask questions about the purpose of engineering education and more generally about higher education. They are being driven by changes in employment patterns horizontally (employment availability at any time) and vertically (employment persistence in a particular job) caused by developing technologies. Their impact on social structure and social mores is profound, so questions have to be asked and are being asked about the purposes that higher education will have to accomplish in the future, how it will be delivered, and how it will be afforded [3]. In the first place they are philosophical issues and philosophers of education have shown in the past that they are highly competent to deal with them as they effect general education. Now is the time for engineering educators to join with them in a reconsideration of the aims of higher education and within that context those of engineering education. It cannot, however, achieve this goal without interaction with subjects from the social sciences that are themselves spin-offs from philosophy [e.g. sociology-[of knowledge], psychology- [of development, the mind), and the humanities [e.g. historical context]). One topic that is pressing is the relationship between liberal and vocational education and the necessity or otherwise for liberal education that is highlighted in a 2011 report from the National Governors Association [4].

It is customary to try and express aims in terms of behavioural outcomes. Often these require interpretation, and as Yokomoto and Bostwick showed some of the statements in ABET 2000 were ambiguous [5]. One of the lessons of twentieth century philosophy is that it can help us

clarify meaning and ensure that statements are understood similarly by those we wish to respond to them [6].

But a discussion of aims is meaningless if there is no agreed understanding of what engineering is and what it is that engineers do. It is surprising how little is known about what engineers do and how they feel when they are doing engineering. In these recent discussions much attention has been given to the differences between engineering and science. Two books and a paper that may be regarded as seminal were published in the early years of the 21st Century. In the same year (2003) Koen linking philosophy and engineering illustrated how the theoretical and practical can merge to form real-world practical solutions [7]. He generalised the engineering method to become a universal method based on heuristics. Bucciarelli set out to show that philosophy mattered to engineers and in so doing asked important questions about the nature of engineering knowledge [8]. Since then epistemological issues have occupied much of the debate that has been generated. To Bucciarelli, perhaps more than any other writer, is owed the understanding that design is a social process, and from that comes a major contribution to our understanding of the aims of engineering education namely- that engineers have to have a good understanding of social processes. Ethnographic studies by engineers who are also qualified philosophers and sociologists associated with the University of Grenoble in France give powerful illustrations of this need that have implications for the curriculum [9].

In the following year Goldman in a paper set out the argument for a philosophy of engineering as distinct from a philosophy of science [10]. Among his arguments is that because engineering couples values and knowledge to *“the world engineering practice should enable the exploration of experience “as itself a source of values”* which may be read as a call for students to be trained in reflective practice, and coincidentally what it is ‘to be’ an engineer. This links in with authors like Davis who have taken the teaching of ethics beyond a simple the understanding of codes of conduct and whistle blowing into what it is to be a professional engineer [11]. Such studies have to be placed in the context of engineering decision making. Like Vincenti he underlines the importance of understanding what it is that engineers do [12].

In a significant departure from the general run of discussions in ethics Bowen argues that engineers have forgotten their major role which is to promote human well-being because they *“have not engaged sufficiently in ethical analysis of their activities”*[13] In pursuit of what he calls an “aspirational ethic” he draws on the work of Buber and MacIntyre, two twentieth century philosophers with quite distinctive views. In contrast to those who have argued that too much emphasis is placed on comparisons with science in these discussions Bowen draws on the philosophies of business and medicine for comparison.

Finally, there has been much debate, most of it informal, about the role of philosophy (other than ethics) in the undergraduate curriculum. Smith and Korte, for example would argue that the application of the philosophical method to engineering learning enhances that learning [14]. While not disputing this view I argue that students need to be confronted with the

perennial questions that have occupied philosophy, and that taken together society will gain the reflective practitioners of profession and life that it so badly needs.

So where does one start? One begins with the self as agent and asks what is my philosophy of engineering education and how does it influence my attitudes toward teaching and the curriculum? When that is answered find out what the philosophies of your students are in order to choose an educational theory that is compatible with your philosophy and those of your students. Maybe you will have to do some reading, which is not a bad place to begin a philosophical journey!

[1] Since 2005 two groups have held regular sessions. The first group was founded in Denmark has run conferences that have produced several books. The first was *Philosophy in Engineering* (2007) edited by S. H. Christensen, M. Meganck and B. Delahouse (Academica, Denmark). The second group developed out of committees of the National Academy for Engineering, Royal Academy for Engineering and the Dutch equivalent. Their first conference was published as *Philosophy and Engineering: An Emerging Agenda* (2010) edited by I van de Poel and D. Goldberg (Springer, Dordrecht and New York). The third group has organized special and paper sessions at the Frontiers in Education Conferences, and members have contributed to ASEE annual conferences. Their focus has been on philosophy and engineering education. The IEEE Ed Soc together with the ASEE ERM division and NSF sponsored a symposium at the 2011 FIE Conference. They produced a review and bibliography that are published in the FIE Proceedings. Heywood, J., Carberry, A and W. Grimson. *A Select and Annotated Bibliography of Philosophy in Engineering Education* (34 pages), and Heywood, J. *A Historical Overview of Recent developments in the Search for a Philosophy of Engineering Education* (24 pages)

[2] Sherren, D. C. And T. R. Long (1972). The educator's dilemma. What makes Clyde want to learn? *Engineering education*, 63, (3), 188 -189.

[3] See for example (a) Sparks, E and M. J. Waits (2011). *Degrees for What Jobs? Raising Expectations for Universities and Colleges in a Global Economy*. Washington, DC. National Governors Association. (b) A polemic that looks at what it considers the harmful influence of the UK and USA on higher education, and Irish higher education in particular among other matters. Gallagher, M (2012). *Academic Armageddon. An Irish Requiem for Higher Education*. Dublin. Liffey Press.

[4] Heywood, J (2012) *Engineering at the Crossroads: Implications for Educational Policy Makers*. Plenary Lecture. ASEE Annual Conference. Pamphlet. Available electronically from ASEE or the author.

[5] Yokomoto, C. F and W. D. Bostwick (1999). Modelling the process of writing measurable outcomes for Ec 2000. *Proceedings Frontiers in Education Conference*, 2, 11b1 pp 18 – 21.

[6] for a comment on analytic philosophy in education see Noddings, N (2007) *Educational Philosophy*. 2nd Edition., Cambridge, MA, Westview Press. She draws attention to the work of R. S. Peters and notes his distinction between Aims and Purpose. In this article they are confounded. Her book is a good introduction to the philosophy of education.

[7] Koen, B. V (2003). *Discussion of THE Method. Conducting the Engineer's Approach to Problem Solving*. New York, Oxford U. P.

[8] Bucciarelli, L. L. (2003). *Engineering Philosophy*. Delft, DUP Satellite.

[9] Vinck, D (ed) (2003) *Everyday Engineering. An Ethnography of Design and Innovation*. Cambridge MA. The MIT Press. The studies does not deal specifically with the education of engineers but the implications are both clear and profound.

[10] Goldman, S. L (2001) Why we need a philosophy of engineering. A work in progress. *Interdisciplinary Science Review*, 29, (2), 163 – 176.

[11] Davis, M (1998) *Thinking Like an Engineer. Studies in the Ethics of a Profession*. New York, Oxford UP.

[12] Vincenti, W. G.(1990) *What Engineers know and How They Know It. Analytical Studies from Aeronautical History*. Baltimore. The Johns Hopkins University Press.

[13] Bowen, W. R (2009). *Engineering Ethics. Outline of an Aspirational Approach*. London, Springer.

[14] Korte, R and K. Smith (2009) Developing engineering student's philosophical inquiry skills. *Proceedings Frontiers in Engineering Conference*, T4B, 1 – 2.