

”Where do we go from here?” A Discussion Regarding Technological Literacy / Philosophy of Engineering

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This discussion has its origin in “*Finding the Sweet Spot Between Engineering Faculty’s Willingness to Teach and Non-majors’ Willingness to Learn*” (ASEE 2017 Session M349) panel discussion with Sheila Tobias, author of “*They’re Not Dumb, They’re Different*” and “*Breaking the Science Barrier*”; Dr. Maria Garlock, Princeton University; Dr. Agnes d’Entremont, University of British Columbia; Dr. Gary P. Halada, Stony Brook University; Dr. Jennifer Buckley, University of Delaware; and Dr. Carole Womeldorf, Syracuse University; and moderated by Dr. John Krupczak, Hope College. The panel’s discussion focused on the challenge of increasing the understanding of engineering and technology among the majority of undergraduates who are not STEM majors. It included contributions from engineering faculty who successfully established general education courses on engineering topics for non-engineering students at their respective institutions with a focus of the development of strategies to create a broader national / international movement to promoting engineering for all students. Major discussion points included:

- How to attract non-engineers.
- How to accommodate the interests of non-engineers.
- How to evaluate students who are being introduced to engineering concepts and ways of thinking for the first time.
- How to initiate and to maintain course offerings as part of general education.
- How to promote engineering enhanced liberal education for all students.

At the TELPhE division’s subsequent business meeting that year, the discussion from Session M349 was extended to encompass programs, initiatives, communications, affiliations, and publicity actions that are outside the academic community that can serve to promote technological literacy / philosophy of engineering.

This discussion continued into 2018 and resulted in panel session “*Using Modern Technology to Educate and Inspire Non-STEM Majors*” (Session T549) at the ASEE 2018 annual conference in Salt Lake City. The technological developments and innovations presented that might be used to overcome barriers to educating and inspiring non-STEM majors included:

- Massive open on-line courses (MOOCs) to dispense with the limitations of the traditional classroom.
- The proliferation of on-campus MakerSpaces that give access to 3-D printers, laser cutters, DIY electronics, and CAD / CAM and solid modeling design technology to all students and, in many cases, the public at-large.
- Flipped classrooms and Youtube that educate non majors and the interested public and promote technology and engineering in new ways.

Prior to this panel discussion, on Sunday afternoon, a group from TELPhE met to continue the discussion from 2017. Some observations: “*We are living in an increasingly created world.*” – Alan Cheville; there needs to be a way of developing “*technical expertise without engineering*

insanity.” – John Krupczak. We observed that for many non-engineering students the question regarding their enrolling in, and completing of, a technical / engineering course was, “*How is this course going to affect my GPA?*”

The group also, as a whole, discussed the corporate environment in the form of “*How is this technology / engineering going to affect the bottom line?*” – read corporate earnings forecasts – and that corporations have moved from a focus of using technology and engineering for corporate growth and return on investment (dividends) to a focus of using financial perspectives to meet investor earnings forecasts and corporate compensation initiatives. It was noted that corporations are increasingly led by non-technical managers. In facing daily technological / engineering literacy problems and decisions in areas such as product and process risks, communication technology, government regulation and policy, availability of resources, de-monopolization of technical know-how, and the new extra-national nature of innovation, does the non-technical background of these leaders preclude an understanding, a flexibility, and an adaptability essential to be literate in the technology / philosophy of engineering arena essential for corporate growth and long-term viability? Instead, the focus seem to be meeting earnings forecasts.

Henry Petroski, in *To Engineer is Human: The Role of Failure in Successful Design* [1], relates an encounter in chapter 1 with a neighbor who, after the Kansas City Hyatt Regency skywalks collapse, wondered why engineering did not know enough to build so simple a structure as an elevated walkway. The neighbor went on to cite the Tacoma Narrows Bridge collapse, the American Airlines DC-10 crash in Chicago, some other famous failures, and a few things that he had heard about hypothetical nuclear power plant accidents that he was sure would exceed Three Mile Island in radiation release. The neighbor’s point was that engineering did not quite have the world of their making under control. Petroski’s response was that predicting the strength and behavior of engineering structures is not always so simple and well-defined an undertaking as it seems, which he later admitted didn’t seem to change his neighbor’s mind about anything. Petroski then observes that “Engineering has as its principle object not the given world but the world that engineers themselves create.” suggesting the need to extend the understanding of technological literacy / philosophy of engineering to a much broader community.

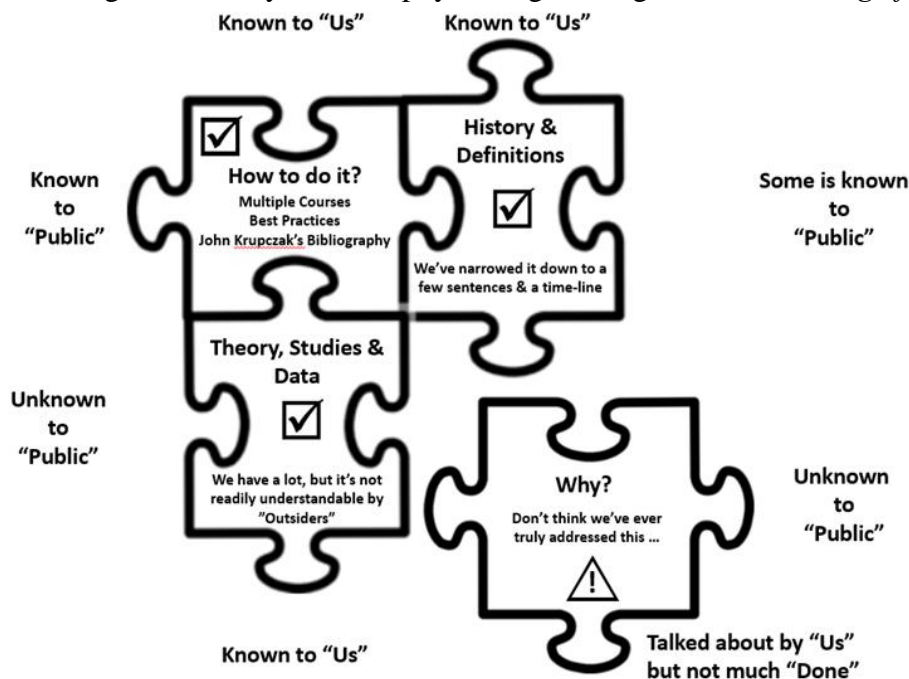
So, what should we do; why should what we do be taken seriously; how can a uniform technological literacy / philosophy of engineering message be broadcast; how can we identify our real audience and influence policy; how does this lead to a larger message; how can we educate the public to ask the right questions... the people we need to reach, the people outside academia who speak a different language [2], [3].

In addressing these questions, has making the case for technological literacy / philosophy of engineering been too inward a discussion, and therefore left to engineering practitioners and academics, and social scientists? Years ago, technological literacy / philosophy of engineering was simple know-how. Today, it encompasses social consequences, political and economic implications, international concerns, government regulation, communications technology, and product and process risks [4], [5]. In these arenas, the consequence of not having an

understanding of technological literacy / philosophy of engineering can lead to a society falling prey to unfounded fears and over-reaction resulting in an inability to truly understand and assess the important technological issues and attendant decision processes to the detriment of that society's well-being [6], [7].

As educators, what should our next action(s) be regarding technological literacy / philosophy of engineering [8]? From a bibliography [9] of technological literacy / philosophy of engineering resources, we have a pedagogy (158 papers and references), a history and definitions (8 papers and references), and theory, studies, and data (37 papers and references). But, we have only 7 papers and resources on the "Why?" (Figure 1), the piece essential to move the discussion of technological literacy / philosophy of engineering into the context of public discussion [10], [11].

Figure1: Technological Literacy / Philosophy of Engineering: "Where do we go from here?"



So... "where do we go from here?"

- Why is technological literacy / philosophy of engineering necessary... ?
- What is the message that needs to be associated with this domain... ?
- Is it concentrating on our course offerings and making sure we're represented in general education programs, offering courses or ...
- Is creating a knowledgeable and informed student, parent, public, policy maker, politician, investor, elected official, corporate leader what we need to do?
- Should we be focusing on a national message, and break away from presenting on this topic to ourselves – a choir of academics – who have already acknowledged this?
- How do we address this issue to the public, and how do we relate it to perceptions of its groups and constituencies?
- Does our focus still have to be to address ASEE on this issue?

What say ye?

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