

“Education Engineering”

By Charles Fadel, Founder

Q: “Education Engineering??” Did you mean “Engineering Education?” I get zero hits on my searches for “Education Engineering.”

A: I mean it, as I coined the term. Whereas “engineering education” is the teaching and learning of engineering, “Education Engineering” is analogous to civil, mechanical, and electrical engineering. It is the use of the *precise methods, processes, and tools of engineering, applied to education.*

Q: Is this a new term?

A: Yes! But to my surprise, after describing the ideas behind it, I did find mentions of “education~~al~~ engineering” dating as far back as 1945,¹ 1951,² and 1960,³ but they are focused on learning science or assessments, not the entire education system.

Note that “education~~al~~” conveys the meaning of “for education” or “about education,” not “the engineering of education [processes],” which is our approach here.

Q: So, what are some relevant examples of the precise methods, processes, and tools of engineering that you are using?

A: Here are several examples:

- Methods: “prototype and then produce.” Past a certain point in synthesizing academic knowledge, there are reliability and validity obstacles. Rather than waiting for elusive perfection upfront, it is more effective to develop a system, then test it and iterate. It is also a scientific process, to posit the best conceivable hypothesis and then test it via experimentation.
- Processes: Total Quality Management in Statistical Process Control, in which one does root-cause analysis by asking “why?” five times. Or using Pareto charts to organize the parameters by decreasing importance, to be addressed sequentially (or not, by deliberate choice).
- Tools: the use of software to synthesize a large number of papers on a given topic, thereby offering *traceable* research evidence.

¹ Educational Research Bulletin, Vol. XXIV, No. 2, February 14, 1945 [Is There a Field of Educational Engineering?](#)

² Educational Research Bulletin, Vol. 30, No. 9 (Dec. 12, 1951), 230-237+246

³ Journal of Educational Sociology (Apr. 1961), 377-381

Q: Why is that necessary?

A: Education has been mostly driven by academic research, which is excellent at raising questions and suggesting answers, but not necessarily rewarded to solve the actual problems *in situ*. Engineering is all about solving problems.

Q: Can you disclose the *complete* list of methods, processes, and tools you use? You gave us examples above.

A: Sorry, those are considered “trade secrets” for now. We may publish them eventually.

Q: Isn’t all this the same as “Learning Sciences?”

A: Per Wikipedia’s definition: “Learning Sciences (LS) is an interdisciplinary field that works to further scientific, humanistic and critical theoretical understanding of learning as well as to engage in the design and implementation of learning innovations, and the improvement of instructional methodologies.”⁴ Our take: *Learning science is applied specifically to individual learning, whereas Education Engineering is applied to all of education’s systems.*

Q: Isn’t this all the same as “Learning Engineering”?

A: Per IEEE in the footnote below⁵: “Learning Engineering is a process and practice that applies the learning sciences using human-centered engineering design methodologies and data-informed decision making to support learners and their development.” Again: *Learning Engineering is applied specifically to individual learning, whereas Education Engineering is applied to all of education’s systems.*

Q: But education is a discipline in the humanities! Are you trying to reduce everything to numbers?

A: Not the least bit. *Au contraire*, we are very realistic about how far one can parametrize the world, so we are borrowing from engineering while blending with humanities’ practices of synthesis. *We strive for balance.*

Think of Biology for instance: during Darwin’s time, it was entirely qualitative (descriptive). Now if you want to identify one species from another, you check their DNA (quantitative). Quantitative techniques are now being applied in History⁶ and even wine-making⁷!

⁴ https://en.wikipedia.org/wiki/Learning_sciences

⁵ <https://sagroups.ieee.org/icicle/>

⁶ <https://en.wikipedia.org/wiki/Clidynamics>

⁷ <https://vinepair.com/articles/vp-pro-qa-karl-storchmann> “There is almost no question that cannot be tackled in a quantitative way. **We want to insert some reason into the industry and its decision makers.**”

Q: How did you come up with this approach?

A: I studied electrical engineering and quantum physics at the university, and worked in technology companies for 25+ years, so I derive a lot of metaphors and ideas from my training - as we all do. Notably, at Analog Devices, I was inspired by founder Ray Stata's approach to "improving the *rate* of learning" of the company, and the TQM techniques he introduced: It was a seminal moment, in its elegance and power. I am now adapting this mindset and other techniques to Education transformation. In the words of Choong-Ki Kim, father of S. Korea's semiconductor industry: "*Scientists consider Why first, but we engineers must think How first.*"

Q: Is this yet another fad?

A: I hope not! Our success in this coming decade will speak for the cogency and enduring qualities of this approach.

If you have other questions on Education Engineering, please send them to me directly at charles.fadel@curriculumredesign.org

Let's learn together for many years to come - enjoy!

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