Education and Science

From the early chapters of DeBoer (1991), we can see how several nineteenth century educators challenged the notions accepted in classical education, from Spencer arguing that schools were “mumbling little else but dead formulas” (referring to science education) (p.13), or that the development of independent learners was essential, to Huxley saying that science studies should “not rely on the textbook as their source of information”, but rather the “physical objects themselves” (p.10), ideas also supported by Eliot in that science “should be taught with objects and instruments in hand—not from books merely, not through the memory chiefly, but by the seeing eye and the informing fingers” (p. 30-31). As early as 1894, Elliot was already asserting that education was a source for personal empowerment, and that all worthy education should follow his six essential constituents devised in his “Unity of Educational Reform”, which included: training through the senses, practicing in comparing and organizing data, and training in the power of expression, among others.

Nevertheless, at the same time, the school population was “beginning to enter a period of explosive growth” (p. 39), together with an increasingly long list of new subjects. Given that most of this population was not college-bound, this called for a diversification on high school education modules (more commercial courses, manual training and other more vocational courses) and “a need to make college entrance requirements more uniform”. Thus, the “Committee of Ten”, led by Eliot, was born, followed by the College Entrance Examination Board. Unfortunately, this led to education being analyzed from a utilitarian prism, but not the kind of usefulness that Spencer described (in developing the individual person), but how useful the person would become to society. That meant that certain fields were stripped from programs that provided vocational training, such as history, “thought to be useless for producing effective members of society” (p. 66). And this also affected science education. In DeBoer’s (1991) words, “in the relatively short time between 1893 and 1920, the justification for science in the curriculum had shifted from an argument based almost exclusively on science’s ability to develop one’s intellectual skills, especially the ability to observe accurately and reason inductively on the basis of evidence, to one based on science’s ability to develop an individual who would be a happy and contributing member of society” (p. 70). The creation of standardized achievement test would in turn give new importance to factual knowledge (because it was the thing most easily measured) and made it easy to differentiate students on the basis of these tests and “place them into science courses on the basis of their performance” (DeBoer, 1991, p. 84). And although there was some hope in progressive education, with A. W. Stewart of Kent State University discussing the need to develop tests that could be used to measure the ability to *apply* science principles, not just factual knowledge (DeBoer, 1991), the urgency that World War II created, put these discussions on the back burner and for education it meant strengthening the “vocational and applied aspects of education that had been gaining momentum since the early part of the century” (p. 128).

Further, the war had other effects on education, such as pointing the need to improve the entire educational system (through the testing of recruits, they noticed a deficiency in basic literacy and quantitative reasoning skills) and showing that science, mathematics and technology were crucial to conduct military efforts (DeBoer, 1991). This, according to DeBoer, killed progressive education in favor of traditional intellectual values and the curriculum reform that would follow, presenting “science disciplines as logically structured areas of human investigation” (p. 171). However, curriculum makers failed to consider “the importance of student interest or the pedagogical need to relate science knowledge […] to the experiential world of the student” (p.171) or postponing the abstract learning until the student was able to deal with it. But by the end of the 1960s, due to the project’s “failure to achieve some of the more important social goals of science teaching” (p. 172) a “new progressivism” would arise. These two concepts would keep on being developed in parallel and in conflict for decades to come, and as we can see today the issue has not been solved yet.

So far, we have read through this course so many theories that contradict science as a series of facts, instances where we see the importance of a child learning through material objects and experimentation rather than abstract concepts and deficit-model teachings (i.e. the heliocentric theories in the “A private universe” video by the Annenberg Foundation (1987)). Nevertheless, our grades are still defining us and standardized testing is still being led by the regurgitation of concepts. Because my education was primarily done in Europe, I haven’t been really exposed to the standardized testing in the US, but my experience in Spain included the “Selectividad” to enter University (similar to SATs), which for most tests, if not all, required me to write verbatim what we had learned from our books and, to make matters worse, in the case of my degree, required me to get a grade higher than the highest grade possible in our system (an 11 over 10).

Reading DeBoer has definitely brought to me some very necessary insight into this fight between traditional and progressive teaching and I think makes me understand better (even if I find it sad) the state we’re still in. The readings from Gallas, D. Kuhn and Matthews have also shaped the way in which I plan to pursue my future teaching endeavors, and Lemke reassured in me the need to focus on the scientific language and how we use it in teaching at all levels, formally or informally. All of them have convinced me how ultimately science is a social endeavor and should be taught as such, through its history and philosophy as Matthews defends, through its language or through arguments and debates, as we see in Deanna Kuhn’s examples. I think Gallas’ “Science Talks” (1995) are a beautiful way and example to integrate in a classroom the argumentation that Deanna Kuhn studies (2009), and it also reminded me of the video we saw in our last class meeting on March 28, on the debates about magnetism in a high school classroom with lower track high school students (Yerrick, 1999). I’m currently devising ways to include these kind of debates in future education endeavors, and although I expect to experience what Gallas describes as the “irk” to interfere and redirect the class and the conversation (I will do my best to refrain from doing so), I’m excited to have a new insight on how the theories unravel in my student’s minds and how they can help each other to shape them.

**References**

Annenberg Foundation (1987) *A private universe* [Video file]. Retrieved from: <https://www.learner.org/vod/vod_window.html?pid=9>

DeBoer, G (1991). *A History of Ideas in Science Education: Implications for Practice.* Teachers College Press.

Gallas, K. (1995). *Talking their way into science: Hearing children’s questions and theories, responding with curricula*. Teachers College Press.

Kuhn, Deanna, (2009). “Teaching and Learning Science as Argument” in Wiley Online Library. DOI 10.1002/sce.20395

Kuhn, T. S. (1996). *The structure of scientific revolutions*. University of Chicago Press.

Latour and Woolgar (1986). *Laboratory Life.* Princeton University Press

Lemke, J. (1990). Talking Science. Ablex Publishers.

Matthews, M. R. (1994). *Science teaching: The role of history and philosophy of science.* (pp. 3-20) Psychology Press.

Morgan, E. (2009). *I believe we evolved from aquatic apes* [video file]. Retrieved from: <https://www.ted.com/talks/elaine_morgan_says_we_evolved_from_aquatic_apes>

Popper, K. (1959). *Conjectures and Refutations: The Growth of Scientific Knowledge.* Routledge Publishers

J.J. Schwab (1975). “Education and the Structure of the Disciplines”

Shermer, M. (2002). *Why people believe weird things: Pseudoscience, superstition, and other confusions of our time*. Macmillan.

Shermer, M. (2010). *The pattern behind self-deception* [Video file]. Retrieved from: <https://www.ted.com/talks/michael_shermer_the_pattern_behind_self_deception>

Stoet, G., Geary, D. (2018). *The Gender-Equality Paradox in Science, Technology, Engineering, and Mathematics Education*. Retrieved from: <https://journals.sagepub.com/doi/abs/10.1177/0956797617741719?journalCode=pssa>

Traweek, S. (1988). *Beamtimes and Lifetimes: The world of high energy physicists.* Harvard University Press.

Yerrick, R. (1999). *Re-negotiating the Discourse of Lower Track High School Students.* Research in Science Education, 1999, 29(2), 269-293.