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Curriculum Critique

FOSS, Motion & Matter, Investigation 3: Engineering

My mother, a Kindergarten teacher, has a habit of putting words in my mouth that for many years I found annoying. When she offers advice or guidance, instead of coming from her, it comes in the form of her as me. On my anxiety about having too much work: "You could go up to your teacher and say, 'Mr. Beaver, I've been working really hard on your homework, but I just can't keep up with it because….'" On my frustration with a recent purchase: "You could call them up and say, 'I have recently purchased your device, and I expected it to work differently….'"

These first-person scripted instructions grated on me in part because of the assumptions embedded in them. Why should I tell Mr. Beaver I've been working really hard on my homework, when the truth is that I haven't been working very hard at all, and my anxiety derives from the guilt of having slacked off? Why should I tell the customer service representative that I expected the item to work differently, when the problem is that in retrospect I think it was overpriced?

I eventually came around to this kind of packaging of advice, and its assumptions, as I became aware of its utility. My mother's solutions were always framed as the most effective way to solve a problem. What would I need to say to get the extension on the assignment, or to receive a refund on my purchase? The extent to which those assumptions oversimplified the truth reflected my own communication problems—not hers—and her intent was not to form judgments but to streamline the path to success.

So it is with scripted elements of curricula. The FOSS *Motion & Matter* Investigation Guide is replete with italicized prose which literally puts words into a teacher's mouth. For example, as students are constructing a cart with the provided set of materials (plastic sticks and circles, straws, popsicle sticks, binder clips etc.), the instructions ventriloquize:

> "*I've noticed that many of you are using the disks and shafts to make wheel-and-axle systems like you made in previous investigations. Some of you have run into the problem that once you have the cart all taped together, it doesn't roll—it only slides…. What do you have in your zip bag of materials that might help solve this problem? What will allow the axle to rotate freely?* [The larger straws or binder clips can provide solutions for this problem.]" (FOSS 2015, p. 176)

Some might find the assumptions embedded here annoying. Who's to say that many of the students are building wheels that won't roll, or that these are the right questions to ask at this time? However, like the maturity which allowed me to listen to my mother's advice, a practical perspective allows teachers to accept the script as useful, even when they stray from it.

Such assumptions work their way all the way up the food chain of curriculum construction. Who determines what is taught, and how? The questions have been agonized over by the likes of John Dewey, Paolo Freire, Howard Gardner and many other educational theorists. Freire, in particular, rejects the idea that some external entity like FOSS should impose a curriculum on learners without their expressed involvement. He takes the idea a step further and declares that even teachers—let alone companies like FOSS—should not be calling the shots: "Here, no one teachers another, nor is anyone self-taught. People teach each other, mediated by the world…" (Freire 2013, p. 80). Freire's view contains an obvious contradiction—how do we imagine an education where teachers do not teach students? Dewey also struggles with this tension between teacher authority and student agency: "When external authority is rejected, it does not follow that all authority is rejected, but rather that there is need to search for a more effective source of authority" (Dewey 1938, p. 21).

Insofar as it can, the FOSS curriculum strives for Dewey's "more effective source of authority" by interlacing structure with options. In the introduction to the Investigation Guide: "FOSS is crafted with a structured, yet flexible, teaching philosophy that… allows both teachers and students to assume prominent roles in the management of the learning experience" (FOSS 2015, p. ii). Through this structured-yet-flexible model, the FOSS curriculum attempts to bridge the rift between externally mandated standards and learner agency.

The Overview section of the Instruction Guide states, "FOSS instruction allows students to express their understanding through a variety of modalities." The examples which follow pay homage to Gardner's theory of multiple intelligences:

> "For some students, appropriate experience might mean more time with the active investigations or online activities. For other students, it might mean more experience building explanations of the science concepts orally or in writing or drawing. For some students, it might mean making vocabulary more explicit through new concrete experiences or through reading to students. For some students, it may be scaffolding their thinking through graphic organizers. For other students, it might be designing individual projects or small-group investigations. For some students, it might be more opportunities for experiencing science outside the classroom in more natural, outdoor environments." (FOSS 2015, p. 18-19)

Gardner distinguishes his intelligences from learning styles: "The concept of style designates a general approach that an individual can apply equally to every conceivable content. In contrast, an intelligence is a capacity, with its component processes, that is geared to a specific content in the world (such as musical sounds or spatial patterns)" (Gardner 1995). Similarly, the flexibility in the FOSS curriculum here indicates a range of performance types available to the students, rather than presentations from the teacher. These options are a modest concession to Freire's call for student agency, organized around Gardner's multiple intelligences.

Some of the many, many assumptions about learners made in the development of a curriculum like FOSS (which would make Freire turn over in his grave) are at least made explicit: "FOSS is built on the assumptions that understanding of core scientific knowledge and how science functions is essential for citizenship…" (FOSS 2015, p. ii). This is a hard assumption to reject in modern American society. Other assumptions are made implicitly—like the idea that hands-on activities are both fun and interesting: "hands-on science… is universally interesting, and the joy and satisfaction of discovery are shared by everyone" (FOSS 2015, p. 18). While this is a strong generalization, it is reasonable to accept that hands-on activities are probably *more* fun and interesting than passive lectures—especially for young children.

The vision put forward by the FOSS materials projects a healthy balance between Freirean learner-agency and traditional authority and structure. But how successful is FOSS in achieving this goal? Unfortunately, I cannot make a comprehensive statement on this matter, as I did not have the time to review the entire curriculum, or observe it in action. The lesson which I did review—*Motion and Matter,* Investigation 3: Engineering—did allow for some learner agency, albeit within the confines of the *how,* not the *what.* For example, when students face the problem of inventing bearings while building a cart (see quote in the 4th paragraph), there are multiple viable solutions to the problem. Students could use straws with tape or different parts of the binder clips to make the wheels turn.

Students building the cart will encounter a reality which is familiar to us adults: there may be multiple right answers, but there is also definitely a wrong answer. A cart with no bearings is no cart at all. This is an important distinction to make in 4th grade, but somewhere along the trajectory of education we must make another one: when there are multiple right answers, some are better than others. Perhaps this idea makes the progressivists in education cringe, but evaluation and judgment are at least as essential for citizenship as core scientific knowledge and science practices. Students who can determine the better of multiple right answers, dubbed "evaluative epistemologists" by Deanna Kuhn, "have reconciled the idea that people have a right to their views with the understanding that some views can nonetheless be more right than others" (Kuhn 1999, p. 22).

Which version of the cart performs better at a given task? Perhaps it is a question beyond the scope of 10-year-olds, but where in the K-12 curriculum (or beyond) do

we teach evaluative epistemology? Judgment seems to fall somewhere between agency and external authority, somewhere between positivism and constructivism. Reality is not static, but neither is it chaos. Truth is not given, but it is built upon. We may stop short of saying there is a *right* way forward, but must we abandon the idea there is a *better* way?

REFERENCES

Dewey, J. (2013). *Experience and Education. Journal of Chemical Information and Modeling* (Vol. 53). https://doi.org/10.1017/CBO9781107415324.004

Freire, P. (2000). *Pedagogy of the oppressed.* New York: Continuum.

Gardner, H. (1995). Reflections on multiple intelligences: Myths and messages. Phi Delta Kappan, 77, 200–209.

Kuhn, D. (2011). A developmental model of critical thinking. *Educational Researcher*, *28*(2), 16–25. https://doi.org/10.2307/1177186

The Regents of the University of California (2015). *FOSS Next Generation: Motion and Matter—Teacher Toolkit, Investigations Guide.* Delta Education.