Aerobic Science Education

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The basic philosophy of aerobic exercise is that it makes little difference what you are doing in particular, as long as you are breathing hard and feeling exhilarated. That by itself is good for you. Analogously, in "aerobic science education" it makes little difference what is studied, as long as it engages students in doing interesting, science-like activities.

If there is nothing else important to be done, physically or mentally, then these aerobic philosophies are good enough. But in much of the world, exercise is not something extraneous—as in *simulated* rowing, skiing, stair-climbing, walking, or biking. There is more real work to do than can ever be done. Given that people are going to exercise anyway, what a nice idea that they might accomplish something else useful at the same time—say traveling somewhere, shoveling snow, hauling in fish, or picking up litter. In science education, there are many important ideas and skills that most people never catch on to before they leave college, even if they study long and hard. It would be a nice idea for students engaging in science-like activities to also get a start on some of these difficult understandings.

It could be, of course, that important ideas tend to be difficult and not very engaging. Certainly exercise that is useful (say, shoveling snow or picking up litter) isn't nearly as much fun as exercise that has no point at all (say, basketball or jogging around a track). Food that is good for you is seldom as pleasing as food that isn't. For children, at least, the thought that adults consider something to be good for you can spoil it altogether.

(Another possibility, however unlikely, needs to be acknowledged: Inventing activities that help students to learn difficult ideas might also be more taxing or less engaging *for the inventor.* Or, even if significant-content activities were not inherently more difficult, having to stick to those would still constrain the inventor's freedom to invent whatever comes to mind. Such constraint on freedom might in itself be less engaging or more demanding for the inventor.)

But let's imagine for a moment that engaging activities occurred around almost any ideas. In that case, it would be desirable to choose activities that started students on the way to understanding the more important ideas. It seems difficult to object to accomplishing something *in addition to* exercise—if that is in fact possible. But the *in addition to* must be taken very seriously. If hauling in fish is interspersed with long periods of just sitting around in the boat, fishing will fail as an aerobic activity. If studying proportions involves a lot of contrived story problems, it will fail to engage students in science.

The prevalence of any-content-will-do-as-long-as-it's-engaging science education is understandable in a climate of poverty in education. If people are in ill health for lack of aerobic exercise, then any aerobic exercise at all may be desirable. If much of science education today is turning kids away from science, then any science activities at all that engage them are desirable. If there are hardly any engaging activities around, then engagingness should receive top priority, whatever the content.

But let's imagine that conditions improve and everyone is getting enough exercise, every student is becoming engaged in studying science, and comparably engaging activities are invented for a wide range of topics. Then surely it would make sense to choose—other things being equal—activities that also pay off in progress toward important understanding.

A similar analogy could be drawn for "empty calories" and "caloric" science education. Under starvation conditions, any calories at all are desirable, "empty" or not. Only after there is enough to eat to sustain life is the issue of diet quality likely to be addressed.

The aerobic orientation of some science educators is understandable. Currently science education in the elementary school might well be considered to be in very poor condition. But unless the importance of the content is *necessarily an obstacle* to engagingness, mere aerobics will not do in the long run.

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