

The Robot Factory: Pseudoscience in Education and Its Threat to American Democracy

Q & A with physicist and author Joseph Ganem

Why did you write *The Robot Factory*?

JG: My anger over the reduction of both education and science to tools of corporate profitability and political control. In the United States, we talk a lot about the importance of education and science, but only about their economic benefits – measured in dollars – and their political benefits – support for the narrow interests of our particular faction. Very few of our political and corporate leaders have any interest in education and science for what they should be – methods of inquiry to pursue truths that will enhance our quality of life.

You use the word “pseudoscience” in the subtitle. What do you mean by this?

JG: The testing metrics and statistical jargon widely used in education settings today give many destructive educational practices an appearance of scientific validity. But, as I show in the book, much of that appearance is fake – pseudoscience is the term scientists use. Many of the statistics are meaningless and the arguments based on them circular.

What are some of these practices?

JG: Evaluating schools and teachers based on student test scores rather than on their specific actions. Saying that good teachers and good schools have students with high test scores is circular reasoning because it tells you nothing about what these teachers and schools are actually doing. If you believe that good teaching results in students with high test scores, then you need to define good teaching first before you can test that hypothesis. Testing a class of students and then concluding that they must have had a good teacher because the scores are high tells you nothing about what the teacher actually did, and what, if any of those actions impacted the learning outcomes. Only the teacher’s actions in the classroom can be reproduced or changed, not the testing outcomes.

How is collecting testing data on student achievement fake science?

JG: It doesn’t have to be but often it is. While a great deal of data on student educational outcomes is collected, the data is rarely used to identify *causes* of poor outcomes, and it is rarely used to build predictive models for education outcomes in order to guide interventions to improve them. Instead the data is more often than not used to bully teachers and schools. This is not how science works. A scientific approach to education would use data to identify causes for high student achievement, build predictive models for educational outcomes, and then intervene when necessary to effect positive change. Closing a low-performing school or firing teachers because their students have low test scores are not useful interventions if the causes for the poor outcomes have not been identified. For example, when a plane crashes we

don't shut down the airline, and start a new one. We find out what caused it to crash and take the steps necessary to see to it that those conditions do not occur again.

Why are so many smart educated people swayed by fake science?

JG: As I explain in the book, in K-12 education, science and the foundational subject of math are not taught properly. The practice of raising math standards at the K-12 level in order to increase achievement has actually resulted in more students arriving at college in need of remedial math. Making math problems at the K-12 level harder does not lead to a better understanding of math, it just frustrates students instead. Science education has become focused on memorizing facts and obtaining a scientific skill set, but not on how scientists actually think, formulate questions and go about their work.

But it seems that STEM (Science, Technology, Engineering, Math) educational programs are everywhere these days. Many educators feel that it is the liberal arts that is under attack. Aren't science and math becoming the main focus of education today at the expense of other disciplines, especially the liberal arts?

JG: Yes, many high-profile members of the American political and corporate leadership actively promote science education and encourage students to enter STEM fields. Ironically, many of these same leaders publicly disparage science and scientists. For example, in June 2018 the stridently anti-science Trump administration hosted a White House summit to promote STEM education. This appears to be a glaring contradiction. However, if you examine the words and actions of many of these leaders you realize that what they want schools to graduate are passive workers with a scientific skill set – sophisticated robots to use my analogy – not actual scientists who can think for themselves and ask questions. The truth is that the divide between STEM and the liberal arts is a false choice. *Science is a liberal art*. The purpose of science is the same as in the liberal arts – ask meaningful questions and search for truthful answers.

How does our current approach to education threaten our democracy?

JG: False choice, not just in education, but on larger societal issues has become the defining characteristic of public discourse in 21st century America. You can no longer choose to seek the truth, you can only choose sides between competing narratives. The result is that pseudoscientific thinking and circular reasoning abounds. A person's religious and political affiliation now determines his or her beliefs on such pressing issues as education, gun violence, climate change, and healthcare. That could not possibly be the case if people independently examined the weight of the evidence and plausibility of the arguments on these issues. Democracy cannot function if all the participants are programmed like robots, and become trapped in competing narratives that are scripted for them. It becomes impossible to *collectively* solve problems, which is the essence of a democratic society. As a result, paralysis sets in and authoritarian solutions become more attractive. We are seeing this happen.

What is your vision for education?

JG: Schools are busy preparing students for an economy that no longer exists, not the future one that lies ahead. For example, articulating a standard skill set for “college and career readiness” – to use a recent catch phrase – is an exercise in futility. Change is happening faster than any list of standards can accommodate. An education focused on “college and career readiness” will be obsolete before it begins. A standards-based education that rewards programmed responses results in a passive and dependent workforce – perfect for serving government and corporate elites – but destructive to our society in the long run.

Instead, education needs to become “change-focused.” We need to meet students wherever they are and build on their backgrounds. Rather than use our schools to erase diversity by standardizing educational outcomes, we should embrace diversity. The economic needs of the future are unimaginable, but we do know is that we will need people with a wide diversity of talents and interests and they will need to be flexible and adaptable in order to deal with accelerating global change.

In addition, the adults in our society need to step up and model the educational values that they so loudly espouse. Schools cannot be cultural islands in which values such as respect and intellectual honesty are demanded from teachers and students, while at the same time the adults, particularly the leadership, model the exact opposite behavior. The crisis we face in education is misunderstood. It is not a crisis in test scores and our low standings on various lists of international rankings. Rather, the crisis is a breakdown at a very human level of our relatedness with one another. Education is suffering because of this crisis, but education can and must be the solution.