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Answer Sheet

What's the purpose of education in the 21st century?

By Valerie Strauss February 12

What is the purpose of education? The question came into stark relief when Wisconsin Gov. Scott Walker recently tried to quietly change the century-old mission of the University of Wisconsin system by proposing to remove words in the state code that command the university to "search for truth" and "improve the human condition" and replacing them with "meet the state's workforce needs." Walker backed off when the issue became public and sparked intense criticism from academics and others, but the issue remains a topic of national debate and of the following post. It was written by Arthur H. Camins, director of the Center for Innovation in Engineering and Science Education at the Stevens Institute of Technology in Hoboken, N.J. The ideas expressed in this article are his alone and do not represent Stevens Institute. His other writing can be found at www.arthurcamins.com.

By Arthur H. Camins

Debate about the purposes of education never seems to end. Should young people become educated to get prepared to enter the workforce, or should the purpose of

education be focused more on social, academic, cultural and intellectual development so that students can grow up to be engaged citizens?

Over the last 50 years, anxiety about competition with the Soviet Union, Japan, and China for global economic, military and political dominance have supported periodic calls for more effective workforce development. Wisconsin Gov. Scott Walker recently tried to change the mission statement of the University of Wisconsin to focus exclusively on workforce development. With each new workforce development or economic competitiveness demand on our K-12 schools, there has been push-back from those who want greater emphasis on a broader view of education.

But it doesn't have to be either-or. Education should prepare young people for life, work *and* citizenship.

Knowledge of the natural and engineered environments and how people live in the world is critical to all three purposes of education. Critical thinking, creativity, interpersonal skills and a sense of social responsibility all influence success in life, work and citizenship. For example, unhappy personal relationships often spill over into the work environment, while a stressful workplace or unemployment negatively impacts family life. Uninformed disengaged citizens lead to poor policy choices that impact life, work and citizenship. To paraphrase the verse in the old song, "You can't have one without the others."

This multiple-purpose perspective has practical implications for both day-to-day instruction as well as education policy.

What classrooms features support education for life, work and citizenship?

The key is to identify the learning behaviors in which students should be engaged. The National Research Council's Framework for K-12 Science Education provides some good examples. The framework describes the practices that scientists and engineers utilize to build new knowledge and designs, but also the student engagement that leads to learning. To be clear, the framework starts from the premise that science is a means to develop explanations about how the natural world works, and engineering is a means to develop solutions to human problems. Both are intended to improve our lives– a strong motivator for all learning. With a little tweaking, the practices are surprisingly applicable to various school subjects and as vehicles to address our multiple purposes.

(1) Ask questions about phenomenon (causes of cancer, climate change) and define problems that need to be solved (designing cancer treatment drugs, low-impact energy generation). In classrooms, students can ask questions about how living things get energy to live and grow. They can design prototypes of robots to clean up an oil spill. An educational focus on asking productive questions and defining meaningful problems isn't just an academic skill. It is an important disposition across life, work and citizenship.

(2) Develop and use models. Models represent relevant testable features of scientific explanations or design solutions. In classrooms, teachers engage students to surface, clarify, refine and advance their understanding. Done well, this means that teachers don't just present already established ideas but engage students in examining and advancing their own ideas. It means that students are challenged to reflect on what they already think they know and when appropriate research what others know in order to develop a preliminary testable model. One key modeling idea, applicable to life, work and citizenship is that most problems worth contemplating are complex and that seeking to understand that complexity is a better approach than a rush to simplicity.

Another important idea is that models, or our initial ideas, should be subject to systematic investigation. Knowing whether or not those models comport with reality is critical, lest we make poor uninformed choices with unintended consequences.

(3) Plan and carry out investigations. The goals of investigations are to test, refine or replace existing or hypothetical explanations or design solutions. For example, in high school biology classrooms, students may design investigations to determine what kinds of algae and what conditions are optimal for removing carbon dioxide from the atmosphere. In doing so, they need to anticipate what data would support or challenge their initial ideas or design choices. Developing students' abilities to examine data systematically, is yet another multipurpose education outcome. Taught well, students learn three basic premises: The questions asked frame what data is available for inquiry. The questions not asked may be just as important. In addition, in an active classroom with plenty of time for discussion, students learn that different people look at the same data and reach different interpretations. Not a bad life skill!

(4) Analyze and interpret data and (5) Use mathematics and computational thinking. Data does not speak for itself. Investigations to test explanations or designs yield data that must be interpreted. In classrooms organized around these eight practices, students learn that answers to important questions are not preordained. Instead, answers come from examining whether, when, under what circumstances, and how things work in the world. Students learn to use both traditional and modern interpretative tools. Especially in examining complex systems or designing complex solutions, mathematical representation and computational analysis are critical. Students learn to see mathematics not as procedures to be memorized, but as tools for making sense of the world– yet another multipurpose skill.

(6) Constructing explanations and designing solutions and (7) Engage in argument from evidence. The framework says:

> "The goal for students is to construct logically coherent explanations of phenomena that incorporate their current understanding of science, or a model that represents it, and are consistent with the available evidence.... [When considering proposed solutions to engineering design problems], there is usually no single best solution but rather a range of solutions. Which one is the optimal choice depends on the criteria used for making evaluations."

However, the framework goes one step further to say that in addition to developing logical evidence-based arguments, students should practice defending or revising their explanations or solutions in the light of competing ideas. Think about the power of depersonalizing arguments and making them about evidence. That sure could improve addressing the inevitable conflicts that are part of the fabric of life, work and citizenship.

(8) Obtain, evaluate, and communicate information. The practices of science and engineering are forward-looking, knowledge- and solution-directed and always seeking improvement. As such, there is a premium on communicating with others. As a result, classrooms that engage in these practices are characterized by collaboration, reflectiveness and openness to alternative ideas. Once again, great skills to nourish for life, work and citizenship.

What policies promote education for life, work and citizenship?

First, across multiple traditional subject areas, teaching to develop students' expertise

to apply these practices implies substantial shifts in instructional emphasis. These shifts will require the development of new curricula and professional development. That should be a high funding priority.

Second, because substantial engagement in these practices is a significant cultural change, time and patience are in order. No quick fixes or short-term measurable results can be expected from current formative or summative assessment instruments or practices.

Third, teaching through these practices demands content that has personal and social relevance for students so that they are intellectually and emotionally engaged in their own learning. This implies that teaching for test success is an insufficient, if not undermining, motivator. As a result, current policies that give priority to consequential assessment need to be severely curtailed.

Fourth, since our social and technological context is constantly evolving, education for life, work and citizenship cannot just focus on what is already known and how we live now. Therefore, teaching and assessment that privilege rote learning should give way to preparation for future learning.

No matter what progress is made to shift the practices and content of daily classroom instruction, inequity will continue to be a substantial limiting factor. Application of the systems thinking that characterizes progress in science and engineering to education policy means that real sustainable improvement depends on addressing inequity in areas such as well-paid employment, health care, food, and housing security. You can't have one without the others.

Valerie Strauss covers education and runs The Answer Sheet blog.