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Theme: Rhetorical education and the democratic mission of the School

Essay

The liberal arts, the sciences, and the education of good citizens

Cheryl Glenn

Since the time of the ancients, the liberal arts have been the centerpiece of education, comprising essential knowledge for *vita activa*, the knowledge necessary for the well-informed citizen to cultivate and participate in democratic life. However, the twenty-first century emphasis on professional status, income, and financial security has shifted our attention away from developing well-informed, engaged citizens to developing financially successful STEM (science, technology, engineering, mathematics) workers. Because we need both, we should insert the A of arts into STEM, translating STEM into STEAM.

Keywords: liberal arts, rhetoric, citizenship, STEM, STEAM.

Introduction

> "The Sky Is Falling"
> "The Humanities as We Know Them Are Doomed"
> "Demand for STEM Programming Continues to Increase; Countless Race to Meet It"
> "Humans versus Algorithms: Why the Future Needs More Arts and Humanities"

These headlines represent a contemporary tension in education, that between the liberal arts and the sciences, a tension some believe will lead to a permanent break, while others believe will generate resolution. Since the time of the ancients, the seven liberal arts have been

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the centerpiece of education, with rhetoric at their core. The trivium (grammar [prose literature], rhetoric, and logic) has been associated with the humanities while the quadrivium (arithmetic, geometry, music, and astronomy) has been firmly aligned with the sciences, with the cluster of science, technology, engineering, and mathematics we now refer to as STEM.

While the quadrivium has always been important to nation-building, the trivium constitutes essential knowledge for *vita activa*, the knowledge necessary for a well-informed citizenry to cultivate and participate in democratic life. In a democracy, such citizens make informed judgments about the past (judicial rhetoric), call attention to the virtues and dangers of the present (epideictic rhetoric), and responsibly deliberate on the best path to the future (deliberative rhetoric). Such have been the three classes of rhetoric since Aristotle established them in the Athenian democracy some 2,500 years ago.

In the twenty-first century, however, "less than 5% of the world's population lives in a 'full democracy'" (Ma 2018), and nearly all nations—democracies or not—find themselves concentrating on economic growth rather than on the health of democratic society. The top three "full democracies" are Nordic countries (Norway, Iceland, and Sweden) with the "flawed democracies" of United States and Italy tied for a twenty-first place ranking—just after South Korea, the last "full" democracy on the list (Ma 2018). Not many full democracies are thriving globally.

Little wonder, then, the rhetorical arts are facing a crisis of utility on both the international political stage and across the educational landscape. After all, the rhetorical arts are closely linked with democratic enhancement rather than with economic growth, the stimulation of national economies, financial security, and professional success (or so most people believe). Students, parents, ordinary citizens, and especially policy makers and legislators believe that STEM fields offer more economic advantage for individuals and nations than any of the liberal arts. As a result, the liberal, rhetorical arts as a course of study and as a profession are systematically being diminished—around the globe—in favor of the STEM fields. This trade-off has shifted our attention from developing knowledgeable citizens who actively engage in their democracy to developing workers who drive a twenty-first century economy, as though one must choose between developing knowledgeable citizens or developing national economies. A zero-sum game, to be sure.

Self-proclaimed the most powerful democracy in the world, the twenty-first-ranked, flawed democracy that is the United States serves as a case in point. US President Donald Trump has recently called for

a $200 million-a-year boost to STEM education (Balingit 2017), after handing over the US Department of Education to Betsy DeVos, a major political donor with no educational experience or teacher support. The United States is not investing in education for citizenship, for revitalizing our democracy. On the other hand, Sweden, ranked the third-best full democracy in the world, has recently returned the liberal arts to their rightful place in the educational curriculum, now requiring rhetoric for all Swedish high school students. With an education in rhetoric, Swedish students can develop educated capacities to (1) investigate issues, (2) challenge unjust systems, (3) cultivate themselves as engaged citizens, and (4) foster and participate in a way of life they believe in (Glenn 2018). The Swedish government is investing in democratic, engaged citizenship while simultaneously investing in nation-building by pledging billions of kronor for research in the STEM fields and affiliates.

Given that economic growth is so eagerly sought by all nations and financial security by college students (and their parents), the liberal arts face hard questions: What is their personal value? What is their democratic value? And, most important to many, what is their national value? On a global scene of nation-building for economic gain, these arts do not always demonstrate a clear connection to wealth and success. However, rhetorically leaning teachers, scholars, students, and activists regularly provide answers to those hard questions by demonstrating the value of the rhetorical arts to nation-building and financial security, to citizenship and democracy.

In both *Rhetorical Education in America* (Glenn 2004) and *Rhetorical Feminism and This Thing Called Hope* (Glenn 2018), I argue that educational programs and rhetorical practices (writ broadly) must be developed in innovative ways if we are to build a future in which our democracies flourish and our generations thrive. My vision of civic discourse—of rhetoric—is rooted in democratic representation and inclusion as well as in democratic opportunities for a broad education and economic sustainability. In this essay, I extend that argument by examining the status and potential of a STEAM emphasis in both the USA and Sweden, maintaining that we must couple the nation-building power of STEM with the citizenship-value of the liberal arts. We should insert the A of arts into STEM, thereby translating STEM into STEAM. My long-standing and ongoing collaboration with Swedish colleagues, which centers on energizing the liberal arts (especially rhetoric), guides my focus to my nation and that of my colleagues.

Formal STEAM initiatives quickly disprove the notion that the rhetorical, liberal arts are opposed to the hard sciences, that responsible

citizenship and technological advances are mutually exclusive. They are not. Throughout history, scientists and technologists have weighed the ethical implications of their work (Leonardo da Vinci and the submarine, John Napier and artillery, Clara Immerwahr and chemical weapons, Leó Szilàrd and nuclear weapons, Rachel Carson and pesticides, just to name a few). In addition, centers for science, technology, and ethics have been established around the globe, often at universities. The sciences and the arts have long worked hand-in-hand for the good of the commonweal—unfortunately, too often below the radar of voters, policy makers, legislators, and other important decision makers. Formal STEAM programs work to demonstrate (advertise, actually)—to students, their parents, educators, and legislators—just how the hard sciences and the liberal, rhetorical arts work as one in order to nurture involved, knowledgeable citizens, build our nations, boost our economies, and invigorate our democracies.

To make my points, I open with the problem of opposing STEM to the liberal arts before turning to the overwhelming cultural support for STEM fields (by pundits, parents, administrators, and politicians alike) at the expense of the liberal, the rhetorical arts. I then move into the significant conversations and controversies surrounding STEM vs. the liberal, rhetorical arts. Finally, I take us into the direction of what might be a more productive future for ourselves, our students, and our nation: the programmatic confluence of STEAM.

STEM vs. the Liberal, Rhetorical Arts: The Overall Problem

A political incident captures the problem of STEM vs. the arts. During the 2016 US presidential nomination campaigns that eventually led up to the nominations of Hillary Clinton and Donald Trump, Florida Senator Marco Rubio attempted to distinguish himself from the other Republican contenders. He did so by linking economic growth and education and declaring his support for vocations. "Welders make more money than philosophers. We need more welders and less philosophers" (Rubio 2015). His comment provided plenty of fodder for the US media, who thrive on any "crisis" in education. (His comment also attracted the attention of grammarians who corrected his use of "less" to "fewer" when referring to the number of philosophers).

For those of us in academia, Rubio's comment was a throwaway line; after all, most everyone is familiar with the publicized tensions between the liberal arts and STEM, most of which tilt toward the *alleged* superiority of the STEM fields where the workers (or so the

argument goes) are smarter, jobs are guaranteed, and high incomes are assured. For these purported reasons, graphs like the following (posted on the webpage of the Association of American Colleges and Universities) portray the liberal arts and the STEM disciplines in opposition, as though smart students will surely choose the more financially promising sciences. The two figures below indicate that (1) the projected growth for employment in STEM fields is nearly twice that of non-STEM employment, and (2) the annual salary of a STEM major will be at least $20 thousand more than that of the non-STEM major.

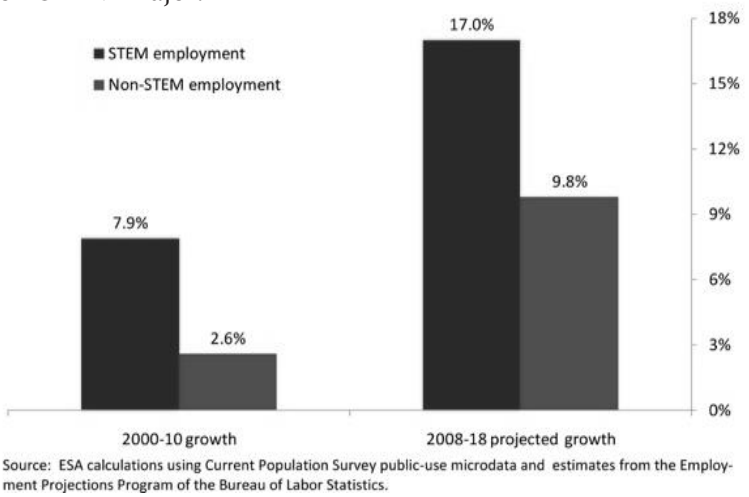

Figure 1: Graphs show recent and projected growth in STEM and non-STEM employment, posted on the webpage of the Association of American Colleges (Langdon et al. 2011).

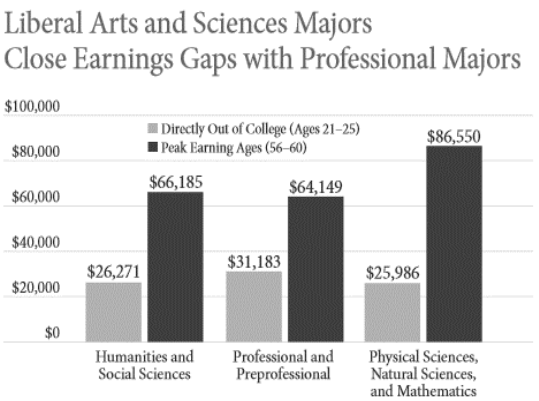

Figure 2: Graph posted on the webpage of the Association of American Colleges and Universities showing the earning gaps of liberal arts and science majors (Humphreys & Kelly 2014).

The preceding two figures capture the prevailing assumptions: (1) the only way to ensure the future for oneself, one's family, one's nation is by majoring in a STEM discipline; (2) education is merely an economic passage; and (3) teenagers—even high school students—must specialize early on. At present, teenagers are being pressured to chooses a career track before they have had enough (or any) exposure to discover what they might actually love doing for the rest of their lives, as though loving one's work is beside the point, as though the only rationale for choosing a career is a financial one.

To choose the arts, then, could be only the fool's choice.

Scores, Standards, and Standings

In addition to its roots in income anxiety, this belief in the superiority of STEM education is embedded in a fascination with scores and standings. Of course, the United States should be concerned about its low standards of education in all subjects, especially in math and in science. Even in the 1960s, when international science and math tests were first administered, the United States was never at the top and often near the bottom in global standings. According to a survey conducted by the Programme for International Student Assessment (PISA) in 2012, global standings are in crisis. The United States ranks twenty-seventh world-wide and Sweden twenty-eighth in terms of students' abilities in mathematics (after Korea, Japan, Switzerland, The Netherlands, Iceland, and so on). Math literacy rates in both countries are below global average. According to "A Dozen Economic Facts About Innovation," a policy memo published by the American advocacy group, The Hamilton Project, Sweden comes in sixth globally while the United States lines up at eleventh in terms of the university degrees conferred in STEM fields in 2012. In other sites, Sweden comes out ahead of the United States, with the United States lagging behind all developed countries and many so-called undeveloped countries as well.

Although there is no clear positive correlation between test scores and a nation's economic success, there is, nevertheless, a professed STEM urgency in terms of US and Swedish education. Both countries are competing in science, technology, and engineering on a global scale with countries who already have an edge (Korea, Finland, Japan) and at a time when the United States, Sweden, and nearly all other nations are in need of another great wave of innovations in science, agriculture, manufacturing, energy, medicine, transportation, and education.

Given how poorly US students are poised on the global scene, the touted US goal is to increase by one million the number of STEM college graduates by 2022 (Jackson-Hayes 2015). Sweden has no stated specific goal, yet the Swedish government has, in the past few years, made its largest ever financial investment in the life sciences (well over $400 million US) and budgeted hundreds of new spots for engineering students at the universities with a goal of 1,600 new places for civil engineering students alone by 2016. And in health care and medicine, Sweden had more entrants than ever before (Swedish Higher Education Authority 2017).

Making advances in science and technology are important aspirations, to be sure. Like every nation, both the United States and Sweden need educated people in those fields; STEM majors are crucial for sustaining steady material improvements in these democracies. But the ongoing obsession with STEM majors and careers could well lead to a pool of mostly white, mostly male workers all of whom serve the same function in a modern, *un*democratic work force.

Issues of Access, Equity, and Inadequacy

Diversity of gender, race, and ethnicity constitutes another critical consideration in STEM if countries want to support scientific innovations within a flourishing democracy. In fact, like every nation, what both the United States and Sweden need is a *diverse* pool of highly educated people across the board—in STEM, in the liberal, rhetorical arts, and in vocational training (in a nod to Rubio). In Sweden, where occupations are most often broken down by gender (rather than gender and race), gender equity remains a compelling issue. Pernilla Wittung-Stafshede, Division Head of Chemical Biology at Chambers University in Gothenberg states in the blog STEM Women, "I expected no gender problems in Swedish academia when I returned to a full professor position in Sweden after 10 years as faculty in the United States. I was mistaken" (Wittung-Stafshede 2016). In the United States, nearly half of all STEM workers are white men, with the other half composed of "others"; i.e., white women and men and women of color (National Science Foundation 2015). Sweden's percentages reflect, of course, a different demographic, but still the consequences of gender inequity remain evident. Wittung-Stafshede reports that female scientists win less than 20% of all grants from the Swedish Research Council and less than 9% of Sweden's top research awards; furthermore, women comprise only 20% of university professors

among Sweden's universities (even though they comprise more than 60% of Swedish students).

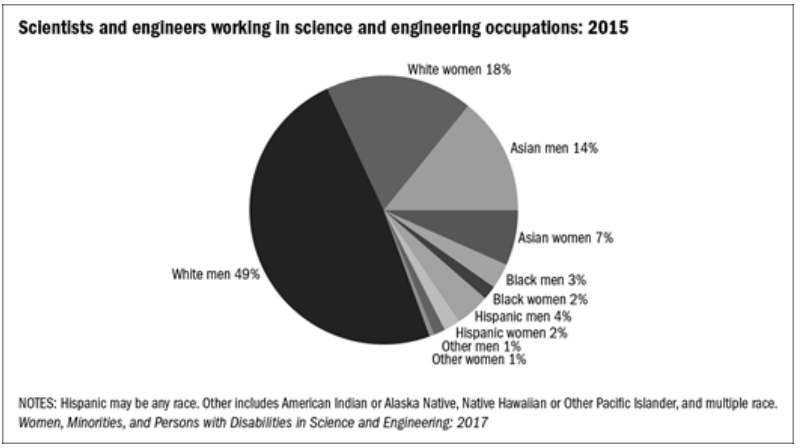

Figure 3: Science and Engineering Demographics in the USA (National Science Foundation 2015).

In Sweden, women comprise 93% of nurses but only 21% of software and systems engineers and only 16% of electrical engineers (Swedish Higher Education Authority 2014).

The most recent report by the US Department of Education Commission on the Future of Education briefly mentions the continuous *un*equal access to higher education (especially in the STEM fields) for women, people of color, foreigners (United States, Department of Education 2006). Otherwise, the report focuses entirely on education for economic gain, lauding development in the STEM fields, with no mention of education's (let alone, the arts') critical role in a functioning democracy.

The Power of Rankings and Funding

Despite ongoing problems of access and equity, those focused on developing *only* the STEM fields, at the expense of the liberal, rhetorical arts, believe that *only* the STEM disciplines will secure their financial future, stimulate economic growth, and improve the rankings and reputations of their workplace. For instance, US and Swedish universities alike are ranked primarily on faculty research, the significance of which is calibrated by Nobel prizes, National Academy appointments, external funding, and the like. External funding comes from faculty grants, a situation in which *one* STEM worker can bring

in more funding than *ten* language-arts faculty combined. All of these enhancements emphasize the STEM fields and reduce in relative importance rhetoric and the other liberal arts.

Furthermore, the rankings of US universities align perfectly with the priorities of Washington, DC, the source of all federal funding, as well as with the biggest granting agencies in the United States: The National Institute of Health (NIH), the National Science Foundation (NSF), and the continuously underfunded National Endowment for the Humanities (NEH). In 2016 alone, the federal government allocated $7,463 billion to the National Science Foundation and $147 million to the National Endowment for the Humanities (National Science Foundation 2016; National Endowment for the Humanities 2018). Thus, the NIH and the NSF can depend on the federal government to award them *billions* (not mere millions) of US dollars each year, which they can turn around and spend on the STEM fields. The current NSF budget alone is fifty-one times the size of the NEH budget, or to say it another way, the NEH budget is less than 2% of the NSF one (National Science Foundation 2016). The NEH funds the liberal, rhetorical arts.

Like that in the United States, most Swedish research is conducted and financed by companies, but university-level research is funded by the government: the Swedish Research Council, Formas (the Swedish Research Council for Environment, Agricultural Sciences, and Spatial Planning), FAS (the Swedish Council for Working Life and Social Research), and VINNOVA (the Swedish Agency for Innovation Systems). These government agencies have allocated billions of Swedish kronor to STEM research, while Sweden's Scientific Council for Humanities and Social Sciences has apportioned a markedly smaller amount to the humanities, social sciences, and education (which includes a grant for teacher research on democracy). The Swedish Research Council alone has allocated 3 billion 73 million kronor to STEM, with 449 million kronor going to the liberal, rhetorical arts—that's an 8:1 ratio (Swedish Research Council 2015). Given the funding patterns in the United States and Sweden that favor the STEM disciplines, universities, parents, and students alike are deserting those arts in favor of more lucrative, more valued STEM fields (Greenstone & Looney 2011).

Engineering, nursing, business, information science, and technology are the popular fields, and they are, indeed, crucial to the nation-building welfare of both the United States and Sweden. Most colleges and universities in both countries have chosen to admit and enroll increasingly more students in the STEM fields than in the liberal arts (again affecting the racial, cultural-ethnic, and gender balance

on campus). Sweden recently admitted 10,255 humanities and arts students and 75,835 STEM students (Swedish Higher Education Authority 2017), an increase of 130% in terms of STEM students since 1996 (Myklebust 2018).

Of course, this capitalist model of STEM education skirts the pitfalls of such rapid growth in these STEM fields, shortcomings that include emphasis on (1) highly applied learning that quickly generates into profit-making strategies, (2) profit that actually elides the significance of basic research itself, (3) highly technical skills that quickly become obsolete (becoming short-term workplace needs rather than durable skill sets), and (4) technological developments rather than the significance and impact of those developments. The capitalist model also glosses over questions about the intrinsic value of choosing one's educational pathway based on interests and abilities (rather than on potential income); the quality of one's life, decision-making, and ethics; the alleged positive correlation between a STEM major and guaranteed professional success; and the fundamental worth of a broad education that combines the quadrivium with the trivium. For all these reasons, a STEAM model of education enhances STEM studies, for the STEAM model connects the scientific work that leads to professional success with the arts that enhance intellectual development, ethical deliberation and decision-making, global awareness, the project that is democracy, and, yes, to professional success.

Transcending the False Dichotomy

Together, the liberal arts (secured in rhetoric) and the sciences constitute sources of knowledge vital to the health of a democracy and to nation-building. Whether deliberating, debating, or dissenting, vote-wielding citizens must be knowledgeable, to be sure, but, in addition, they *must* be ethical and *should* be eloquent. Socrates taught Phaedrus that good rhetoric seeks the truth. Isocrates saw the rhetorical arts as both practical and necessary to civic education, to directing public affairs, ideas consolidated in Cicero's work on rhetoric as a mode of political thought and of action. It was Cicero who taught us that the best citizen-rhetor must be knowledgeable, moral, wise, and eloquent, for "wisdom without eloquence does too little for the good of states, but eloquence without wisdom is generally highly disadvantageous and never helpful" (Cicero 1949). After all, the ideal rhetor is the moral guide of the state, "accomplished in every kind of discourse and in every department of culture" (Cicero 1979). That citizen must be knowledgeable, to be sure, so as to think critically, perform

intelligently, and communicate really well. The goal of rhetorical education is to become Quintilian's (1969) *vir bonus dicendi peritus* (good man speaking well).

The liberal, rhetorical arts are the studies that help form us into critical thinkers; more empathic human beings; the kind of adaptable, creative, entrepreneurial people with whom we want to work and collaborate, the kind we want to be. These arts are the studies that help us become global citizens—and active local ones as well. These are the fields of study that anchor an American democracy, promoting opportunities for "life, liberty, and the pursuit of happiness" for every citizen, regardless of gender, cultural-ethnic background, socioeconomic status, and religion. These are the disciplines that nourish a Swedish democracy, "For Sweden—with the times." These rhetorical arts—what we now think of as reading, writing, listening, productive silence, and speaking—constitute essential sources of knowledge for maintaining the health and character of any democracy whether in Sweden or the United States: for voting (knowing the candidates and the issues); for pleading a case (shaping a compelling argument); for serving on a jury (carefully assessing all the evidence and testimony to come to an ethical decision whenever you are making a judgment); for serving in the military or other public service; for traveling across borders of race, gender, socioeconomic class, language, and cultural-ethnic background; and for performing publicly, politically, academically, and professionally with intelligence, knowledge, eloquence, and ethics.

These are the disciplines that ask us to deliberate on scientific findings, on the implications of medical research, on the impact of technological advances. They demand that we reflect on political issues; understand how scientific policy affects us and how it affects those who are *different* from us; imagine a variety of complex social and medical issues affecting the arc of human life (from birth and childhood through family relationships, illness, and death). The arts prepare us to judge political leaders knowledgeably and realistically and to consider our nation holistically, while also understanding the role that our nation plays in a complex world order. Yes, these are the liberal arts that help us develop values and actions precious for the future of citizenship and democracy, values and actions that are crucial in this era of religious, racial, economic, and political anxiety here and around the globe.

Most other nations (save China and other Asian economic rivals) are cutting away all "useless" things (such as the liberal arts) in order to stay competitive in the global financial market. And US policy makers and legislators have joined the trend, retreating from the liberal arts to transform secondary and higher education into vocational, technical

training and purposefully diminishing the practice of liberal education as the cornerstone of the American democratic project. Figure 4, a history of Pennsylvania's appropriations for higher education, emblematizes appropriations for education across the United States, as all fifty states have followed the same trend.

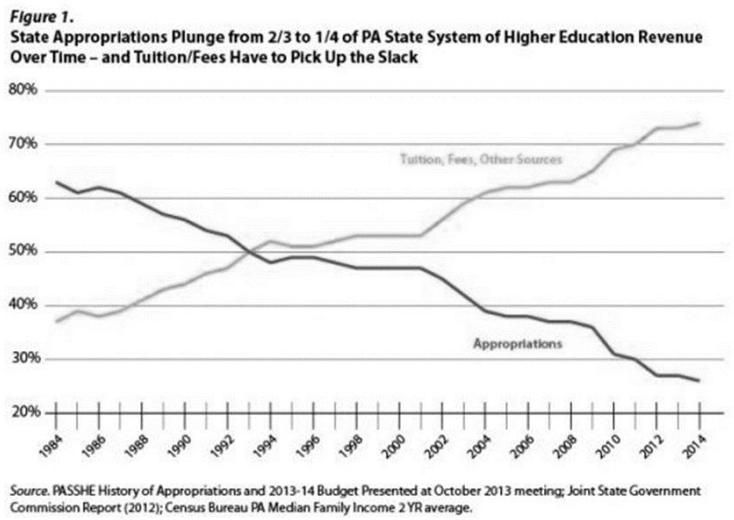

Figure 4: History of Pennsylvania's appropriations for higher education (Herzenberg, Price & Wood 2014).

Pennsylvania state legislators have worked steadily and over the past three decades to *de*fund education from kindergarten to the PhD. Whereas in 1984 just over 60% of higher education revenue came from the state; in 2014, that revenue was just over 20%. The inverse applies to the amount of higher education revenue that comes from students (and their parents): 37% in 1984, and 75% in 2014.

This trend of diminishing governmental investment in education has come to pass at the same time that the number of lower-income students, immigrants, and students of color has increased, the heterogeneous students who need education the most to become fully engaged, financially secure American citizens. Of course, both the USA and Sweden want to increase the number of educated citizens, but neither government is as willing to invest in education as those nations with the most homogeneous and accomplished students overall. In Korea, Japan, and Finland, for instance, generously funded education is a public good for the sake of the nation, worthy of investment. The mostly white, mostly male US policy makers and legislators no longer consider education a public good, given the diversity of its population. In other words, when student demographics reflect those

of the legislators, education is supported. When not, it is not. Thus, education—especially in the liberal, rhetorical arts—is no longer considered vital to the health of the democratic republic. More than any other field of study, the liberal, rhetorical arts are being trimmed away because their very real contributions to professional or national advancement are not obvious.

When the primary goal of any nation is economic growth, everything else is directed toward profit, even and especially education. Therefore, around the globe, the liberal, rhetorical arts are underappreciated, if not under siege. Departments are shrinking; class sizes are burgeoning; and cheaper on-line teaching is replacing residential instruction. The liberal arts tradition is weakening in the face of the corporatization of education. Few universities in the United States celebrate liberal arts education, touting instead the latest achievements in technology and their role in generating profits for business and industry. Only the world's greatest universities—Oxford, Cambridge, Harvard, Lund—continue to emphasize the liberal arts. In most places, these arts are being devoured by capitalism, with nations and their systems of education heedlessly discarding the knowledge necessary for keeping democracy alive.

For these reasons, we should not be forced to choose between a false dichotomy, between STEM, which promotes economic growth, profit, and professional success, and the arts, which promote the knowledge essential for active participation in civic, social, professional, and personal, and interpersonal life. Democracies need both. Nations need to educate engineers, scientists, and technicians alongside philosophers, historians, writers, and teachers. These two strands of education are not enemies; they are allies. When practiced in their most expansive state, the STEM disciplines are infused by the spirt of the liberal, rhetorical arts: probing critical thinking, bold imagination, logical analysis, collaboration, empathic understanding of human experiences, and ethical considerations of our complex world, its inhabitants, its problems. These are not insignificant abilities, and these are, indeed, qualities that employers are searching for, even more than technical expertise, which so quickly becomes outdated.

So what are the options at this point? How might nations re-energize the liberal arts, the rhetorical arts in order to mobilize a scientific, technical future infused with the liberal, rhetorical arts? How might nations leverage STEAM for the twenty-first century?

Future Directions for STEAM

Stepping into the brink, I offer some suggestions of how the liberal, rhetorical arts might adapt to merge with STEM and, once again, thrive.

First of all, those of us working in the arts must cross disciplines, cross borders, and forge interdisciplinary alliances with the sciences and technologies. We *can* push beyond the "humanities" model of the liberal arts that, for too long, has focused on that aristocratic, public, persuasive *man*, expanding that model to include the contributions of *all* humans, regardless of skin color, genitalia, sexuality, cultural-ethnic background, religion, or nation. Many in the liberal arts are already doing just that, but now is the time for vigilance, to remember the human model of *woman* as well the poor, disabled, and elderly humans of our neighborhoods and nation, citizens who also merit our scholarly interest and respect (Glenn 2018). We can ask questions such as "What are the social consequences of giving a newborn chemotherapy? Of offering euthanasia to the elderly? Of feeding poor people genetically modified foods?" From this expanded notion of human, those working in the liberal, rhetorical arts can cross over into the study of the cyborg, the cybernetic organism who has integrated technology so as to restore function or enhance abilities. Consider all the humans who now take advantage of glasses, contacts, hearing aids, cochlear implants, pace makers, hip replacements, artificial limbs, organ transplants, cosmetic surgeries, Parkinson's brain implants, IQ enhancements, pre-natal screenings, in-vitro fertilization, and genetic testing. Such cyborgs already include many of us.

Second, by leveraging the strengths of the liberal arts adapted to new technologies and terrains, we are also positioned to push for globalization. Global studies allow us to engage with the urban and rural areas that surround us, to reach out in ways that support and stimulate civic life, active citizenship, working together, and democracy, whether at home or abroad. (For instance, the US Luce Foundation Grants and Swedish STINT grants support globally engaged humanities projects.) And this kind of global citizenship requires the liberal arts, what with their factual knowledge, basic economics, assessment of historical evidence, and accounts of social justice, major world cultures, and religions. We can pose such research questions as "What are the social consequences of importing cheaply manufactured clothing from the poorest nations? How did fake Russian accounts on Facebook and Google affect the 2016 US presidential election?"

Third, in addition to aligning the liberal arts with technologies as we tack out from the local to the global (and then back again), we can

partner with other STEM disciplines, obtaining financial support for cross-disciplinary collaborations with scholars across our campus and beyond, researchers in information technology, business ethics, social work, and earth and mineral sciences. Such a bold move obliges us to move beyond our disciplinary silos to consider a number of issues. For instance, "How have Facebook's advertising algorithms led to anti-Semitic and racial profiling?" "What does Uber (or Facebook, for that matter) need to do to restore its once-good reputation?" Or we might even shift our focus from humans themselves to the ways humans are linked with other animals and with the ecosystem.

Whether we establish short-term collaborations, long-term programmatic mergers, or transdisciplinary research institutes, we move our ethical framework and cross-cultural foci beyond the human as we conduct research in environmental and biogenetic humanities. Our consideration of the debates over climate change have just as much to do with our understanding of what one human generation owes another as it does with the science of greenhouse gases. Such studies ask us to examine human impacts on our earth, ranging from the creation of the Anthropocene geological epoch to more recent impacts that include habitat destruction, environmental pollution, and animal and plant extinctions (destructions so great that they will result in an obvious boundary in Earth's rock layers).

Thus, when the sciences and the arts are linked programmatically, STEAM creates a cross-disciplinary education in which *all* students engage in disciplinary research, critical thinking, ethical and empathic approaches to problems that invite critical and creative explorations within these scientific fields. Such explorations pose penetrating questions that are guided by human-based ethics and are analyzed within the sociocultural context. STEAM offers an educational program that evaluates scientific evidence in terms of its sociocultural impact. Technology regularly *achieves* a great deal in terms of manufacturing, drug therapies, algorithmic advertising, agriculture), but the liberal, rhetorical arts help us humans understand the *impact* of these things. STEAM invites *all* students to develop polished communication skills, including argument analysis, critique, engagement, negotiation, and performance; to develop cross-cultural contacts and understandings that include languages, collaborations, and civic engagement (the Roman concept of *civitas humanitas*) on both the local and global scale.

After all, according to the American Association of Colleges and Universities, the majority of employers want institutions of higher education to place *more* emphasis on critical thinking, problem solving, oral communication, written communication, work-place application

of knowledge, gathering and evaluating information from multiple sources, innovation and creativity, collaboration across differences, and making ethical choices and decisions. Employers are looking for candidates with these broad skills (developed in the liberal, rhetorical arts) *even more* than they want disciplinary-specific emphasis on science and technology, numbers and statistics. What employers want is STEAM.

In other words, in order to compete on a global market, we need education that enables people to learn, think, adapt—and be innovative. The future of innovation and productivity will require workers who have both STEM and liberal arts skills: that is to say, STEAM.

Finally...

These are just a few ideas for stimulating the resurgence of a border-crossing liberal, rhetorical arts: STEAM. When Socrates and his cohort developed these arts, they spoke of citizens who were active, critical, curious, capable of resisting authority, just as they were capable of resisting peer pressure. The liberal arts developed as a means to assist citizens with civic participation and engagement, with domestic and foreign relations. And even then, they were concerned with technology—especially that new technology of writing. As we all know well, after much consternation, especially on the part of Plato, rhetoric and the other liberal arts merged quite nicely with this new technology.

But education—whether the liberal arts, the sciences, or STEAM—is not just for citizenship. It should prepare people for employment as well as for meaningful, purposeful lives. After all, contentment is the key to happiness in life. We need to keep that in mind as we think of education in capitalist terms. Economic security is one thing, to be sure, but the mere accumulation of wealth actually separates us one from one another, decreases personal drive, and has no direct correlation with personal happiness or contentment. The best education, then, will shape the entire person, the entire intellect.

Over a century ago, educator and Nobel Prize Laureate in literature Rabindranath Tagore admonished us that "the highest education is that which does not merely give us information but makes our life in harmony with all existence" (Tagore 1917). When we remember that we are humans who share customs, values, traditions—who have much in common—we are on our way to doing just that. When we ethically and empathically cross cultural and national borders, disciplines and boundaries, we can, indeed, design education that

gives us information, helps us communicate that knowledge, and encourages us to live in harmony (or at least not in war) with all existence. We can move through the world, eyes open, arms out, making the connections that count, really count.

We need the arts, humanities, and especially rhetoric just as much as we need the sciences—together, these are the studies that have always shaped great cultures, nations, and democracies. The liberal arts offer ways of making sense of the world that are valuable and useful— not just because they feed the STEM disciplines, but also because they nurture a world we all want to make happen. A truly sustainable economy—and democracy—is driven by creativity and innovation, with knowledge of the humanities, language, culture, and the arts being of crucial importance. Never have they been more important.

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