

ANALYSIS

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# Reframing sustainability initiatives in higher education

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## Abstract

Amidst the ever-changing and increasingly complex challenges facing the planet and humanity, there is a growing need to educate the next generation of environmental stewards and leaders who are global citizens with sustainability mindsets. Universities have come a long way in developing sustainability programs – both in the curriculum and in terms of campus operations. Many research universities are highly focused on cutting-edge science and technology to address global challenges, and funders are looking for that innovation and entrepreneurialism. These are noteworthy efforts, but do they give students what they need or want? Has the commercialization and corporatization of college campuses led to a shift away from the notion that higher education is a public good that benefits society, not just individuals? Beyond the technical expertise, 21st century challenges demand that the workforce be diverse and capable of recognizing and tackling ethical, cultural, and equity issues for a sustainable and just future. An ethics-driven and interdisciplinarity curriculum framed around the Sustainable Development Goals (SDG), civic engagement, and experiential learning that allows students to put their knowledge into action is needed to prepare individuals for such a workforce. This paper provides both a critique of areas in which higher education is falling short of its responsibilities and some translatable models and opportunities for improvements in reframing sustainability initiatives on campus, including in the curriculum.

## Policy and Practice Recommendations

- Campus leaders and faculty should take note of surveys of younger generations, especially Gen Z and Gen alpha, as they provide valuable insights into what youth are focused on and what knowledge and set of skills they desire to become innovative problem solvers and builders of more resilient communities.
- To prepare the next generation of environmental stewards and leaders, high impact practices that move knowledge to action are needed.
- Sustainability topics should be incorporated across the curriculum on campuses, not just in certain majors.
- Higher education needs to re-embrace the notion of service to the public good and work collaboratively across institutions and sectors to address complex societal challenges.

**Keywords** Actionable knowledge, Civic engagement, Climate change, Global challenges, Ethics, Experiential learning, Health education, Innovation, Interdisciplinarity, Social entrepreneurship, Sustainability, Sustainable development goals (SDGs)

## Main text

*At a time when society is faced with tremendous challenges of poverty and growing inequality, global environmental problems, food security, new and emerging diseases, scarcity of resources, and conflict,*

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*more than ever we need not only science and technology, but also innovative thinkers, advocates, and activists. We need educated people who aren't content with simply finding a job but are still idealistic enough to want to change the world for the better. In other words, we need higher education to lead the charge in lighting fires<sup>1</sup>, to be inspiring the next generation of problem solvers who will work at the front lines of these grand challenges of the 21st century [1].*

I wrote this paragraph as part of a blog post in 2014, and subsequently was invited to submit a revised version of the post as a guest editorial in *Liberal Education* [2], a magazine of the American Association of Colleges and Universities, an organization “dedicated to advancing the democratic purposes of higher education by promoting equity, innovation, and excellence in liberal education.” Rereading this excerpt, now a decade later, I realize that my plea for innovative thinkers and an education system that enables students to translate their knowledge into action, or what is now referred to as actionable knowledge, is still relevant [3]. Amidst the ever-changing and increasingly complex challenges facing the planet and humanity, there is a growing need to educate the next generation of environmental stewards and leaders who are global citizens with sustainability mindsets [4].

I am a firm believer that institutions of higher education have a responsibility to serve as models for society in terms of sustainability, reducing their carbon footprint, and creating resilient, inclusive, and thriving communities. Most 21st century challenges are represented in the 17 Sustainable Development Goals or SDGs that were adopted as the United Nations 2030 Agenda for Sustainable Development in 2015 [5] and they could serve as an ideal framework for campuses in their efforts to prepare future *social entrepreneurs* who can address unmet societal needs, climate change, and other local and global problems [6]. Such reframing of sustainability initiatives in higher education could resurrect the notion that higher education is a public good where both the institution and the individuals that they educate benefit society [7].

#### **A focus on market forces and innovation – to what end?**

Adjectives like innovative, entrepreneurial, and agile are now frequently used on campuses in the United States. For example, a campus in eastern Pennsylvania has an endowed center which “fosters and sustains a culture of

innovation and entrepreneurship that increases the creative capacity of ... students to lead and inspire change.” Such campus entities have become common, along with Shark Tank-like competitions for students to pitch entrepreneurial ideas for prizes.<sup>2</sup> Contemporary job profiles for academic administrators call for agile leaders who “will join the institution in a new era of innovation” or a candidate who is an “astute academic innovator.” Given the many challenges that campuses are faced with (e.g., demographic trends, an uncertain economy, ever-changing workforce needs, a mental health crisis, and the “great resignation”), there is a critical need for change, agility, and adaptation. But are any of these innovations aimed at preparing the future leaders and civically engaged individuals needed to address local and global challenges in a world of change (as many mission statements allude to)? Or do they reflect a capitalistic mindset as universities grow increasingly corporate [8]?

As far back as 2006, Burkhardt and Merisotis noted that despite universities having a long history of defining and responding to societal challenges, there has been a declining awareness of higher education as a public good as campuses began to emphasize “economic gains to the individual and the state at the expense of other equally compelling social benefits” [9]. In the same monograph, Boyles, et al. [10] provide an overview of the forces that have led to the commercialization and corporatization (i.e., privatization) of higher education, resulting in “many institutions moving away from focusing on the needs of people within our society” and instead, focusing on “financing the work of the universities while competing for students and status.” There has been a shift to the private good, a belief that “educating the private individual will contribute to the public good through an increase in economic growth, thereby defining the public good as local, state, and national economic vitality” [11]. Linking public good to economic viability is analogous to defining the prosperity of a country solely by its gross domestic product (GDP) instead of also considering other important factors such as literacy rates, access to healthcare, and natural capital (i.e., indicators of human and environmental wellbeing). The capitalistic view that equates success with continued economic growth is not sustainable. Tim Jackson has written extensively on the concept of prosperity without growth and the transition to a sustainable economy [12] and campuses and students would benefit from studying such alternative theories.

<sup>1</sup> The quote “Education is not the filling of a pail, but the lighting of a fire,” commonly attributed to William Butler Yeats, is the inspiration for the reference to “lighting fires” in this passage excerpted from a March 2014 blog post entitled “What Fires Should Educators Light” (see reference 1).

<sup>2</sup> Shark Tank is a reality television series in the United States in which a panel of investors (the sharks) decide whether to invest as entrepreneurs make a business case for their company or product.

Much of the current focus on campus agility and innovation is a result of changing demographics in terms of who is attending college, when they are doing so, and what they want out of their education. Institutions are in competition for a decreasing number of the traditional undergraduate students and for non- or post-traditional students looking to complete a degree or to upskill or retrain in a new area. As colleges and universities compete for a diminishing pool of prospective students, they should be considering what is on their minds. According to a 2023 Student Voice survey, conducted by *Inside Higher Ed* and College Pulse, 45% of high school students considered environmental sustainability in their college enrollment decision [13]; 81% of college students are at least somewhat worried about climate change. Climate change is on the minds of the new class of 2027 (the first-year college undergraduate students in the 2023-24 academic year), and this could be a critical factor in how high-schoolers make their final college choices [14]. In informal polls I conducted in fall 2023 in the first-year student bioscience seminar at my institution (Moravian University in Pennsylvania), students ranked climate change as the environmental issue that they are most concerned about. Overpopulation, waste and overconsumption, and air and water pollution are also high on their list of concerns. In a 2023 global study conducted by Ernst and Young and Junior Achievement, waste production was ranked among the “most concerning local climate-related issue by four out of five generational cohorts”, and younger generations were more concerned about the loss of biodiversity and air pollution issues compared to older generations [15]. Each of these issues of concern are raised in at least one of the 169 targets associated with the 17 SDGs [5].

Universities have come a long way in developing sustainability programs – both in the curriculum and in terms of campus operations. There are over 900 members of the Association for the Advancement of Sustainability in Higher Education (AASHE) whose mission is “to inspire and catalyze higher education to lead the global sustainability transformation.”<sup>3</sup> Institutions can voluntarily analyze their operations and curriculum through a standardized framework to get a STARS rating (the Sustainability Tracking, Assessment & Rating System), somewhat analogous to LEED certification for green building projects. However, the information is self-reported and not verified. There are subscription fees, so some institutions may not be able to afford this process, especially at a time when many campuses are experiencing financial hardships. Several university presidents and chancellors

have signed the Presidents’ Climate Leadership Commitment, pledging to develop a climate action plan aimed at reaching carbon neutrality and to submit an annual evaluation of progress, including data on greenhouse gas emissions [16]. This list has grown from the twelve original college and university presidents who initiated the commitment in 2006 to 413 institutions in 2023 that have signed the climate pledge, representing about 10% of U.S. higher education institutions [14]. These are noteworthy efforts, but do they resonate with students? The 2023 report from *Inside Higher Ed* indicated that only about one in five Student Voice respondents were aware of their college having signed a net-zero carbon emissions pledge [13]. In other words, most students surveyed didn’t know if their campus had signed or not.

We live in an era in which terms like eco-anxiety and climate grief have entered the lexicon, and the psychological and physical health impacts of this psychological stress are the subject of current research [17]. Many members of Gen Z and Millennial cohorts not only worry about their own futures but are increasingly reluctant to have children out of fear of the pending impacts of climate change [18]. This evidence should provide sufficient rationale for higher education institutions to have a strong focus on sustainability and to be working with communities to collectively solve problems and build resilience. If not, then campus discussions about student success and wellbeing ring hollow. Clover Hogan, a young researcher who has been described as an activist and entrepreneur, started the non-profit Force of Nature with a mission “to help people step up rather than shut down in the face of the climate crisis.”<sup>4</sup> She is committed to help channel “climate anxiety into agency; develop the skills to make a difference; and inspire change at the systemic level” and advises multinational corporations on how to integrate the climate concerns of Gen Z into how they run their business [19]. It is telling that one thing she doesn’t regret is “forgoing university in order to found a nonprofit at 19” [20]. She is not the only climate activist who has – at least for the time being – rejected college as a means to gain the skills necessary to address world problems.

Another driving force for innovation is related to research and the competition for prestige, grant funding, and endowment investments [10]. Many research universities are highly focused on cutting-edge science and technology to address societal and environmental challenges, and funders are looking for that innovation and entrepreneurialism. This focus on research has led to public perceptions that the focus on teaching

<sup>3</sup> See <https://www.aashe.org>.

<sup>4</sup> See <https://www.cloverhogan.com>.

(and students) has declined. The competition for funding (including from tuition-paying students), publications, and patents tends to discourage collaboration across disciplines and with other institutions. Yet SDG 17 speaks of the power of collaboration. Higher education respondents to a 2023 survey of the overall landscape of the implementation of the SDGs in teaching and research recognized the global goals as an opportunity for increased collaboration within and between universities but noted that there is a lack of recognition for this type of cooperation [21].

In 2013, then President Obama called on “companies, research universities, foundations and philanthropists to join him in identifying and pursuing the Grand Challenges of the 21st Century” [22]. These grand challenges and a call to increase access to high-quality STEM education were elements of the various iterations of his administration’s *Strategy for American Innovation*; the message was clear that scientific discovery and technological innovation are key to “America’s well-being” [23]. The third iteration of this strategy was released in 2015, the same year as the United Nations 2030 Agenda for Sustainable Development, yet there was no reference of the sustainable development goals (SDGs) in the strategy. This was also the year that the Paris Agreement was adopted under the United Nations Framework Convention on Climate Change, yet the strategy doesn’t directly mention climate change either. In his 2015 State of the Union Address, Obama noted:

*Twenty-first century businesses will rely on American science and technology, research, and development...I want Americans to win the race for the kinds of discoveries that unleash new jobs [24].*

This call to “win the race” along with the America COMPETES Act [25], with its premise that research and technological innovation are the foundation of future economic growth, furthers the notion that prosperity equates to GDP. This unsustainable model incentivizes competition, rather than collaboration and authentic partnership building, i.e., the very premise of SDG 17. It should be noted that the America COMPETES Act has legislative mandates for the National Science Foundation (NSF) and thus, impacts funding priorities. NSF is a key source of funding for research and science education in the United States.

Of course, we need this innovation. Science and technology are necessary to address many of the global challenges we are facing, and we need to continue training the next generation to be innovators. Engaging students in this research is an important form of experiential learning that will help cultivate future problem solvers. But in this race for discovery and innovation,

are we failing to consider the ethical implications of some of the technology-based solutions? In the competition for grant funding and publications in prestigious journals, are we forgetting the value of cross-disciplinary dialog and collaboration? During United Nations conferences on climate change or the SDGs, the value of nature-based solutions and traditional and indigenous knowledge in addressing global challenges is commonly discussed. Does this conversation extend to the academic research circles, especially in developed nations? As noted by Filho et al. [21]:

*Sustainability research has the advantage of being able to focus on problems that threaten the livelihood and integrity of various groups. It is also key in documenting experiences, supporting solutions, and integrating different types of knowledge – from academic to indigenous, from policy development to practice and in revisiting priorities in the wake of local or global crises (e.g., the Coronavirus pandemic). .... The use of the SDGs in academic research is supporting experts in addressing global and local challenges, with general priority in areas related to education, sustainable cities and climate change (SDGs 4, 11 and 13). By means of a focus on areas such as the study of human-natural systems, it provides much-needed insights and draws attention to problems that require sustainable solutions.*

#### **An ethics-driven and interdisciplinary reframing of sustainability initiatives in higher education**

In a 2011 essay on the Ethics and Climate blog [26], Dr. John Lemons, professor emeritus from the University of New England (which coincidentally, has a tagline of *Innovation for a Healthier Planet*) criticized higher education for its failure to address the strong ties between capitalism and consumerism (which he saw as factors that increase the problems of global climate change), the lack of inclusion of ethics into sustainability programs, and a neglect of liberal and civic education. He notes further that “Some have argued that the lack of political resolve to tackle sustainability issues stems from resistance to assumptions that modern economic and technological thinking will solve society’s problems.”

Below are two specific examples that, in my opinion, illustrate a need to scrutinize higher education research, curricular innovation, and growth initiatives. Such re-examination should go beyond a technological and capitalistic focus to include an ethics lens and the SDG framework.

### **Ethical dilemmas associated with technological “Solutions” to climate change**

There is increasing focus on geoengineering approaches to mitigate the impacts of greenhouse gases through net zero emissions including solar radiation management and carbon capture and sequestration. This includes research being conducted on university campuses. A 2021 report from the U.S. National Academy of Sciences recommended that we should continue to pursue solar geoengineering [27], although a news release announcing this report did have a cautionary tone and a call for research from the social sciences:

*“The U.S. solar geoengineering research program should be all about helping society make more informed decisions,” said Chris Field, Perry L. McCarty Director of the Stanford Woods Institute for the Environment, and chair of the committee that wrote the report. “As we continue to make slow progress in addressing climate change, we urgently need to understand the full range of options for alleviating its harms. Based on all of the evidence from social science, natural science, and technology — this research program could either indicate that solar geoengineering should not be considered further, or conclude that it warrants additional effort” [28].*

The funding support for geoengineering research in academia has been scrutinized [29], even by the key researchers in the field who have admitted that launching such an approach to reduce warming would be a planetary-scale experiment [30]. Ecologists and plant scientists (including this author) have expressed concerns that solar radiation management (blocking sun rays from reaching the Earth’s surface) will negatively impact primary producers in ecosystems and crop yields. New research suggests that sulfur gas, soot, and fine dust thrown into the Earth’s atmosphere from a large asteroid that hit Earth off the coast of what is now Mexico (the Chicxulub impact, about 66 million years ago) blocked the sun, and in turn, photosynthesis for almost two years, potentially leading to the demise of dinosaurs [31]. As noted by the lead study author from the Royal Observatory of Belgium, Dr. Senel, “It collapsed the food web, creating a chain reaction of extinctions” [32]. Much has been written about 1816 as the “year without a summer,” following the eruption of Mount Tambora in Indonesia the year before. Emitted ash triggered a global change in climate, resulting in crop failure across Europe and the U.S. due to the cold, a lack of sunshine, and torrential floods in some areas (notably Ireland). Grain prices soared, novel strains of cholera emerged in India, poverty and crime became rampant, and many people died of starvation. Be it dust particles, ash, or aerosols from natural events or

geoengineering technology, blocking sunlight is problematic for life on Earth.

Thus, there are many ethical dilemmas surrounding the question of whether such technology should ever be unleashed, and if so, who should make that decision. Where are our philosophers, historians, and anthropologists in these conversations? Are these debates happening in college classrooms and across campuses? This example provides is a strong argument for the value of a liberal arts education and collaborations across disciplines to both inform research about potential ethical dilemmas and social implications associated with applications of certain technological “solutions” and to produce engaged and knowledgeable citizens who can objectively evaluate the risks and benefits of new technology before it is deployed.

### **Addressing climate change and health in campus policies and the curriculum**

In September 2021, the World Health Organization (WHO) published the *COP26 Special Report on Climate Change & Health: The Health Argument for Climate Action* [33]. This report identified climate change as the “single biggest threat” to humanity amid a global pandemic. The links between fossil fuel combustion and health, as well as between climate change and health, are clear. Are institutions of higher education prepared for the impacts of climate change on the health of workers, and do health education and training programs include climate change in the curricula?

There has been rapid rise in new health-related academic programs on many campuses across the United States, including those traditionally considered liberal arts undergraduate colleges. The impetus for the new programs has not only been to meet workforce shortages in the healthcare industry, but also to attract new students and add revenue streams for institutions. But are the students in these programs learning about health issues related to climate change or how to respond to climate-related disasters? A 2020 survey from the International Federation of Medical Students’ Associations (IFMSA) found that climate change was taught in only 15% of medical schools worldwide, and often, the climate health teaching activities were led by students, not faculty members [34]. In 2016, IFMSA student members published a training manual on climate and health [35]. A study conducted by the Nursing Program at the University of Pennsylvania during the 2017-18 academic year found only one program in the country that included climate change in the curriculum (at Columbia University). Since then, nurse educators and some programs, including at UPenn and Moravian University where I work, are beginning to rectify this situation. Penn Nursing is

“retooling its curriculum, transforming its physical footprint, and conducting research on how the environment affects vulnerable populations” [36]. There is a significant environmental justice emphasis in their new programming [37]. Moravian offers a course entitled Global Disaster Preparedness & Management for which I am a regular guest speaker to talk about climate change and health. An online PubMed search shows an increased number of publications discussing curricular reform in nursing programs, including the addition of climate change topics, since 2018 – the year in which the WHO published its first special report on health and climate change in conjunction with the annual Convention of the Parties (COP24) of the United Nations Framework Convention on Climate Change [38].

The faculty from the Nursing, Public Health, and Environmental Science and Studies programs at Moravian are discussing a new interdisciplinary certificate program in environmental health that will include a significant component focused on climate change, its health impacts, and potential solutions. Such an interdisciplinary curricula could be easily incorporate aspects of all 17 SDGs. Furthermore, in recent discussions with individuals responsible for emergency medicine training and certification in Pennsylvania (i.e., for EMTs), it was noted that none of the required continuing education sessions include content on how climate change might impact the types of health emergencies that first-responders will increasingly have to deal with. We are discussing new training to correct this deficiency. This is an example of how higher education can collaborate to address a community problem and provide life-long learning opportunities (e.g. SDG 4), while also identifying new pools of learners for revenue generation.

In addition to incorporating the SDGs into health curricula, there is a moral imperative to consider impacts of a changing climate, poor air quality, and historic inequities as campuses and other workplaces review policies impacting the health, safety, and well-being of their employees. For example, in summer 2023, much of the U.S. experienced periods of extremely poor air quality due to wind-blown smoke from wildfires in Canada. In Pennsylvania and New York, the air quality index reached very dangerous levels. For example, on June 7th, the measurements of the daily-average  $PM_{2.5}$  in New York City broke records at 117 micrograms/cubic meter of air, which is three times higher than the standard set by the Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) and over eight times higher than the standard set by the World Health Organization [39]. This same day, AQI levels reached a record 484, falling just short of the 500 upper limit on the existing AQI scale. These hazardous levels of pollution

had immediate health impacts. Between June 6 and June 7, the hospitalization rate in New York City jumped 81% with soaring asthma-related emergency room visits for subsequent days. Bethlehem in the Lehigh Valley of Pennsylvania is about 80 miles west of New York City and had similar poor air quality and resulting health problems. In 2023, the neighboring metropolitan area in the Lehigh Valley, Allentown, was once again ranked #1 on the list of “Asthma Capitals,” i.e., the most challenging cities to live in with asthma [40]. The region has significantly higher-than-average asthma prevalence even without the wildfire smoke. We quickly learned that college campuses (and many other workplaces) lacked relevant policies for keeping workers safe, especially those who worked outdoors. The New York City administration was criticized by the city’s public advocate who offered a long list of recommendations [39]. Given the trends in rising temperatures, droughts, and wildfires in North American (and around the world), this is not likely to be an isolated event. Besides air quality, many institutions also lack policies related to work requirements and safety during periods of record heat when severe dehydration and heat stroke are serious threats. Students trained through interdisciplinary programs that incorporate the SDGs could work in teams to put their knowledge to action reviewing such campus policies (or those from community organizations) and make recommendations on how to revise them leading to better health and safety outcomes for workers.

Institutional vision statements talk about enabling students to solve real-world problems through state-of-the-art research under the mentorship of distinguished faculty. Service-learning opportunities such as described above is another way for students to put their knowledge to action for the betterment of communities (i.e. in service of the public good). Faculty mentors should be looking for these types of experiential learning opportunities for students. In an informal survey that I distributed to youth who were planning to attend the United Nations Framework Convention on Climate Change COP28 in fall 2023, the majority of respondents (undergraduate and graduate students) indicated that they had not had an opportunity to participate in such sustainability-linked learning opportunities, be it research, service-learning or internships. Filho et al. [21] noted that students are not proactive in requesting more content and research opportunities related to the SDGs, but “when prompted to engage in sustainability through learning”... “their competencies in the process of problem-solving in their regions and work area are developed.”

In a preface to the essay by Dr. Lemon noted above [26], Donald Brown, Scholar in Residence, Sustainability Ethics and Law at Widener University stated that

he believes “that US higher education is at least partly responsible for the failure of the United States to respond to its ethical obligations, duties, and responsibilities for climate change” and that Dr. Lemon’s post “makes the case that ‘piecemeal’ reform of higher education about climate change will not be sufficient and that comprehensive educational reform of higher-education is necessary.”

### Towards reframing sustainability initiatives in higher education

As a first step towards reimagining a sustainability-focused educational system, we need to understand the current state of the curriculum not only in higher education, but also in our primary education system. The EY - JA report entitled *How Can We Empower the Next Generation to Build a More Sustainable Future*, based on their 2023 survey concluded that “young people ...look to their schools to prioritize sustainability education, update curricula often enough to capture current trends, and utilize hands-on learning methods that focus on skills acquisition as much as knowledge acquisition” [15]. However, another 2023 study of K-12 teachers conducted by the Smithsonian Science Education Center and Gallup found that, by far, U.S. educators rank lowest (compared to teachers in Brazil, Canada, France, and India) in receiving the necessary support to incorporate sustainable development topics into the curriculum; they cite a lack of time, instructional materials, and expertise [41]. Although they believe that teaching about sustainability is important, most U.S. teachers (65%) say the subject does not fit within the topics they teach, including 59% of those who teach science [41]. Only 20 states in the U.S. have adopted the Next Generation Science Standards,<sup>5</sup> and despite major advances in science and technology, many states use K-12 science standards that date back to the 1990s [42]. The former U.N. Millennium Development Goals were developed in 2000 and the 2030 Agenda for Sustainable Development (the current 17 SDGs) were adopted in 2015; thus, it is not surprising that sustainability topics are lacking in the curriculum.

This provides a tremendous opportunity for institutions of higher education to update undergraduate teacher preparation programs and to offer post-baccalaureate training and continuing education for practicing teachers in the areas of sustainability. It is encouraging that some states are recognizing the curricular shortcomings in this area. For instance, in 2020, New Jersey became the first state in the U.S. to mandate teachers cover climate change in all subjects beginning in kindergarten [43].

Pennsylvania adopted Science, Technology & Engineering, Environmental Literacy & Sustainability (STEELS) Standards in July 2020, and these will be a requirement for all state school districts for the 2025–2026 school year [44]. The Smithsonian Science Education Center provides training opportunities and classroom resources related to science literacy and sustainability [45]. Local environmental education centers also provide valuable resources and experiences for educators and field trips for students of all ages.

Thus far in this paper, I have argued for an ethics-driven, interdisciplinary approach to sustainability education being offered beyond environmental and sustainability majors and provided specific examples in the health fields and teacher preparation programs. To educate the next generation of environmental stewards and leaders who are global citizens with sustainability mindsets, what other steps can campuses take?

Campuses could use the SDGs as a framework for establishing some learning objectives within their general education curriculum or for their overall graduate requirements. Educators should start by becoming familiar with the 17 SDGs, including the targets under SDG 4, the goal aimed at ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all [5]. Campus teaching and learning centers could sponsor discussions about the interdisciplinary connections among the SDGs. UNESCO has published several useful resources, including learning objectives for education related to the SDGs [46]. The National Academy of Sciences published a 2020 report entitled *Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels* [47]. These are good resources to use as starting points for such conversations. An online search turns up several publications on how the SDGs have been incorporated into the curriculum in countries outside of the U.S. The Global Council for Science and the Environment (GCSE) is exploring accreditation for sustainability and sustainability-related programs in higher education, although the SDGs are not specifically mentioned [48]. Lehigh University developed a means for inventorying their campus-wide course offerings to determine whether sustainability is central or even pertinent to a particular course, and if so, to which SDG(s) would it map [49]; (personal communication with Dr. Dork Sahagian, Lehigh University). This inventory was done using keywords in course catalog descriptions, but analyses of syllabi on file could also be done, especially since so many institutions now use online learning management systems.

Students and faculty can collaborate virtually with peers across institutions and disciplines to share ideas and expertise, collectively problem solve, and design

<sup>5</sup> The Next Generation Science Standards do not mention sustainability or sustainable development but climate change topics are introduced. See <https://www.twigscience.com/ngss-states/>.

action plans to address SDG-related issues locally, such as food security on college campuses or in local school districts. This model is used by the NSF-funded project: Youth Environmental Alliance in Higher Education or YEAH [50–52]. The twelve founding institutions in the U.S., U.K., and Australia have developed an online course and training modules, and teams of undergraduate and graduate students for institutions around the world collaborate on research projects and disseminate their results through a virtual international conference. Additionally, cohorts of students gain training on how to be active civil society participants at the annual UNFCCC climate conferences (the COPs). The Millennium Fellowship Program, organized by the United Nations Academic Impact and Millennium Campus Network [53], offers a semester-long leadership development program for student teams from college campuses around the world. Besides virtual programming, students design and carry out local projects addressing one or more of the SDGs, moving knowledge to action.

Authentic experiential learning and service opportunities in partnership with communities can provide valuable opportunities in the sustainability or climate change spheres. Students at Moravian University have worked with the city council to help develop a climate action plan and with the regional planning commission to determine baseline greenhouse gas emission data. Beginning in fall 2024, students and faculty from Moravian University and other local colleges will work in partnership with the Nurture Nature Center on a CREATE Connections project [54] funded by NOAA's Office of Environmental Education and Environmental Literacy program [55]. This multi-disciplinary collaboration will “engage youth and community to increase knowledge of weather and climate science, the risks from local hazards, and strategies for hazard mitigation, while storytelling and co-creating a vision for community resilience.” The Nurture Nature Center has research-based programming and resources for all ages, including a regional youth climate summit. This center has long collaborated with regional faculty, students, municipal governments, and the public, using science, art, and community dialog to identify solutions for local environmental problems. The Nurture Nature Center also offers internship opportunities for students from a wide array of disciplines, and these provide students with valuable experiential learning opportunities.

Lehigh University in Pennsylvania has a new NSF-funding training grant to support a *Stakeholder-Engaged, Equitable, Decarbonized Energy (SEED) Futures Training Program* that will “transform the training of PhD and Master’s students through stakeholder engagement, equity considerations, and interdisciplinarity to pioneer impactful solutions while developing key skills for energy

sector leadership across a range of roles from academia and industry to government agencies and policy organizations” [56]. There are likely many other examples of university-community partnerships focused on sustainable solutions. Having a public database of examples of meaningful work that enable students to put sustainability knowledge into action and provide a public good would be useful, especially if information on how such partnerships were initiated and lessons learned were included. Institutions looking to make positive contributions in their geographic region could use this resource for inspiration. The Sustainable Development Solutions Network might be a logical home for such a resource.<sup>6</sup>

As we prepare this next generation of environmental stewards, problem solvers, and leaders, they should also have global perspectives given the far-reaching impacts of the 21st century challenges and the disparate impacts of environmental problems and social inequities on the Global South and communities of color. Many colleges and universities have goals of global learning or global cultural competencies, and this is a logical place for institutions to consider including the SDGs. In a 2023 article, Landorf and Doscher [57] discussed how their institution, Florida International University, stated that the ultimate goal of global learning is “to increase quality of life for people and the planet. We therefore assert that global learning is the process of diverse people collaboratively analyzing and addressing complex problems that transcend borders and engaging in actions that promote collective well-being.” Importantly, they go on to state that:

*Global learning is concerned with exploring authentic complex problems with interconnected local and global implications such as those encompassed by the United Nations Sustainable Development Goals.*

In summary, institutions of higher education play an important role in providing the research and new technology that can be used to address 21st century global challenges. But beyond this innovation, institutions should also be examining ways to incorporate sustainable development and climate change concepts across the curriculum and to provide students with meaningful experiences to put their new knowledge into action in their communities and beyond. Our youth have the passion and desire to learn useful information and skills to help address complex problems in their communities. They have the capacity to become future social entrepreneurs. As educators, we owe it to them to provide innovative learning opportunities, not only in the

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<sup>6</sup> See <https://www.unsdsn.org/>.



classroom, but in action-oriented research, learning, service, and civic engagement.

#### Abbreviations

AQI	Air Quality Index
COMPETES	Creating Opportunities for Manufacturing, Pre-Eminence in Technology, and Economic Strength
COP	Conference of the Parties (within the United Nations structure of conventions or agreements)
EMT	Emergency Medical Technicians
EPA	United States Environmental Protection Agency
GDP	Gross Domestic Product
IFMSA	International Federation of Medical Students' Associations
K-12	Kindergarten through 12 <sup>th</sup> grade
LEED	Leadership in Energy and Environmental Design
NOAA	U.S. National Oceanic and Atmospheric Administration
NSF	National Science Foundation
SDG	Sustainable Development Goals
STEM	Science, Technology, Engineering and Math
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization
YEAH	Youth Environmental Alliance in Higher Education

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#### Authors' contributions

DWH wrote the main manuscript text and the ideas and research were hers.

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