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Title	Education in a warming world: Trends, opportunities and pitfalls for institutes of higher education
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Publication date	2022-07-07
Publication information	Kelly, Orla, Sam Illingworth, Fabrizio Butera, Sian Cowman, and et al. "Education in a Warming World: Trends, Opportunities and Pitfalls for Institutes of Higher Education." Frontiers Media, July 7, 2022. https://doi.org/10.3389/frsus.2022.920375.
Publisher	Frontiers Media
Item record/more information	http://hdl.handle.net/10197/25267
Publisher's version (DOI)	10.3389/frsus.2022.920375

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frontiers | Frontiers in Sustainability

TYPE Perspective
PUBLISHED 07 July 2022
DOI 10.3389/frsus.2022.920375

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SPECIALTY SECTION
This article was submitted to Sustainable Organizations, a section of the journal Frontiers in Sustainability

RECEIVED 14 April 2022
ACCEPTED 16 June 2022
PUBLISHED 07 July 2022

CITATION
Kelly O, Illingworth S, Butera F, Dawson V, White P, Blaise M, Martens P, Schuitema G, Huynen M, Bailey S and Cowman S (2022) Education in a warming world: Trends, opportunities and pitfalls for institutes of higher education. *Front. Sustain.* 3:920375. doi: 10.3389/frsus.2022.920375

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Education in a warming world: Trends, opportunities and pitfalls for institutes of higher education

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Higher education institutes (HEI) face considerable challenges in navigating how to respond to the escalating and intertwined socio-ecological sustainability crises. Many dedicated individuals working in the sector are already driving meaningful action through rigorous research, teaching, knowledge sharing, and public engagement, while there is a growing consensus that sector-wide change is needed to ensure that aspirational declarations and positive individual actions translate into sustainable and transformative change. This article seeks to contribute to such efforts by illustrating a number of trends, examples, and reflections on how third-level educational institutes can act sustainably. We highlight the potential of five strategies HEI could employ to support the creation of a more sustainable future namely, (i) innovative approaches to climate change education; (ii) research agendas for societal transformations; (iii) providing climate change education for professional development; (iv) supporting public intellectuals; and (iv) investing in whole-systems approaches to greening the campus. The insights are the product of an interdisciplinary working group with members from across Europe, Australia, and the UK. These international examples provide insight and a sense of possibility for future application.

KEYWORDS

climate change, education, sustainability education, sustainable universities, sustainability challenges, sustainable organizations, higher education, environmental education

Introduction

The consequences of the global socio-ecological sustainability crises, which stem from post-industrialized actions centered on excessive resource use (such as fossil fuels) are intensifying (UN Environment, 2019; Trisos et al., 2020). To adequately respond to the scale and complexity of sustainability challenges, including climate change, biodiversity loss and social inequality, states, particularly high-income nations, must implement far-reaching social, economic, and technological changes (UNEP-United Nations Environment Programme, 2021). Higher Education Institutes (HEI) are well-placed to support national efforts to meet the challenges posed by the global crises through rigorous research, teaching, knowledge sharing and public engagement (McCowan, 2020; ALLEA-The European Federation of Academies of Sciences, 2022; Kelly et al., 2022; UNESCO, 2022). Momentum for change is gathering. Notably, in 2019, networks representing more than 7,000 HEI announced that they are declaring a "climate emergency" (O'Malley, 2019).

However, the potential of the higher education sector to pursue this agenda is limited by a challenging broader political economy of declining public funds, increasing privatization and marketisation (Wals, 2014), and the endemic competitive ethos that reduces the likelihood of coordinated efforts within and between HEI (Butera et al., 2021). Further, HEI cannot be understood as a monolith. Not all institutions have the same interest, responsibility or capability in promoting sustainability (McCowan, 2020). Similarly, while individual academics or departments may work directly on promoting sustainability through research on the production of renewable energy others may contribute to the (re-) production of technologies and knowledge systems[1] that exacerbate the crises. So while the number of universities declaring climate emergencies is on the rise, there remains considerable variation in the extent to which emergency declarations translate into meaningful action (Facer, 2020; Latter and Capstick, 2021). Notably, some institutions have become embroiled in greenwashing controversies (Jones, 2012), while others faced legal action from students for their continued support of the fossil fuel industry through financial investments (McGreal, 2022). As a result of these challenges and complexities, many argue that HEI efforts to promote global sustainability have not been proportionate to the scale and urgency of the challenge (Fazey et al., 2021).

A model for HEI impact

This paper highlights some trends, opportunities, and pitfalls to HEI efforts to respond to the socio-ecological sustainability crises. Our insights are rooted in a transdisciplinary approach to sustainability research. Namely, we are a group of academics of varied disciplinary backgrounds[2] who endeavor to identify and transform practices (Hirsch Hadorn et al., 2006) to achieve a collective social resolution to sustainability challenges (Funtowicz et al., 1998). To this end, we draw on Tristan McCowan's theoretical framework, which provides an analytical lens to understand better the complex interplay between HEI, societies, and sustainability across five modalities of HEI operations: (1) education, (2) knowledge production, (3) service delivery, (4) public debate, and (5) campus operations (McCowan, 2020). We identify some challenges, opportunities and pitfalls and best practice examples for HEIs' across each of these five domains.

Education: Diverse perspectives through innovative pedagogies

An established and growing body of literature is dedicated to understanding the most effective approaches to education for sustainability and climate change (Orr, 1995; Monroe et al., 2019). While much work remains to be done (UNESCO, 2019), educators are increasingly engaging in innovative problem-based pedagogical approaches to enhance learning outcomes for complex sustainability problems like climate change (McCright et al., 2013). A plethora of innovative and solutions-focused approaches to teaching and learning for sustainability now focus on building knowledge, skills, values and emotional resilience (McCowan, 2021). In line with a transdisciplinary ethos, there are also growing efforts to make curricula more inclusive of diverse voices, ideas, and expertise (Herman, 2016; Monroe et al., 2019; Kornei, 2021).

A range of perspectives and innovative pedagogical approaches are being employed to facilitate a more inclusive approach to teaching and learning for sustainability. For example, socio-scientific issues is a pedagogy approach being used by science educators to engage students in explorations of local, socio-ecological challenges. This approach often involves the use of drama pedagogies to explore sustainability-related issues from multiple stakeholder perspectives (Raphael and White, 2021). Other examples of such innovative pedagogies include the use of poetry (Molderez et al., 2021), participatory arts (Cook, 2020) and games (Wu and Lee, 2015), all of which have been utilized to engage students, promote solidarity, and help to challenge the hegemony of traditional approaches (Gurnon et al., 2013). Research shows that such approaches can be effective in leveling hierarchies by creating a shared

1 For example, some ecological economists have classified the mainstream profession's response to the climate crisis as a "major failing". See for example Oswald and Stern (2019).

2 See the following link for details on WUN team, whose disciplinary backgrounds include but are not limited to pedagogy, social science, creative writing, environmental science, and political science: https://wun.ac.uk/wun/research/view/education-in-a-warming-world-a-collaborative-research-network-on-education-and-climate-change/.

sense of vulnerability, removing the notions of "experts" and "non-experts," to instead create spaces where more voices can be heard and acted upon (Illingworth et al., 2018). The inclusion of diverse perspectives and pedagogical approaches is key to transformative and empowering sustainability education.

Research agendas for societal transformations

The window of opportunity to secure a liveable and sustainable future for all is rapidly closing (IPCC-Intergovernmental Panel on Climate Change, 2022). HEI research communities play a pivotal role in advancing climate mitigation and adaptation strategies through their research and innovation in STEM. Although comparatively underfunded and historically under-engaged (Overland and Sovacool, 2020), the social sciences have much to add to addressing the sustainability crises. These rich theoretical and empirical evidence bases reveal the psychological, political, social and cultural factors underpinning the sustainability crises, and are critical to successful design and implementation of transformative solutions (Dietz et al., 2020; Longo et al., 2021).

For example, there is a rich and well-established evidence base that has long questioned the viability of our current socio-economic system (Meadows et al., 1972; Mazur and Rosa, 1974; Daly, 1991). In particular, scholars in sociology and ecological economics have for decades interrogated the utility of economic growth after certain national thresholds of human wellbeing have been achieved and have highlighted the ecological unsustainability of unfettered growth. Historically, these insights have filtered through to policy conversations[3] but remained peripheral to national decision making. However, as the intensity of the socio-ecological sustainability crises grows and the limitations of multilateral negotiations become more evident, pressure on national policymakers to bring about transformative social change is growing (Pew Research Center, 2021). As a result, engagement with social science research (Stern and Dietz, 2015; Venturini et al., 2020) including literature on transforming socio-economics to focus on human wellbeing and planetary limits (Lenzen et al., 2022) as opposed to economic growth, are increasing in both the academic (Callaghan et al., 2020; Tollefson, 2021) and policy domains. This trend is evidenced by the growing numbers of high profile networks dedicated to implementing this agenda through research, multi-stakeholder partnerships and public engagement (see Table 1 for a list of examples).

3 See for example the French "Beyond GDP" agenda, informed by the scholarship of Amartya Sen and Joseph Stiglitz and the Index of Sustainable Economic Welfare (ISEW) proposed by Herman Daly and John Cobb.

Service delivery: Climate change mitigation through professional development

Service delivery includes those activities that connect HEI with external communities (McCowan, 2020) and can include professional education, external funding, and community engagement initiatives. Partnerships for the provision of sustainability-related education to industry professionals is a form of service delivery for which there is growing demand. For example, within the formal schooling sector, research found that many educators at the primary and secondary school level feel ill-equipped or constrained by existing curricula to integrate climate change education (ALLEA-The European Federation of Academies of Sciences Humanities., 2020). HEI can play an important role in addressing this issue by building institutional capacities through collaboration on curricular development, in service training at the school level, while also continuing their role of preparing new educators (Reimers, 2020).

Beyond the education sector, there is a growing demand across the private and public sectors for sustainability education and support for both climate mitigation and adaptation efforts (Surminski, 2013). While positive examples exist (see Table 1), this unmet need presents significant opportunities for HEI to actively engage with professionals, thereby contributing to the spread of sustainability and climate literacy amongst those in positions of influence within industry.

Public debate: Supporting academic advocacy

Advocacy can be defined as publicly adopting a position and promoting it through various activities such as lobbying, campaigning and engaging and organizing the public (Gardner et al., 2021). Given the scale and urgency of sustainability crises, there is growing momentum for academic involvement in various forms of public advocacy (Gardner and Wordley, 2019; Green, 2020; Gardner et al., 2021). For example, a small but growing number of academics are becoming involved in activist networks, such as Scientist Rebellion—see Table 1 for other examples.

For others, engaging in the public debate on environmental issues through social media and other channels is a form of advocacy that can complement other academic outputs (Tollefson, 2021). The rise of social media platforms, such as Twitter, has facilitated an increase in this form of public debate. Research has shown that such social media can increase general understanding of climate change and even help drive

TABLE 1 Promising Trends in sustainability-related trends in higher education based on literature and case studies.

University operations	Promising Trends
Education: innovative problem-based pedagogical approaches	• UNESCO The Futures of Education—An initiative aimed at catalyzing a global debate on how knowledge, education and learning need to be reimagined in a world of increasing complexity, uncertainty, and precarity. • Higher Education Sustainability Initiative (HESI)—a partnership between several United Nations bodies and sustainability organizations, which aims to provide higher education with an interface between higher education, science, and policy making by supporting sustainable development, convening multi-stakeholder discussions and action, and sharing best practices. • Gesturing Toward Decolonial Futures—An arts/research collective that works on artistic, pedagogical, cartographic, and relational experiments that aim to identify and de-activate colonial habits of being, and to gesture toward the possibility of decolonial futures, including around (un)sustainability. • Carbon City Zero—A collaborative deck-building game, in which players develop a sustainable city, used across several HEIs.
Research: promoting societal transformations	• Center for People, Place and Planet—A research center that focuses on reconnecting people, ecosystems, and place-based knowledges for universal wellbeing and conducts transdisciplinary research using participatory methodologies in the context of global environmental change. • International Universities Climate Alliance—A central hub for universities to share the latest climate research with the public and enable greater collaboration between leading research teams, supporting global leaders, policy makers and industry in planning for and responding to climate change. • Wellbeing Economy Alliance—A collaboration of organizations, alliances, movements and individuals working toward a wellbeing economy. • Research and Degrowth—A diverse and active academic association dedicated to research, training, awareness raising and events organization around degrowth. • Common Worlds Research Collective—An interdisciplinary network of researchers concerned with our relations with the more-than-human world, working across the fields of childhood studies, early childhood education, children's and more-than-human geographies, environmental education, feminist new materialisms, and Indigenous and environmental humanities. • Worldwide University Network Global Challenge Group on Responding to Climate Change—A set of collaborative, multi-disciplinary and international research programs addressing the catalysts, causes and consequences of climate change. • Brown Climate Social Science Network—An international network of social scientists producing peer-reviewed research focused on understanding political conflict over climate change.
• Service Delivery: climate change mitigation through professional development	• NurSusTOOLKIT—A project to provide free, online, evidence-based Sustainability Literacy and Competency (SLC) resources in Nursing education, developed by Plymouth University, Esslingen University, the University of Jaen, and Maastricht University. • Climate Change Education Research Network—A network based out of four UK universities, to connect academic researchers and educators working on Climate Change Education at primary and secondary level. • Knowledge Center for Carbon and Climate—An Irish government project based in the Munster Technological University to establish a national platform for co-development and co-delivery of knowledge and skills to support and enable enterprise and society to adapt and transition to decarbonized economy and embrace sustainable living. • The Climate Ambassador Scheme—A new UK initiative linking university climate experts with teaching professionals in primary and secondary schools to provide them with training, fact-checking, or advice to school leaders or governors on cutting carbon emissions. • Five-Step Framework for Education for Sustainable Development—A step-by-step guide developed by Sheffield University for embedding Education for Sustainable Development across the institution, being used by departments to embed ESD in their (non-sustainability related) courses.
• Public Debate: supporting academic advocacy	• Scientist Rebellion—A network of scientists from a wide range of HEIs taking public actions calling for governmental climate change and sustainability policies. • Scientists for Future (S4F) International—A network of scientists, who work to support the global climate movement by providing facts and materials based on reliable and accepted scientific data to activists, politicians, decision makers, educators and the general public.

(Continued)

TABLE 1 Continued

University operations	Promising Trends
	• Astronomers for Planet Earth—A volunteer network of astronomers, astronomy students, and astronomy educators committed to the struggle against climate change and for climate justice. • Place-based Climate Action Network—A network which brings together the research community and decision-makers in the public, private and third sectors through five innovative platforms: three city-based climate commissions (in Leeds, Belfast and Edinburgh) and two theme-based platforms on finance and climate adaptation.
• Campus Operations: thinking beyond the campus	• Queen's Platinum Jubilee Challenge—A 1-year programme launched in Feb 2022 to help UK tertiary education sector hit carbon net zero, run by Royal Anniversary Trust and building on the work of the EAUC—Advancing Sector Emissions' Alignment Project. • The Green Gown Awards—running since 2004, these annual awards running in several countries and regions recognize sustainability initiatives being undertaken by universities and colleges across the world, for example The University of Amsterdam provides its staff a map on which destinations are divided according to travel time by train, and staff may not fly to destinations that can be reached by train within 6 h. • Fossil Fuel Divestment Student Movement—pressured by students, many universities have pledged to remove their investments from fossil fuels. In the UK, the Fossil Free campaign has tracked that 94 universities have divested or pledged to divest £15 bn from fossil fuels. • Academic Air Travel Reduction and Offsetting Project—An open access online map listing over 90 academic institutions that are specifically engaging with the issue of their air travel-related GHG emissions in some way. • The Green Office Movement—A movement of university sustainability hubs that work to inform, connect and support students and staff to act on sustainability in the curriculum, research, operations, community and governance and provides funding, a mandate and office space. • The European University Association—A member survey in 2021 found that 305 HEIs across Europe had greening measures and initiatives in place, including some focused on reducing GHG emissions related to travel. • Higher Education Climate Action Toolkit—A toolkit from the Climate Commission, a partnership between educational and sustainability institutions, designed for university management to advance sustainability and respond to the climate crisis, including not just GHG emissions reductions but climate and social justice.

institutional and political change (Harris, 2018; Schifeling and Hoffman, 2019). Conversely, suppressing expert knowledge can hide environmentally damaging practices and policies from public scrutiny (Driscoll et al., 2021). Many academics remain reluctant to become involved in advocacy, in part due to concerns over losing professional credulity among colleagues and the general public (Donner, 2017). Contrarily, preliminary research suggests there is growing public support for academic advocacy (Cologna et al., 2021).

Lack of institutional support, which ranges from disincentivizing involvement to opacity in terms of roles, responsibilities, and restrictions also act as barriers to academic advocacy (Jessani et al., 2022). As noted by Gardner et al. (2021), there are many ways that HEI can actively support their staff in this domain. First, HEI can defend the right of academics to engage in activism and push back against emerging threats to academic freedom. HEI can also take active steps to facilitate those academics who wish to engage more fully in public engagement. Such support could take the form of altered work allocation models, facilitating engaged research sabbaticals, altering hiring and promotion policies, and providing training to enhance the effectiveness of engagement (Gardner et al., 2021).

Campus operations: Whole systems approaches to campus greening

Campus greening generally refers to those initiatives which encourage pro-environmental practices and that typically pertain to initiatives such as waste reduction, energy efficiency, sustainable transport, and food sourcing (Sima et al., 2019). As noted by McCowan (2020), every dimension of HEI operations and policies from how they manage finances and human resources, to how they sell food and merchandise has important implications for climate change mitigation and adaptation efforts. Furthermore, university operations must embody best practices if emergency declarations are to have legitimacy.

While systemic change has been slow, many promising initiatives are emerging. For example, many universities have begun publishing records of their own GHG emissions. While these efforts are a useful first step, a standardized format for measurement and reporting is lacking (Helmers et al., 2021). There is resistance to implement sector-wide standards as many HEI grapple with how to address emissions, particularly those associated with air travel, while also facilitating important HEI functions such as international student exchange and academic networking. Other initiatives include imposing sustainability

criteria in the choice of suppliers (Sheffield University, 2020), and addressing food choices[4] and food waste at university canteens (ALLEA-The European Federation of Academies of Sciences, 2022).

In addition to these bottom up approaches, HEI are increasingly being incentivised to engage in campus wide greening through national level and international incentive schemes. For example, in 2022 the Queen's Platinum Jubilee Challenge was launched in partnership with the Department for Education to help universities in the United Kingdom to achieve carbon net zero in their operations. At an international level, global university ranking systems, such as the Times Higher Education World University Rankings, now assess university operations against the United Nations' Sustainable Development Goals (SDGs). The inclusion of such criteria in international ranking systems should serve to reward reputationally those HEI with consonance between sustainability aims and actions.

Conclusion

The human-induced socio-ecological sustainability crises pose a severe threat to all levels of society, particularly the most vulnerable. In recognition of this, many of those within the higher education sector are focusing on sustainability through their research and innovation, teaching and learning and institutional footprints. However, institutional and policy barriers and external challenges have stymied structural change. Drawing on McCowan's (2020) framework, we have presented examples of trends, opportunities, and pitfalls for HEI sustainability across five domains: (i) innovative approaches to climate change education (ii) transformative research agendas; (iii) climate change education through professional development; (iv) supporting academic advocacy; and (v) whole systems approach to campus greening. We argue that HEI endeavoring to become truly sustainable organizations must embody values consistent with social-ecological sustainability. Misalignments between espoused values and embodied practice within HEI undermine organizational legitimacy and inhibit the sector's contribution to the public good.

4 For example Berlin Universities are transitioning to 96% vegetarian/vegan food choices: https://vegconomist.com/gastronomy-food-service/berlin-universities-to-drop-96-of-meat-on-canteen-menus-for-climate-harm-reduction/amp.

Author contributions

OK and SI wrote the first draft. FB, VD, PW, and MB provided additions, comments, and suggested edits on the first draft. SC revised the manuscript and produced the second draft. PM, GS, MH, and SB provided additions, comments, and suggested edits on the second draft. OK and SC produced the final draft. All authors contributed to the article and approved the submitted version.

Funding

Worldwide Universities Network (WUN) has funded the research consortium whose members have authored the article, through a Research Development Grant.

Acknowledgments

The authors would like to thank the Worldwide Universities Network for their support.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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