E-collaborating for Environmentally Sustainable Health Curricula

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Abstract

Purpose This chapter aims to demonstrate how medical educators can use e-collaborative tools to collaborating internationally and cross-institutionally towards designing environmental sustainability and health (ESH) education. The main focus of the chapter is on sustainable medical curricula.

Methodology The chapter uses a case-study approach to bridge these broader e-collaborative principles with the specifics of implementation driven and supported by e-collaboration.

Findings The case study describes the evolution of the Sustainable Healthcare Education (SHE)-network into a network collaborative. Finally, the chapter discusses e-collaboration for education development through an illustrative case. The case concerns an UK-Greek University e-collaboration aimed at combating obesity and promoting climate literacy.

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Research implications E-collaboration is central at all levels of the ESH curriculum design process from forming a network collaborative around the curriculum process, alignment of assessment and learning activities with objectives, discussing and agreeing on a vision to the actual implementation plan.

Practical implications E-collaboration aids the curriculum design process such that people feel that their participation and interests are valued, as well as providing resources and input to resource stressed academics and institutions. E-collaboration is not an end in itself, but a means of enabling a global network collaborative to address an issue that suits this type of collaboration towards sustainable healthcare education.

Originality This chapter is inventive in showing how the promotion of climate literacy can be a component of a sustainable medical curriculum and how this process is facilitated with e-collaborative tools. The chapter demonstrates how health education should educate climate literate health professionals who are able to address and reduce public health impacts of climate change.

Keywords Medical curriculum · Environmental sustainability · Network collaboration · Climate literacy · Case study

Introduction

E-collaboration has the potential to enable educators, policy-makers and researchers around the world to contribute towards designing an environmental sustainability and health curriculum, including a focus on climate literacy and health. In particular, e-collaboration provides a way to bring collocated participants from different disciplinary backgrounds, organizations and different regions and countries to contribute together towards an educational project.

E-collaboration in designing health care education is challenging. First, e-collaboration needs to take heed of considerable differences in national standards and provisions of healthcare (Starfield and Shi 2002; Ozcan and Khushalani 2016) and health education (Harden 2006). Second, e-collaboration needs to consider different stakeholders' opinions. The stakeholders include health agencies, clinicians, educators, students, and patients. These stakeholders might hold different opinions about the health curriculum and about use of hospital and educational resources including how to deal with waste and energy consumption; it is fair to assume that different stakeholders represent different positions or interests, which makes e-collaboration all the more necessary to understand different positions and mediate between them. Third, health education is highly interdisciplinary; conceptual and empirical challenges abound in synthesising and working between different traditions of research. In medicine for instance, subjects range from the traditional biosciences of anatomy, biochemistry and physiology to the clinical medical sciences such as oncology and haematology to humanities such as communication and ethics, and social sciences such as psychology and sociology (Kapucu 2006). While cross-disciplinary work provides an expanded perspective

on today's complex health issues, historically entrenched disciplinary boundaries and a tendency toward specialization have created the need to develop new strategies for e-collaboration. In summary, there is lack of trialled approaches towards sustainable medical curricula facilitated by e-collaboration

While e-collaboration can help any curriculum network build, our focus in this chapter has a double focus specifically on both health professional education (e.g., climate literate health professionals) as well as sustainability. Research on how to use e-collaboration to design ESH curricula is both relatively new and highly relevant for patients, institutions (medical schools), societies, and indeed the planet. There is a need to integrate environmental sustainability and health (ESH) in the required and elective health sciences curricula. For example, providing health professionals with the ability to identify climate related health impacts (e.g., aggravation of pre-existing conditions, heat-stress, vector-borne diseases, mental health effects, and respiratory problems). In a few countries, health faculties or medical schools have made solid progress toward incorporating ESH education into the curriculum. Unfortunately, in most countries, such teaching is lagging or altogether absent. This chapter, therefore, advocates for continued innovation in supporting the curriculum collaborative, whose purpose is to design, share, and evaluate different environmental sustainability and health (ESH) education modalities focusing on the environment as a key determinant of health.

In this chapter, we examine our experiences as medical educators collaborating internationally and cross-institutionally towards designing ESH education with a focus on the sustainable medical curriculum that includes educating climate literate health professionals. Network members used electronic technologies because they were geographically dispersed and hence needed to work both synchronously and asynchronously. Our overarching aim in the chapter is to formulate guiding thoughts around general organizational processes that can inform engaging and fruitful sharing of educational curricula, materials and goals.

We provide an illustrative case to bridge these broader e-collaborative principles with the specifics of implementation driven and supported by e-collaboration. The approach to e-collaboration that we propose aims to achieve three objectives. First, the discussion of e-collaboration should provide insights that are relevant to all aspects of curriculum design. Second, cognisant of the global nature of many current challenges for environmental health and medical education, the practices that we propose can facilitate collaboration across borders and can be adapted and applied internationally. Third, we aim for an approach that enables collaboration between diverse stakeholders and involves low financial and environmental costs.

Sustainability in the Curriculum

Fundamental determinants of health such as air quality, water safety, climate, biodiversity and natural resources are global; they cut across national and political borders (Costello et al. 2009). E-collaboration is ideally suited to this kind of global

concern. In one direction, it facilitates design and subsequent dissemination of centrally agreed targets, strategies and policies such as the Sustainable Development Goals and ESD approaches. In the other direction, it allows the dissemination of examples of good practice and supports the development of locally relevant learning opportunities, informed by centrally derived goals and guidelines.

Lack of sustainability is a threat to human health worldwide, yet it has not received the attention it deserves in health education worldwide (Thompson et al. 2014). Learning objectives concerning core sustainability have been developed in the UK (Costello et al. 2009), adopted in the UK national medical curriculum (GMC Outcomes for Doctors 2015), and the validation is ongoing in the USA (Teherani et al. forthcoming) and expanded through international collaboration (Walpole et al. 2017). However, they are, to our knowledge, yet to be incorporated into learning and assessment on a national basis in any country. For example, specific training on the impact of climate change on health is limited, if not completely lacking. Generally, local medical educators' enthusiasm has tended to precede top-down institutional policy and support, driving the sustainability agenda into core teaching. E-collaboration could help to build national and international networks of educators pioneering new ESH teaching, thus bringing momentum to the process of formulating high academic standards and policies to implement ESH.

Organization and Terminology of the Chapter

In Box 1, we present the terminology pertaining to the topic. Subsequently, we describe the evolution of the Sustainable Healthcare Education (SHE)-network into a network collaborative. We then support our discussion of e-collaboration for education development through an illustrative case. The case concerns an e-collaboration between King's College London and Aristotle University, Greece, which aimed to combat paediatric obesity in Greece. By addressing network development as well as an on-the-ground case-based application of e-collaborative principles, we explore the theory and practice of e-collaborating while sharing lessons learned.

> **Box 1: Terminology**
> **Climate literacy and health** relate to how well students and professionals analyse principles of the Earth's climate system and effects on health as well as make judicial decisions in regards to healthcare actions that might affect both health and climate.
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> **Collaborative** or **network collaborative** refers to an organisation within a network in which members contribute towards a specific project.
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> **Curriculum** can on the one hand refer to the organised content and objectives of education as produced by an educational institution such as a medical school. This includes both formal and informal teaching and assessment methods. On the other hand, it can refer to students' experiences

with such content and objectives as they translate it into concrete learning activities.

Curriculum network or **curriculum collaborative** refers in this chapter to a group of medical educators who might be co-located and distributed across the world, yet communicate and e-collaborate on a regular basis and work together to address medical curriculum concerns.

Environmental sustainability and health (ESH) education has an overall mission to educate students with knowledge, skills, and attitudes that can contribute to environmentally sustainable high quality health-care. Sustainable here might refer to activities for building viable ecological, socio-economic conditions for sustainable healthcare. ESH curricula are health educational curricula that integrate learning about the relationship between ecosystems and human health, approaches to providing sustainable healthcare and an environmental sustainability perspective in public health and professionalism.

Medical educators are teachers, administrators, researchers, faculty developers, curriculum designers, and students who are involved in planning, conducting, evaluating, and researching learning and teaching at medical schools.

Collaborative Integration: The SHE-Network

In the following, we explore how the SHE-network has developed from its institutional origins to a global endeavour. Members of the networks involved in promoting ESH education share a desire to ensure that medical students are prepared to address the challenges and opportunities that the relationship between humans and ecosystems brings to healthcare. One example of this is to investigate the impacts on health from changes in the climate. Here we explore how this led into the SHE network's formation and growth. Our discussion touches on the network's aims, its successes to date, and challenges that remain.

Fostering a Collaborative Network

E-collaboration can help to spark and maintain a curriculum collaborative network. The SHE-network was launched in 2009 to foster cooperation around ESH education. Key milestones in the development of the network are shown in Fig. 1.

Members of the SHE-network predominantly used the network as an e-collaborative support structure, sharing their practice, and seeking common solutions. However, until recently, most members acted autonomously within their own institutions to develop teaching for their students. The SHE-network was
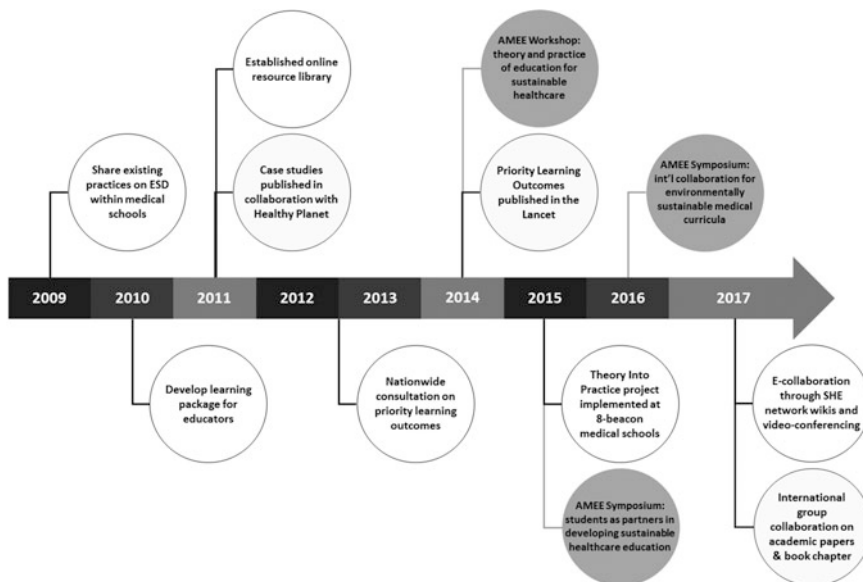
Fig. 1 The key achievements of the Sustainable Healthcare Education network over the past decade

therefore a loose or informal work organisation among educators. The leadership of this group passed, over time, from its creators (one academic and one clinician) to a leader with more ample time and resources (a senior academic medical registrar doctor). With an increasing membership, the SHE-network naturally evolved from loose cooperation with irregular contacts from members, towards a stronger collaboration where active participants maintained regular engagement including updates to all members. The SHE-network is an example of a collaborative that supports consensus building, and provides social capital (Briggs 2007) in what is currently a 'bottom-up' movement, that is beginning at a local level and at low levels in the organisational hierarchy before moving to influence change at an aggregate level (Walpole et al. 2017).

Once the network was well established, the time had come to work towards the global mandate of integrating sustainable practices into medical education and addressing the health impacts of climate change. This came about through a highly interactive symposium (with both face-to-face and video-linked interaction between participants) that also served as a network node. A core group from the SHE network sought a forum for this endeavour and identified the 2016 AMEE (Association for Medical Education in Europe) conference (the world's largest conference for international medical educators, held annually) (Walpole et al. 2017). The group ran a symposium exploring environmental sustainability curriculum development building on previous years' experience at AMEE conferences. After the workshop, conference participants self-selected to join a SHE-based core

group de-briefing and exchanged contact information. When participants returned to their home institutions, several responded to the workshop leaders' invitation to participate in a publication summarizing the workshop structure and outcomes. In the following six months, several related projects were developed.

SHE-network accomplishments

As initially outlined, the aims of the SHE-network's e-collaborative activities target-specific outcomes. Currently completed and on-going projects include network expansion, development of an on-line presence through an established web-based platform, publications and presentations in a range of formats and settings, the development of open-access case studies, curriculum materials and online network discussion.

Network expansion

After the AMEE meeting, the SHE-network expanded its reach through representatives across continents. These included not only individual participants, but affiliated educational networks with the potential to expand SHE's reach. Network strengthening, expansion and creation of nodal centres within or between organizations such as universities or medical schools offer opportunities to support the long-term goal of educating healthcare professionals to think and act for a sustainable agenda. Expanded networks can use e-collaboration to move from a narrowly defined towards a well-defined goal without losing sight of the broader understanding of ESH. For instance, e-collaboration allows for discussion of whether the top priority should be to lower carbon-emission in hospital or primary care or to tackle the mutual effects between health and climate change, or migration patterns in the future.

   At the same time, network expansion requires e-collaboration to facilitate inclusivity, and its correlate: resisting fragmentation. To keep all e-collaborators engaged and goal-focused, small breakout groups were formed through e-communication and these groups addressed specifically assigned tasks. Sub-groups have had the opportunity to reconvene online and report to the broader network on the subtasks and larger enterprise.

Platform development

An e-repository of resources and materials is an important focal point for sharing materials. The SHE-network collaborative uses the Centre for Sustainable Healthcare's subsection on SHE to post resources and materials for curricular development. Access to a repository of free educational materials is essential to assist users internationally in adapting their curricula to specific settings and various levels of resource allocations.

   Based on experience of the SHE network, an ideal repository amenable to e-collaboration should have the following characteristics. First, a list of resources, particularly open-access on-line courses focusing on ESH, but also agencies and organizations that provide education and advocacy tools. Second, the repository should assemble syllabi that users can adapt in developing learning objectives and

structuring courses at their own institutions. Third, full course content modules should allow easy adaptation in resource-limited areas, where lack of time and funding may interfere with curriculum development. Fourth, a materials repository must provide a forum for feedback because of varying local concerns in face of globally applicable conditions. In summary, a materials repository must provide a forum for feedback. The SHE-network's comment function allows e-collaborators to add to and comment on postings, which in turn facilitate discussion of the latest pedagogical thinking.

Scholarship

In the wake of the SHE-network's presence at AMEE, one of the group's goals was to enlist collaboration on scholarly activities, including publications and presentations. Thus, network members could enlist collaboration on projects that would build on previous accomplishments and enhance the network's visibility and credibility.

In writing up research papers and preparing conference submissions, members as e-collaborators of the SHE-network experimented with different communication intensities, that is, coming together face-to-face at widely spaced intervals, communicating as a plenary through video or audio modalities or on a variety of e-platforms, and breaking out into small groups communicating electronically to accomplish specific tasks. But in general, the e-collaboration tools available to the SHE-network serve exactly the same purpose as for any other collaboration and include any combination of the following: synchronous web-based chat tools, asynchronous conferencing tools, e-mail, internet-based list-servers, Web 2.0 with social network tools, collaborative writing tools and collaborative decision support systems (Rosalind 2014).

E-collaboration with videoconferencing is useful in planning conference workshops, conducting research and writing journal articles. Shared successes in these areas have spurred the network on, over time, towards increasingly complex goals. As Schauer and Zeiller (2011) point out, to promote e-collaboration success, successful synchronous cooperation is key. In our experience, none of the communication venues or platforms mentioned above replace or compensate for tacit elements that are crucial to the group's success. These include a sense of diligence and responsibility, passion for the project, and openness and respect towards colleagues.

E-collaboration needs to resolve issues around authorship in a collaborative network. Our experience was that e-collaboration adapted to fluid leadership where different contributors were encouraged to step up at different times depending on the network members' evolving priorities. We found that the more motivated the group, the less leadership is necessary and the more coordination functions take precedent. The assignation of followership, authorship and sense of agency may for that reason not be as problematic for a passionate issue-driven volunteer group as it is for traditional collaborations.

Curriculum development

Network participants have contributed various specific curricular examples via the SHE-network. These range from course syllabi to detailed descriptions of workshops and modules incorporated into pre-clinical and clinical courses to on-line case studies. Although data are lacking on the extent to which these curricular cross-network postings have been adapted thus far across institutions, sharing of curricular material is most feasible under specific conditions.

First, curriculum development must involve committed faculty as e-collaborators who already have experience with curriculum implementation and can inform best practices, that is, share their successes for how to export a curriculum to other medical schools within their own or other countries. There is also a need for relevant faculty in this collaboration e.g. educators who are knowledgeable and experienced in environmental health, sustainability, climate literacy.

Next, faculty will be best motivated to use e-collaborative technologies if they are aligned with the technologies as a social practice of medicine. It is important to recognize that the collaborative tools used for purposes of medical research, medicine as science, medical education and the medical profession follow and an intricate but meaningful social practice (Crawford 2006). Medicine for instance centres on standard diagnostic and treatment modalities across institutions. E-collaboration allows participants to query the network members about differences in the social practices in which they participate. This might give us worked examples as to how health is affected by climate change and its ramifications in different settings.

Finally, to further the network's goal of developing curricular material, network members gather information on and develop responses to the challenges network e-collaborators might have encountered in adapting different components of web-based resources in a range of settings. While this web-based approach to shared curricular materials will likely mean focusing at first on homogeneous end-users, e.g. learners from developed countries where fossil fuel consumption is not only high but also taken for granted in everyday life, we hope to use all the strands of our connective capacities to involve e-collaborators from low- and middle-income countries (LMIC). To this end, it is important to engage students and, elicit their input to make the cases and simulations relevant to their local circumstances to eventually achieve global portability.

Case Example: UK-Greek University Collaboration

In the previous section, we described the development and expansion of an international medical educational network and its potential to enhance communication, scholarly collaboration, and curricular integration of ESH across institutions on a global scale. What might such collaboration look like in the setting of a concrete project that addresses specific institutional and culturally mediated needs? We

present an example of e-collaboration that moved towards designing e-learning tools (see Box 2). The project was specifically geared towards creating a more sustainable healthcare system with few resources. While the example of the SHE network demonstrates how a network can develop and produce wide-ranging outputs, this case demonstrates how a partnership e-collaboration for a more focused project can be effectively engage stakeholders, develop messages and outputs that have value in different contexts and encourage participation and interaction between educators and students. Although the example focuses on addressing obesity, this lessons learned are applicable to promoting climate literate health professionals.

Box 2: Case study: E-collaboration between two institutions

Who? Representatives of the Aristotle University of Thessaloniki, Greece (AUTH) invited representatives of King's College London, UK (KCL).

Why? The overall purpose was to present and cope with an obesity epidemic in Greek society. KCL was invited to support AUTH in introducing a behaviour change intervention to address obesity. By way of background, Greece is burdened with the highest rate of paediatric obesity in the world. Obesity is precursor of inactivity, arthritis, cardiovascular disease, hypertension, diabetes and stroke, as well as social and psychological distress. The impacts of this obesity epidemic are unsustainable, with increasing morbidity driving up the social, financial and environmental costs of healthcare provision. In addition, the Greek healthcare system and indeed higher education system is constrained by financial austerity following the recent collapse of its financial system.

The project was low budget, which was the initial driver for adopting an e-collaborative approach. The project needed lecture materials, handouts, scenarios to support peer-to-peer role-play, teacher training, monitoring of assessments, and careful ongoing evaluation as an established educational programme from the UK was effectively being transplanted into the Greek context.

What? There were three curricula collaborative elements. First, the intervention involved a lecture and role-play on broaching obesity and applying behaviour change theory and motivational interviewing techniques to support patients in both setting and achieving a personal goal. Students were provided with tailored information on evidenced strategies to improve diet, lose weight and/or increase physical activity levels. Second, students were distributed to a large network of general practices across the region and required to complete a behaviour change intervention with patients. Third, students were required to submit a reflection on their experiences as a compulsory but formative assessment.

How? The process involved regular video conferencing meetings using a free online platform were set up with the course organiser at AUTH to individualise the collaborative process. Materials were shared via email and

translated locally. An interactive webinar was set up to support teacher development that included skills training in motivational interviewing and practical applications of behaviour change theory. Students were sent to over 130 primary care locations in three termly blocks and completed behaviour change consultations that included setting patient-led goals and action plans with over 3000 patients in a single academic year. Students were required to submit their reflective essays and a summary of each consultation via a free cloud-based document-sharing site. These were accessed and translated into English using free online translation software and used, with ethical approval, to evaluate the programme, looking at the experiences of students through their reflective essays and the experiences of patients through the consultation summaries.

Evaluation—how? The efficiency of this e-collaborative approach was evident to all involved. KCL's initial input was a single afternoon webinar, where existing teaching materials were recycled. AUTH gained access to the KCL programme that had been honed across three years of action research. Students across a multi-site network were able to articulate and reflect on their learning as part of their assessment, which was then submitted via cloud-based file sharing, and used to quality control and improve their experience. The research interests of the team at KCL were used to support the evaluation needs at AUTH. This synergy was created by breaking down the barriers to international collaboration, where physical distance, language barriers and resource disparities become less significant through technology. The impacts in terms of environmental sustainability will depend on the students' success in changing behaviour. Adopting a 'back of the envelope' method of estimating these savings, if 1 in 10 patients achieved their goal and that goal resulted in a 33% reduction in health care needs over the life of that patient, then the healthcare-related carbon footprint of those 3000 patients would be reduced by approximately 3%.

Integrating a Range of Stakeholders

The first lesson of the case of UK-Greek University collaboration is that e-collaboration can integrate a range of stakeholders. Keeping external stakeholders or key players involved is important in the curriculum design process because they have the resources to improve but also greatly hinder any new initiative. This is particularly relevant when external stakeholders such as health politicians and physician postgraduate representatives at hospitals or in the national physician association are invited to participate in the network collaborative. In short, e-collaboration must keep external stakeholders or key players content that progress

is achieved by frequently communicating (synchronously and asynchronously) with external stakeholders and giving them options about how they transmit their feedback and opinions to the whole network.

The second lesson is that e-collaboration can be used for purposes of knowledge sharing between external and internal stakeholders. Sharing of new curricula, learning-centred teaching, new technologies etc. need to be continuous. This is relevant because a curriculum is a process involving continuous program design and renewal (Briggs 2007). The continuous process derives from the fact that a curriculum has its own lifecycle according to the academic year and stakeholders need to be kept updated about current activities. Furthermore, curriculum renewal or reform might come about following international research trends, faculty and student desires to change (or keep) the curriculum as well as political pressure from external stakeholders. Regardless of the pace of curriculum renewal, e-collaboration is a way of keeping stakeholders at two institutions (e.g. medical schools as in above case: KCL and AUTH) each with external and internal stakeholders on the same page.

A third lesson is that e-collaboration is helpful in uniting stakeholders in the process of formulating a vision. Agreement on standards and course-validation is one aspect of this. Another is to share and discuss benchmarks or visions from professional bodies that the ESH curriculum needs to fulfil. E-collaboration might help participants agree on common standards and the structure of the curriculum such as how many hours and which type of assessment. This should then contribute to building a vision and a shared narrative about the value of ESH for the involved stakeholders of the institutions. In summary, external and internal stakeholder e-collaboration, agreeing on the novelty and visionary status of sustainability (e.g., climate literacy) might help stakeholders to build an ethos as change agents and involved medical schools to build an image as sustainable medical schools (i.e., schools producing climate literate medical professionals).

Addressing National and Local Health and Political Contexts

The above case is an example of how e-collaboration provides an opportunity for one medical school (KCL) to not only export the message of sustainability, but also develop it together with another medical school (AUTH). It is pertinent in the initial phase of e-collaboration to build awareness of national and local contextual differences. Once a consensus has arisen through collaboration, there needs to be a process of individuation to the local context.

The discipline of sustainable healthcare education often arises and becomes an internationally shared agenda within a national or local context. E-collaboration must address local and contextual factors and take account of national and cultural settings in which medical schools are situated. The point is that two different medical schools in different or even in the same countries might not serve the same patients (i.e., presenting with similar disease patterns), the same medical students or

share the same curriculum and educational objectives. Because these differences might sound obvious, or because we as educators get accustomed to our own curriculum and terminology etc., differences can easily be overlooked and tailored solutions might be missed. For instance, while the UN's Education for Sustainable Development (ESD) agenda provided a general context for change (UN 1987; UNESCO 2006), it did not address the specific institutional constraints in healthcare delivery that leaders would need to account for to implement ESD.

ESH education is influenced by numerous factors beyond the pedagogical reorientation urged by ESD. These factors include changes in social and political trends, healthcare practice, scientific advancements, health systems reorganisation, varying climatic conditions and national and international policy developments. For instance, in relation to the above-mentioned UK-Greece collaboration, change caused by external factors such as increased awareness of environmental determinants of health and introduction of carbon-emissions reporting in the UK (NHS 2012). It was also manifested through an increased focus on transparency and quality and a better understanding of the carbon footprint of healthcare, and the creation of new organisations such as Public Health England (Negev and Kovats 2016); and enshrining responsibility within the UK Climate Change Act 2008 (Costello et al. 2009). In summary, e-collaboration towards curriculum development is charged with political pressures for reform or renewal nationally and internationally.

The Role of Students: Enabling Broad, Equitable Participation

E-collaboration can enable broad, equitable participation. The perspective of students is crucial to ensure that the design, content and delivery of curricula meet the needs and expectations of learners. Traditionally curricula have had limited participation of lower 'status' stakeholders, for example students or patients having limited input compared to professors or consultants.

In the Greek/UK collaboration described above (Box 2), students were able to give their 'evaluation' of the course and their experiences with patients as part of their reflective essay submission, effectively creating a participatory action research project, where their experiences were fed forward into the next cycle of curriculum development. Challenges were anticipated in collaborating between differently resourced medical schools with disparate cultures and population profiles. Nonetheless, the depth of learning and reflection by students at AUTH and the reported engagement of their patients exceeded the levels reported at KCL. There was a high level of engagement by students in this progressive, e-collaborative project.

Our vision moving forward would be of an ongoing international collaboration, extending to students, blurring boundaries between educators and students, promoting scholarship, and involving and empowering students as active partners in the ongoing review and development of curricula (Fetterman 2001). The majority of today's students are active users of social media and online communications in a

variety of forms. Notably, In the UK, the medical student campaign 'Healthy Planet' (www.healthyplanet.org), which addresses environmental and health issues, mainly communicates through social media and cloud-based technologies. The International Federation of Medical Students' Associations brings together medical students from over 100 countries, involving a variety of e-collaboration tools. Students may be more *digitally native* and willing to be *digital immigrants* than educators (Prensky 2001) may and may be experienced at getting to know and use new online platforms.

In the case of SHE, students clearly provided leadership, for example, by creating and disseminating e-learning modules and webcasts. Although medical students have highly demanding course requirements to meet, many students have made significant contributions both during student-selected projects and outside of their formal medical training (Dyrbye et al. 2006). Students' idealism, energy and career motivations may be contributing factors. In summary, students are important partners in e-collaboration both because it is important to take into account their perspective on the priorities for medical education, and because they bring useful skills, energy, and experience.

Conclusion

In conclusion, e-collaboration is central at all levels of the ESH curriculum design process. This is particularly the case in forming a network collaborative around the curriculum process, to alignment of assessment and learning activities with objectives, to discussing and agreeing on vision, to the actual implementation. E-collaboration can aid the curriculum design process such that people feel that their participation and interests are valued, as well as providing resources and input to support stressed academics and institutions. E-collaboration is not an end in itself, but a means of enabling a global network to address an issue that suits this type of collaboration.

The projects discussed in this chapter highlight the need for five further lines of research. First, e-collaboration has implications not only for ESH curriculum design, but also for faculty capacity development. Thus, once the curriculum is in shape, we found that there arises a need for initiatives that enhance medical educators' teaching competences or capacities to teach about new and unfamiliar topics (e.g., climate literacy). Medical educators at all levels from tutors to seasoned professors might benefit from participating in the network for e-collaboration on teaching modalities (e.g. e-learning).

Second, future research must (or needs to) look more at ethics. As discussed above, e-collaboration can potentially widen accessibility of and participation in curriculum development, but it is also important to be cognisant of the potential inequality of participation, production and ownership within such a network. Research could investigate the complex issues about ownership of tools, e.g. copyright in relation to sustainability, as well as political and economic

embeddedness of a network aiming to be environmentally conscious. Thus, an issue for environmentally conscious networks is the stated environmental credentials (e.g. green accountability) of providers and platforms that the network engages with. If the provider of an e-collaboration tool does not have an adequate environmental policy, are medical educators wanting to implement a green curriculum ethically obliged to avoid using and recommending such a tool, even if it might technically be the best solution?

Third, future research should consider how the output of an e-collaboration could be formalised and made widely available through e-learning. Our examples demonstrate useful outputs of e-collaboration, and their applicability in different settings. With existing medical curricula often at capacity and little room for new fields to be introduced, e-learning provides an opportunity to provide learning episodes for large numbers of students in both LMIC and high-income countries (Frehywot et al. 2013).

Fourth, future research might look at ESH through the lens of higher education research. One question is whether ESH as a curriculum strategy and ideology impedes or furthers trans-border trade in higher education. On one hand, e-collaboration is arguably a powerful set of tools and strategies that are impervious or at least neutral to the rising demand for online higher education. On the other hand, e-collaboration is not just a neutral approach. It affects how health curricula are shared and developed towards or away from ESH curricula integrated or as stand-alone courses in the curriculum. It was our opinion as researchers and educators that ESH should be integrated into health education and not be a stand-alone course. However, further research is needed to substantiate this opinion and formulate guidelines for the design of ESH curricula.

Fifth, research is needed on higher education concerning the interplay between e-collaborative curriculum and higher education policies around blended learning. University education is going online at a rapid pace with open universities, MOOCs, e-universities etc. Research should assess what role e-collaboration can play in this development.

In conclusion, in our experience e-collaboration around curriculum design is about networking and organising work. E-collaboration might only improve workflows if the organisation, e.g. the ways the members of the subgroups are organised, is ready to embrace e-collaborative tools. E-collaboration emerges to address parochial limitations in institutional and national political agendas pertaining to medical schools' curricula. It underscores the need for global connectivity and continuous real-world practical engagement as well as more theoretical work and collaboration. E-collaboration might help in formulating new policies and initiatives between regions or even countries around student exchange agreements to address sustainability as a global concern by keeping members up-to-date on issues as well as promoting discussion, (e.g., around current thinking and research related to climate literacy for health professionals). The impact of e-collaboration on ESH curriculum and subsequent impact on a more sustainable global environment depend on both the actual tools and their application in collaborative networks.

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