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## EDITED BY

Hannah Covert,  
University of Pittsburgh, United States

## REVIEWED BY

Jason W. Marion,  
Eastern Kentucky University, United States  
Therese Ferguson,  
University of the West Indies, Mona, Jamaica

## \*CORRESPONDENCE

Lindonne Telesford  
✉ ltelesfor@sgu.edu

†These authors have contributed equally to this work and share first authorship

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# Leveraging small island context to advance and disseminate environmental health and sustainable development knowledge through higher education

Lindonne Telesford\*<sup>†</sup>, Chinelo Nsobundu<sup>†</sup>, Tiffany Lewis, Aleah Marks, Amran Alamrany, Oznur Zaim, Innah Lachica, Allen Eruaga, Lira Camille Roman, Tamara Slavkovska, Dhruv Mandal and Vijay Chandran

Department of Public Health and Preventive Medicine, St. George's University, St. George, Grenada

Higher education curricula can be designed to effectively leverage the context of small island states to enhance and deliver sustainable development and environmental health education, catering to workforce development, citizenry, and inclusivity. Small islands and developing states, in particular, are left behind in recognizing and promoting the linkages between environmentally sustainable development and the health of its people. This community case study highlights strategies of a Caribbean-based higher learning institution, leveraging the context of a small island state, to close this gap and create equitable access to integrated sustainable development and environmental health education. Tenets of Education for Sustainable Development theory underpin the pedagogical methodologies used in the delivery of the academic program. The curriculum draws on experiential learning, competency-based education, and diversity and inclusion, oriented to active student–student and student-practitioner engagements. Learning is facilitated through the effective dissemination of information, healthy interactions within a diverse community, professional engagements with multi-disciplinary practitioners, problem-solving, and formulation and presentation of perspectives and experiences relating to the Sustainable Development Agenda and Goals. Highly engaging and inclusive academic processes can accentuate students transitioning into the role of teachers, environmentally conscious leaders and citizens, and competent public health practitioners for the local and global workforces.

## KEYWORDS

environmental health, sustainable development, higher education, global citizens, workforce development, small island developing states, education for sustainable development, Caribbean

# 1 Introduction

Environmental health is an important determinant of sustainable development, playing a pivotal role in safeguarding the health, and well-being of humans and the ecological integrity of the planet. The United Nations Sustainable Development Goals (SDGs) propose holistic approaches for meeting the needs of the current generation, being cognizant of the need to also minimize threats to the well-being of future generations (United Nations, 2019). Grenada, and several other small island developing states (SIDS), have made remarkable progress in advancing the sustainable development agenda and taking affirmative actions to promote and secure environmental health through various initiatives (Global Environmental Facility, 2021). Albeit, SIDS are disproportionately impacted by environmental hazards and efforts to develop sustainably are challenging (United Nations, 2021). Climate change, in particular, is an existential threat to human health and the environment in SIDS, despite the small footprints of these countries in contributing to total greenhouse gas emissions (United Nations, 2021).

In the Caribbean, which includes the tri-island State of Grenada, there is a complicated interplay between environmental health risk factors that predispose to communicable and non-communicable diseases. Climate change has significant implications for the burden of non-communicable and communicable diseases (World Health Organization, 2014), however, in the region, mortality and morbidity associated with non-communicable diseases far outweigh that for communicable diseases (Barreto et al., 2012; World Bank, 2012). Heat rash, heat cramps, dehydration, heat exhaustion, and heat stroke are some direct effects of climate change as well as indirect effects such as the emergence and increasing prevalence of vector-borne diseases, including dengue, chikungunya, Zika and malaria, waterborne diseases, food and nutrition insecurity, and mental health problems (World Health Organization, 2019a,b). The region's health problems are also exacerbated by some persistent factors, including chemical handling and disposal mismanagement that increase the risk of chronic diseases (Dewailly and Forde, 2014; Forde and Dewailly, 2015; Glasgow et al., 2019a,b), inadequate domestic and commercial sanitation resulting in water-borne disease outbreaks, poor air quality from expanding urbanization and industrial activities and Saharan dust plumes contributing to high prevalence of respiratory illnesses, and inadequate capacity to mitigate the impacts of climate events such as flooding, drought, and excess heat (Rise et al., 2022). To combat environmental health problems, priority areas in Caribbean countries include strengthening climate change adaptation and resilience; improving surveillance and control of non-communicable and communicable diseases, health and health-influencing infrastructure development and upgrade, expanding public health education programs, and building workforce capacity (United Nations Economic Commission for Latin America and the Caribbean, 2011; Macpherson and Akpinar-Elci, 2015; Akpinar-Elci and Olayinka, 2018).

To address the region's health issues, cooperation between international organizations and regional and local authorities is also essential. Environmental health management must be more centrally placed in governance, particularly, of the less developed countries and SIDS (Eppinga et al., 2019). Mainstreaming and linking environmental health and sustainable development in the core structure of communities and institutions can be a powerful approach to transforming citizens' thinking and practices that have implications

for the health of the wider population (Eppinga et al., 2019). A greater sensitivity to the interconnectedness between the environment, health, and sustainable development can nudge changes in behaviors and attitudes in favor of achieving the SDGs. The Third International Conference of SIDS, held in Samoa in 2014, gave rise to the Small Island Developing States Accelerated Modalities of Action Pathway (SAMOA), which aims to help developing nations overcome environmental problems through different initiatives, including education (United Nations, 2023). While this program has novel intentions, the context of SIDS must also reflect absorptive, adaptive, and transformative capacities. The presence of higher learning academic institutions in SIDS is invaluable for citizenry, leadership, and workforce development. However, academic institutions are usually insufficiently tapped to effect change and transformation in society. On the other hand, academic institutions, in partnership with other organizations, must be prepared to leverage the environment and systems, characteristic of SIDS, to provide transformative education. A study by the University of Aruba highlights the importance of higher learning institutions designing environmental health and sustainable development education to promote environmental awareness, empower people, and support positive behavior change (Eppinga et al., 2019). The study finds that the negative attributes of culture, attitude, and behavior can be dispelled through tailored, context-sensitive, targeted education programs that are deliberately intended to transform students into effective change agents (Eppinga et al., 2019).

Several factors hamper the delivery of environmental health and sustainable development education in SIDS. A major limitation is curricula void of the integration of concepts relating to the environment, health, and sustainable development. In addition, the opportunities to build practice competence to address the interplay between risk factors and attribution to health outcomes are lacking. Environmental Science is included in the curriculum of the Caribbean Examination Council (CXC) for the Caribbean Advanced Proficiency Examination (CAPE) (Caribbean Examination Council, 2010). However, the emphasis on linking environmental health and sustainable development is relatively new, emerging, and with a comparatively small cohort of students pursuing the course in tertiary institutions. This means that the larger proportion of students in the Caribbean region will not sufficiently benefit from tertiary-level training to champion environmental health and sustainable development in practice.

Grenada's geographical area is 133 square miles with a population of about 110,000 residents (Caribbean Disaster Emergency Management Agency, 2015). The Theophilus Albert Marryshow Community College (TAMCC) is the only immediate post-secondary education institution on the island offering Advanced Level and associate degrees. TAMCC delivers courses that include environment and health studies. These courses, however, are not designed to provide a deep understanding of the relationships between a multiplicity of environmental factors and health. Besides, sustainable development is not a major focus in the TAMCC curriculum. The New Life Organization (NEWLO) is a private vocational institution that offers skills-based education. NEWLO does not offer stand-alone courses in environmental health or sustainable development but introduces some basic concepts across the courses and in personal development sessions. St. George's University (SGU), a private medical school, with a campus in Grenada, offers bachelor's to doctoral degrees

through its schools of arts and science, medicine, graduate studies, and veterinary medicine. Environmental health and sustainable development courses are major offers in the Master of Public Health (MPH) program, which is accessed by Caribbean and extra-regional students – typically, a mix of early and mid-career professionals and graduates of the SGU medical program. Over the years, the MPH program transitioned in its goal, format, and outputs to be more inclusive, diverse, and responsive to workforce needs. This community case study highlights teaching strategies at SGU, consistent with the Caribbean island context, and expected outcomes from the delivery of the Environmental and Occupational Health (EOH) track curriculum in the MPH program, contributing to students transitioning into the role of teachers, environmentally conscious leaders and citizens, and competent public health practitioners for the local and global workforces.

## 2 Context

The MPH program was first offered by SGU in 1999 and accredited by the Council on Education for Public Health (CEPH) in 2010. From the inception, the student body was largely comprised of North Americans but, over time, Caribbean student numbers have increased. In 2018, the program was reorganized from an onsite-only to a hybrid (simultaneous onsite and online delivery) format with synchronous and asynchronous offerings. Eight foundational courses are offered, covering 22 CEPH foundational competencies, following which students pursue track specialization courses. Specific to environmental health and sustainable development, foundational knowledge covers the effects of environmental, biological, genetic, behavioral, and psychological factors on human health; linkages between environmental and occupational factors and effects on human health; contribution of behavioral and psychological factors on health and health inequities; global environmental factors affecting global disease burden; and ecological perspectives on the interconnection between human, animal, and ecosystem health. Foundational skills building focuses on the assessment of population health; evaluation of interventions, and policies; and communication of audience-appropriate information. Interchangeably, students apply concepts across the eight foundational courses. In the EOH track, students cover five competencies in four specialization courses, namely: Environmental Health Management, Occupational Health, Environmental Sustainable Development, Environmental Toxicology, and Global Environmental Change. In the track specialization courses, competency building focuses on formulating interventions to promote health and well-being; literature evaluation and interpretation; evaluation of protocols and conventions impacts on health; application of risk assessment and management tools; and integration of sustainable development principles and goals in project development. All foundational and track courses involve the delivery of didactic materials, discussion forums, and group and individual application assignments. Documents, tools, and processes of practice organizations are introduced in the foundational and specialization courses and students are required to apply concepts in desk- and field-based activities. More specifically, the materials in the EOH track courses address capacity building for practice in fields related to the Sustainable Development Goals; particularly Goal 3 - Good Health and Wellbeing; Goal 6 – Clean Water and Sanitation; Goal 7

– Affordable and Clean Energy; Goal 11 Sustainable Cities and Communities; Goal 12 – Responsible Consumption and Production; Goal 13 – Climate Action; Goal 14 - Life Below Water; and Goal 15 – Life on Land. Course topics include, *inter alia*, water, air, sanitation, vectors, agriculture, land development, food safety and production, transportation and energy, toxicology and exposure, risk assessment and management, determinants of diseases, conservation, built environment; project appraisal; disaster risk management, and climate change.

As outlined by the United Nations Education, Scientific and Cultural Organization (UNESCO), education for sustainable development (ESD) provides learners with holistic, diverse, and culturally competent knowledge, skills, values, and attitudes that enable present and future generations to engage in environmentally sustainable informed decision making (UNESCO, 2020). Drawing on a study with instructors and three groups of students, aged 17–19 years, Fedosejeva et al. (2018) identified key considerations for effective pedagogical methodologies in sustainable development education, targeting Generation Z (Fedosejeva et al., 2018). Scholars define Generation Z by the birth period from the 1990s to the early 2000s (Fedosejeva et al., 2018). Some scholars also consider this generation to represent the period of technology and global unsustainability, hence the need for pedagogy in natural and social sciences (Fedosejeva et al., 2018). In the MPH program, features of both definitions of Generation Z are highly represented with the majority of the student population in the age group from 20s to early 30s. In each cohort, many matriculants already have working titles that would have provided exposure to sustainable environmental health practice and usually, although limited, some level of involvement in problem-solving and managing solutions. The theoretical considerations by Fedosejeva et al. are useful for creating value-oriented environmentally sustainable education. Concepts of Fedosejeva et al. theory are well ingrained in the MPH program in three major ways: high incorporation of technology in field and class interactions; features life-sustaining challenges around the SDGs that confront populations in the Anthropocene age; and packages activities for quick and interactive learning to match the absorptive capacity and mindset of Generation Z.

## 3 Detail

### 3.1 The teaching community, from the start

Students in the EOH track benefit from interdisciplinary professional engagements from the early foundational courses to the latter specialization courses. The Inter-Professional Team (IPT) assignment in the Concepts, Practice, and Leadership of Public Health course requires each student to engage with a team of no less than 4–5 professionals from different practice backgrounds. The exercise helps students understand the realities of public health practice and the implications for individual, community, and population health. The practice environment in Grenada is similar to several other Caribbean countries and possibly to SIDS in other regions. In the first term, face-to-face interactions with professionals, as community teachers, help students to build confidence in acquiring and disseminating information, assert values, and understand public health (including environmental health and sustainable development) issues through

the lenses of professional practice and experience. Students can broaden their worldview ahead of the specialization courses in which they concretize the application of concepts. The IPT assignment includes a reflection on the significance of the exercise for professional development and practice. The students display learning in the higher domains of Bloom's Taxonomy through, *inter alia*, the creation and dissemination of public health promotion products. The products included the development of websites, questionnaires, posters, and brochures. These usable materials are shared with the participating institutions, encouraging students to produce work at a high quality. Extra-regional students harness knowledge and skills for practice in SIDS and other Global South countries. Students can amass a deeper understanding of the multi-sectoral public health influencing factors that characterize these countries. Taken in parallel with the foundational environmental health course, students can immediately merge the application of the concepts from the engagements with the community teachers. The IPT engagements also demonstrate teaching and dialog competencies that students can adopt and utilize in EOH round table discussion assignments with professionals and peer-to-peer engagements.

### 3.2 Innovation in teaching

Historically, the EOH track courses included field-based activities in communities in Grenada. Environmental health inspection is a systematic approach to identifying, understanding, and addressing community public health issues. Before the introduction of the hybrid model, students participated in field trips to assess environmental problems, typically at one operation or community in Grenada. In the dual delivery format, CEPH requires similar learning opportunities for onsite and online students. An innovative approach was, therefore, adopted to facilitate each student's participation in a highly engaging community environmental health needs assessment. Drone footage was provided of an expanded peri-urban area in Grenada, coupled with videos of interviews with community residents describing the environment, public health challenges, and solutions from their perspectives. The selected community represents diverse public health challenges related to the physical and social infrastructure and economic activities. The students conduct the assessment using a standard instrument of the Ministry of Health's Environmental Health Department. Students will critically think about health-influencing factors that plague suburban environments and derive evidence-based solutions that are practical for the community and country. The recorded face-to-face interviews by faculty with residents and environmental health officers demonstrate approaches to community engagement, which is an important skill for improving workforce competence. This community inspection assignment also draws on technological familiarity and exploration, which is favorable to Generation Z. In undertaking the community inspection assignment, students demonstrate the following:

- Identification of demographic features: an analysis of the community demographics helps in understanding disparities and vulnerabilities that uniquely implicate environmental health and sustainable development in small island states.
- Knowledge of natural and built environment: identifying environmental health hazards and determining potential health

impacts create a reference for unsustainable practices and implications for achieving the SDGs.

- Incorporation of public health literature and data: literature references provide evidence and enhance the credibility of students' arguments. This requirement supports professionalism in the management and dissemination of knowledge.
- Problem solving and resolution: community infrastructure and support systems are vital for sustainable development. Solutions can be identified from the perspectives of the community residents and the environmental health professionals.

Drone footage has other advantages for supporting education activities in small island settings:

- Aerial perspective: drones provide a panoramic picture of an extended area with details that would otherwise be missed or excluded in ground-based observations.
- Efficiency: drones provide coverage of an extended area in a short time. The footage can be used repeatedly.
- Data accuracy: drone-captured data is highly accurate and can be used for detailed mapping and analysis.
- Safety: drones offer a safe means of observing hazardous environments and accessing places that are difficult to reach physically.

The Windshield Survey assignment immediately follows, allowing students a further opportunity to objectively assess environmental hazards and potential health impacts in their communities. The Windshield Survey is a process of documenting observations and conducting a rapid assessment of a community or neighborhood while driving, preferably, or walking. Through postings and interactions in the Discussion Forum, students can compare and develop an appreciation for drivers of environmental health across countries and communities. Unique hazards that define Global North and Global South countries can be explored with inquiries through peer-to-peer interactions. These exchanges allow for quick learning, favorable to Generation Z, and enhance the learning environment and students' experiences.

### 3.3 Rooting environmental health in science

The Windshield Survey assignment in the foundational EOH course draws heavily on students' knowledge of the sciences applicable to public health. Students identify and describe an existing mechanical, physical, or chemical hazard, supported by current evidence, apply risk assessment concepts, and propose recommendations for risk mitigation. The Windshield Survey builds competence and capacity in the following ways:

- Data collection: Qualitative and quantitative primary data can be collected, organized, and reported for variables such as housing, sanitation, land use, public infrastructure, community assets and resources, and culture.
- Distinguishing interventions that are appropriate for SIDS as against wealthier developed countries: Following the identification of community hazards, students propose

context-appropriate recommendations for changes in behaviors, systems, and infrastructure to reduce health risk.

- Professional exchange and dialog between representatives of Global North and Global South countries: Peer-to-peer exchanges between students from different countries provoke further thinking and evaluation of environmental safety, health, and response measures across the communities.

Students delve deeper into biology, chemistry, and mathematical applications in public health in the track specialization courses, particularly in Environmental Toxicology, Occupational Health, and Environmental Health Management. The Environmental Toxicology course engages students in critical literature evaluation to assess research methodologies, results, and interpretation, applying public health sciences. These courses provide valuable knowledge and skills to address risks and uncertainties that characterize the environments in which Generation Z is born, live, and work. The quality and sustainability of life will depend on skills for problem-solving and sustainable development implementation capacity.

### 3.4 Collaboration in public health scholarship and practice

SIDS are among the nations most disadvantaged in public education related to the SDGs (United Nations Sustainable Development Group, 2023). Higher education institutions, based in SIDS, are usually underutilized to promote civic education, agitate a public agenda, and develop workforce competence. Through the MPH program, SGU is contributing to bridging knowledge and practice gaps in environmental health and sustainable development, while also fostering citizen consciousness. The SGU MPH program has evolved to be more inclusive, diverse, and responsive to workforce needs.

Fostering global citizenship through education was one of three main goals of the past UN Secretary-General, Ban Ki-moon. In 2012, Ban Ki-moon launched a program to incorporate higher education to strengthen global citizenry (United Nations, 2023). Horey et al. highlight that “true” global citizens are defined by the attributes of values, actions, and understanding derived from skills, knowledge, and perceptions acquired through the pedagogical processes of experience, relationships, and context (Horey et al., 2018). In the Environmental Sustainable Development track course, the Healthy City Assignment requires students to critically assess the layout of an urban area and develop approaches to retrofit the space to align with the objectives of the SDGs. Retrofitting requires technical skills and the ability to safeguard the ecological integrity of the community. This assignment encourages awareness and respect for the Sustainable Development Agenda; social, economic, cultural, and environmental interdependence; critical thinking; and problem-solving. Students bring personal experiences to the forefront and incorporate perceptions and values in proposing alternatives for improving human well-being.

The Dispute Resolution assignment, in the foundational Principles of Environmental Health course, encourages the development of advocacy and dialog skills following the assessment of the social, economic, and cultural impacts of interventions in communities. Scientific knowledge and methodologies come into play, informing

various positions in the dialog. The ESD theory is reflected in quick active research and learning through peer-to-peer interactions, reflecting real-life situations and, at the same time, encouraging creativity and innovation to solve environmental health problems. Negotiation skills are taught, and students practice in a mediation discussion via videos and in writing to solicit consensus in a dispute matter. Dispute resolution skills are particularly useful in small islands and developing states where resources are limited and must be carefully managed. Actions must be goal-driven but also participatory and community-oriented. Group projects encourage interaction and professionalism. The MPH program encourages teamwork and management of group dynamics to undertake complex tasks. Students must, however, also demonstrate individual contributions in the group.

At the end of the Environmental Sustainable Development course, students build on soft skills from the Term 1 IPT assignment and dispute resolution in a roundtable dialog with multidisciplinary practitioners. The evaluation is now focused on knowledge, professional skills, and interactions. Following the round table discussions, the MPH students present posters, depicting environmental health problems in a selected country or community, their relationship to sustainable development concepts, and solutions to invited students from TAMCC and NEWLO. Students in all institutions are encouraged to share experiences and engage in robust discussions and debates with guidance from the faculty and practitioners. Responses from this activity indicate closing the gap in citizens’ knowledge of sustainable development and contributing to the goal of *leaving no one behind*.

### 3.5 Anticipated results

The SGU MPH program is contributing to a sustainable and ecologically conscious future for the Caribbean and other countries. Students’ worldviews are widening, and competency-based education facilitates the transition to practice. Competency-based environmental health and sustainable development education is an asset for SIDS. First, competency-based education is inherently practical, in that, it emphasizes the need for environmental health students to apply knowledge and skills to address real-world challenges encouraging workforce development. Second, competency-based education integrates knowledge from various fields fostering a more holistic understanding of environmental health and sustainable development which is particularly valuable for addressing complex issues in SIDS. Third, students can be assessed to determine whether they attain the required competencies ensuring accountability and the maintenance of high educational standards. Next, through the integration of sustainability and environmental health into the curriculum, students become proficient in their field and develop a sense of global citizenship. Furthermore, innovation and adaptability are encouraged as students are trained to think critically, find creative solutions, and adapt to the evolving challenges that local communities face. Finally, competency-based education ensures that graduates can contribute to a more sustainable, ecologically sound future, bridging the gap in environmental health education in SIDS and harmonizing local curricula with international standards. Thus, these states become better prepared to address the disproportionate environmental health issues they face while

advancing sustainable development within and outside their communities via this cadre of knowledgeable, environmentally conscientious professionals.

As a CEPH-accredited program, the MPH curriculum is aligned to provide knowledge on the effects of the environment, behavioral, and psychological factors on population health, linkages between environmental and occupational factors and human health and inequities, the influence of environmental factors on the global burden of disease, and interconnectedness between human health, animal health, and ecosystem health. Knowledge critically influences attitudes and behaviors (Kollmuss and Agyeman, 2002). Kollmuss and Agyeman (2002) identified ways in which societies might benefit from environmental health education:

- Increased pro-environmental behaviors: students are likely to adopt lifelong pro-environmental behaviors based on education and training. This can include taking steps to reduce waste, preserving resources, and promoting and advocating for environmentally friendly legislation.
- Improved pro-environmental attitudes: students are likely to develop positive attitudes toward the environment and support the sustainable development agenda.
- Strengthened personal and societal norms: students are more likely to adopt personal and societal norms in support of environmentally responsible actions and may inspire others to follow.
- Heightened perceived behavioral control: students' perceptions of capacity and confidence to undertake pro-environmental behaviors will improve with education as an enabling factor.

The MPH program is also designed to close gaps in environmental health workforce capacity. The program caters to skill building in assessing needs, assets, and capacities that affect community health, evaluating policies for their impact on public health and health equity, applying negotiation and mediation skills to address organizational or community challenges, and communicating audience-appropriate public health content. Graduates of the program, especially of the EOH track, also have the advantage of the potential to collaborate around the SDGs with local to international partners. Common knowledge of the SDGs and the priorities for different contexts will help sync perspectives and support building partnerships for work, including with government and private sector organizations. The participation of NEWLO and TAMCC students expands the scope of the impact of the MPH program. The spatial closeness of the institutions on the island, recognition of the disproportionate challenges faced by SIDS, and interest in education relevance by academic institutions provide a ready opportunity for the mobilization and integration of students in cross-institutional environmental health and sustainable development programs. There is also a keen interest in exposing students to issues beyond their communities. The SGU-TAMCC-NEWLO engagements, therefore, offer a rich learning experience, building community and national capacity, and encouraging environmental citizenship.

There are limitations to attitude and behavior change that must be recognized. According to Kollmuss and Agyeman (2002), behavior and attitude change may be slow following the transition from student to practitioner. Secondly, both as a student and practitioner, individuals may display pro-environmental behaviors to varying

degrees. While pro-environmental behaviors are promoted in academic programs, students may not acquire, retain, and adopt information at the same time.

## 4 Discussion

### 4.1 Status of environmental and sustainable development education in the Caribbean

SGU provides graduates of its MPH program and, through joint exercises, students at NEWLO and TAMCC the opportunity to make meaningful contributions to addressing environmental health and sustainable development challenges in the local context and across the countries represented in the student body. The Caribbean region is inherently at risk of environmental unsustainability due to the limited natural resource base, social and economic constraints, and vulnerability to extreme weather events (Ferguson and Sharon Bramwell-Lalor, 2023). Environmental health and sustainable development education have been identified as crucial for the Caribbean region to maintain the level of knowledge and spur action to protect populations through mitigating environmental impacts (Ferguson and Sharon Bramwell-Lalor, 2023). Global initiatives, such as, but not limited to the United Nations Decade of Education for Sustainable Development (UNDESD) have helped contribute to the integration of ESD in both formal and non-formal educational settings (UNESCO, 2014). Regional ESD programs include the Sandwatch program in multiple Caribbean countries (UNESCO, 2010), coral reef education in primary schools in Tobago (Armstrong, 2005), community-oriented learning and infusion of ESD into formal educational programs in Jamaica (Bramwell-Lalor et al., 2023), climate change curriculum integration in Guyana (Bynoe and Simmons, 2014), and teacher education programs (Ferguson et al., 2021). Public education is inherent in consultations for the development of national sustainable development plans and other related national initiatives. Despite these and other education initiatives, proportionate to the vulnerability of Caribbean states, a gap remains in the implementation of ESD programs in comparison to other regions which are less disproportionately vulnerable to environmental impacts (Brunold and Ohlmeier, 2022). Ferguson-Murray (2016) states that the Caribbean region must ensure that ESD policies exist for a coherent approach to the integration of ESD into formal and non-formal education; there must be whole-institution approaches to ESD across the academic levels as well as in other learning and teaching environments; and that children and youth, such as Generation Z, must be mobilized to inducted in sustainable education.

### 4.2 Importance and challenges of environmental health education

The importance of environmental health education in countries that are disproportionately affected by environmental impacts and unsustainable practices cannot be understated (Sarabhai, 2015). Caribbean countries are acutely sensitive to environmental degradation which is increasingly associated with the region's pursuit of economic growth and development (Nazir, 2021). Reconciling development and sustainability is not well entrenched in the economic

system. The goal of environmental health education has been to prevent and resolve the ecological, including health impacts, related to unsustainable practices (Kujoh et al., 2020; Nazir, 2021). One major barrier to improving environmental health education is the opposing pressure of economic development. The resource-deficient state of several Caribbean nations should serve to readily embrace affirmative action toward achieving environmental sustainability to reduce the burden of human diseases and demands on the health care system. What is lacking, however, is the commitment to invest for long-term outcomes and in the interest of future generations. Cost-saving and profit-maximizing drive several organizations, and there is little regard for the magnitude of long-term effects, following prolonged resource exploitation and pollution.

Low environmental health literacy accounts for the unprogressive actions of citizens, often stagnating and reversing the marginal gains made through ESD initiatives (Kollmuss and Agyeman, 2002). Apart from the limited provisions of environmental health education, targeting is another obstacle to producing environmentally conscious citizens. The effectiveness of environmental health education programs is dependent not only on how robust the program is but also on equity in accessibility across socioeconomic groups (Nazir, 2021; Elshaer et al., 2023). The SGU MPH student body is diverse, representing starters, early, and mid-career professionals from Caribbean and extra-regional countries. The construct of syllabi can also represent a challenge for environmental education. Studies on the effectiveness of environmental education have shown that, in many cases, the dissemination of knowledge does not translate to tangible action by students and graduates (Elshaer et al., 2023). The failure to translate environmental education into action among citizens is deemed from a lack of heightened consciousness and awareness, garnered through curriculum delivery (Kollmuss and Agyeman, 2002). On the other hand, there is evidence that including more opportunities for students to recognize and evaluate the implications of environmental impacts leads to greater awareness and motivation to act (Sarabhai, 2015; Ferguson-Murray, 2016; Fedosejeva et al., 2018; UNESCO, 2020). The SGU MPH program, therefore, is well poised to foster environmental consciousness from the inductions in a small island state and provide a viewpoint of the unique disparities that confront SIDS and demand action for global benefit. Underprivileged students and those residing in disadvantaged communities are also likely to experience environmental impacts at a disproportional rate and could benefit the most from ESD to improve efficacy for change (Elshaer et al., 2023).

### 4.3 Impact of mobilizing local communities

In response to the environmental threats that small island nations face, and after assessing Grenada's needs, the World Health Organization provided a list of key recommendations, precisely honing the education system to create a national curriculum on health and climate change, as a foundation for action (World Health Organization, 2019a). SGU faculty and students act as change leaders, drawing attention to local and global environmental health challenges and leveraging the context of the small island state to raise awareness and mobilize participation in problem-solving. The round table discussion, poster presentation, and subsequent dialog build the partnership and trust between the community of students, faculty, and

practitioners, an important attribute for attracting students as future partners and workers. Facilitating equal and fair access to environmental health and sustainable development education is paramount to health literacy. This education equity effort can extend beyond the SGU/TAMCC/NEWLO partnership and extend to household and community members. SGU MPH program is a catalyst in health promotion implementation.

### 4.4 The benefit of academic institutions engaged with the local population

Community- and student-centric curricula, such as in the SGU MPH program, offer benefits to both the academic institution and local populations. Leveraging and involving community partners in education delivery serves as a channel for students to access real-world settings (Comeau et al., 2019). Students can take on hypothetical roles, interface with professionals in practice, and engage in critical thinking and problem-solving. The ability of students to effectively communicate with professionals and communities is enhanced. Student-community engagement is also important for developing social and cultural awareness and identity (Comeau et al., 2019). Finally, piqued interest in special issues can advance the academic research agenda (Ahoba-Sam, 2019) and bolster the image of the institution as being integrated into the life of the community (Comeau et al., 2019).

Local communities also benefit from engaging with academic institutions. Academic institutions offer resources such as education, training, and expertise to communities. In this case, through the MPH program, SGU is indirectly supporting communities, through building the human resource capacity in otherwise resource-limited areas. In the context of small islands, engagement between higher learning institutions and communities can support the optimization of health and other interventions. The role of academic institutions in providing technological solutions and communities in sharing traditional and anecdotal knowledge can constitute a pivotal synergy for advancing sustainable development action (Singh et al., 2017).

## 5 Acknowledgement of constraints

One of the most challenging tasks for academic institutions is to track and monitor the professional pathways of alumni. Alumni surveys typically focus on workforce status, type of employment organization, and duration of employment, where applicable. Access to updated contact information, type of employment (part-time or full-time), alumni characteristics, including age, and technological access and capacity are indicative of alumni survey response rates (Lambert and Miller, 2014; Mwizerwa et al., 2017). To mitigate this response challenge, alumni surveys tend to be brief and general with little to no opportunities to thoroughly reflect on and objectively describe how specific aspects of training influence job performance. Nevertheless, Lambert and Miller (Lambert and Miller, 2014) provided an encouraging perspective from a study comparing cohorts of alumni responding to the National Survey of Student Engagement (NSSE) in 2000, 2005, 2006, 2007, 2008, and 2009, and those same cohorts of alumni responding to the Strategic National Arts Alumni Project (SNAAP) in 2010 at six diverse institutions. The results

indicate that responses from a small cohort may be as representative as those from larger cohorts (Lambert and Miller, 2014). Employer surveys can complement and validate alumni responses, however, employers may lack thoroughness in their understanding of academic content and students' experiences to objectively evaluate the impact of academic activities on job performance. Higher learning institutions, such as SGU, should not only seek to improve alumni participation in surveys but also seek to improve the quality of data that may be collected from small cohorts. Over the past three years, anecdotal observations from students responding to alumni surveys and faculty personal knowledge suggest high employment uptake of graduates from the Environmental and Occupational Health track. This uptake presents a valuable opportunity for graduates to contribute to the achievement of sustainable development goals across the globe. The specific impact of each MPH specialization training on job performance should be thoroughly explored.

In conclusion, across the world, SIDS in particular, are confronted to varying degrees with environmental sustainability and health challenges. Higher learning institutions can leverage the challenges of SIDS to build capacity for local and global action. Following its transition to the hybrid model, the SGU MPH program adopted a more transformative learning model. With the growing number of Caribbean nationals in the program, along with international students, the focus on both Global North and Global South context, engagement with local experts as community teachers, creative and innovative teaching, and a collaborative approach to problem-solving is contributing to students' development as future teachers, competent practitioners, and environmentally conscious citizens. The participation of NEWLO and TAMCC students offers an opportunity to expand the impact of the MPH program. The spatial closeness of the institutions on the island, recognition of the disproportionate challenges faced by SIDS, and interest in education relevance by academic institutions provide a ready opportunity for mobilization and integration in cross-institutional environmental health and sustainable development programs. The inclusive program can benefit students, academic institutions, and the wider communities. Students can improve their problem-solving and communication skills while developing their cultural awareness and professional identity. Academic institutions can improve their relationship with communities, allowing for the advancement of research within their institutions and their public image. Communities receive education and training support that is vital to support local and national sustainable development. It is also important to note the implications of this case study on the continual development of effective curricula to deliver sustainable development education. Highly engaging and inclusive academic processes can accentuate students transitioning into the role of teachers and will draw on their own experiences to identify effective content and delivery. Not only that, but future teachers will envision pedagogical methodologies that align curriculum with context. As such, it is important for higher learning programs to continually engage in systematization processes that focus on what is delivered and the possible and actual short-term and lifelong impact on learners thinking, attitudes, and behaviors. Those findings should be published, highlighting strengths and weaknesses for future address. Evaluations should be ramped up to provide additional perspectives on the impacts of environmental health and sustainable development in higher learning, leveraging the context of small

island states. Finally, strengthening the relationship between students, academic institutions, and communities will catalyze future change for environmental sustainability and preserving human health and well-being.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Author contributions

LT: Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing. CN: Methodology, Supervision, Writing – original draft, Writing – review & editing. TL: Writing – original draft, Writing – review & editing. AM: Writing – original draft, Writing – review & editing. AA: Writing – original draft, Writing – review & editing. OZ: Writing – original draft, Writing – review & editing. IL: Writing – original draft, Writing – review & editing. AE: Writing – original draft, Writing – review & editing. LCR: Writing – original draft, Writing – review & editing. TS: Writing – original draft, Writing – review & editing. DM: Writing – original draft, Writing – review & editing. VC: Writing – original draft, Writing – review & editing.

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## 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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