

Integrating the United Nations' sustainable development goals into a teaching–research nexus: examples from the University of the Sunshine Coast

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ABSTRACT

The Sustainable Development Goals (SDGs) adopted by the United Nations in 2015 constitute a 'universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity'. The 17 SDGs are integrated and target the development of 'balance social, economic and environmental sustainability' and recognise that 'action in one area will affect outcomes in others'. 'The creativity, knowhow, technology and financial resources' from every sector of the society are required for timely delivery of the SDGs. The major contributor into the generation of such 'creativity, knowhow and technology' are the higher education institutions (HEIs). This article will emphasise the roles of HEIs for the timely delivery of the SDGs with examples from the University of the Sunshine Coast (UniSC).

Keywords: global goals, HEIs, higher education institutions, Pasteurian pedagogies, SDGs, south to south cooperation, SSC, sustainable development goals, teaching–research nexus, University of the Sunshine Coast.

Sustainable development goals

Global partnership for the SDGs¹ (Fig. 1) recognises that 'ending poverty and other deprivations must go hand in hand with strategies that improve health and education, reduce inequality, and spur economic growth' as well as 'tackling climate change and working to preserve oceans and forests'.² However, Fagunwa and Olanbiwoninu note that 'although the SDGs are well-structured to address the global challenges mankind faces, they are unrealistic unless strategies to reach the targets are defined in detail'.³ Moreover, Cash *et al.*⁴ highlight that 'science and technology (S&T) must play a more central role in sustainable development, yet little systematic scholarship exists on how to create institutions that effectively harness S&T for sustainability' (p. 8086). Their study also suggests that 'efforts to mobilize S&T for sustainability are more likely to be effective when they manage boundaries between knowledge and action in ways that simultaneously enhance the salience, credibility, and legitimacy of the information they produce' (p. 8086).⁴ Higher education institutions (HEIs) are the key institutions that effectively manage knowledge and action boundaries as well as defining the strategies for the timely delivery of the SDGs.⁵ Accordingly, embedding the SDGs into teaching curriculum of HEIs can speed up the process and ensure timely delivery of the goals by 2030 through development of target directed strategies and harnessing S&T for sustainability.^{5,6}

Microbiology discipline specific education for sustainable development goals

Microbiology is a key sub-discipline of science and addresses 'food security, health and wellbeing, clean energy, environmental degradation and climate change' (Fagunwa and Olanbiwoninu, p. 1³), which are covered under different SDGs.

Louis Pasteur initiated pedagogies of the discipline by promoting the value of microbiology research for the individual and the society to grow and improve in harmony with the works of nature.⁷ Pasteur also valued the quest of fundamental understanding and application,⁸ and 'The structure and organization of Pasteurian pedagogy mirrored Pasteur's conception of experimental science training, in which theory and practice were closely linked.' (Opinel, p. 38⁷). Foundations in student learning thus stem from

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#1 No poverty	#2 Zero hunger	#3 Good health and well-being	#4 Quality education	#5 Gender equality
#6 Clean water and sanitation	#7 Affordable and clean energy	#8 Decent work and economic growth	#9 Industry, innovation and infrastructure	#10 Reduced inequalities
#11 Sustainable cities and communities	The global goals for sustainable development			#12 Responsible consumption and production
#13 Climate action	#14 Life below water	#15 Life on land	#16 Peace and justice, strong institutions	#17 Partnerships for the goals

Fig. 1. The Global Goals for Sustainable Development (adapted from *The 17 Goals of the United Nations Development Programme*).^{1,2}

the understanding that the innovative applications are products of gained in-depth knowledge and sound understanding in the subject matter related to the field of command.⁶

UNESCO in its *Education for Sustainable Development Goals* publication⁹ in 2019 outlined the learning objectives that are required to generate a skilled workforce for the timely delivery of the SDGs. They are: (1) Cognitive learning objectives, (2) Socio-emotional learning objectives and (3) Behavioural Learning Objectives (Table 1). Microbiology discipline-based teaching thus must address these objectives since microbial technologies can provide ‘exceptional diversity of applications’ that can address most of the SDGs that have ‘very diverse and complex components and requirements’ (Timmis *et al.*, p. 986¹⁰).

Global citizens

UNESCO also provided recommendations for the schools for creation of ‘global citizens’.¹¹ Timmis *et al.*¹² noted that ‘microbiology literacy needs to become part of the world citizen job description’ (p. 1513) and invited microbiologists, microbiological-learned societies, and microbiology-literate professionals to participate in and contribute toward creation of microbiology-literate societies for generation of required educational funds as well as ‘convincing educators, policy makers, business leaders and relevant governmental and non-governmental agencies to support and promote this initiative’ (p. 1513¹²). HEIs thus also play a catalyst role through engagement with local schools and general public for ‘Global Citizens’ education.

Think regionally, strategise locally and succeed globally

The OECD in 2007¹³ stated that to be competitive in the globalising knowledge economy, the OECD countries need

to invest in their innovation systems at national and regional levels. Accordingly, meeting the regional development goals, nurturing the unique assets and circumstances of each region and developing knowledge-based industries are becoming increasingly important. HEIs are recommended to ‘focus strategically on the contribution that they can make to the development of regions where they are located’ (p. 11¹³). They ‘must do more than simply educate and research, they must engage with others in their regions, and provide opportunities for lifelong learning’ (p. 11¹³).

The University of the Sunshine Coast (UniSC) opened in 1996 and was the first ‘Greenfield’ university to open in Australia since 1971. The University’s mission has been to become an institution with a strong emphasis on sustainability and environmentally friendly regional development all along. It has transformed a former cane farm into a multi award winning modern and distinctive sub-tropical architectural development (www.usc.edu.au). It remains an ‘urban catalyst’ for the rapidly developing and changing region that is both a holiday destination and a biotechnology hub.¹⁴ It was also included in an OECD study as a subject for its level of engagement with the local regional community.

From its early days the UniSC has emphasised the value of a sound teaching–research nexus that has a ‘dual pathway where research shapes and informs teaching, and teaching shapes and informs research’. Again, since its foundational years, the microbiology stream has been one of the key teaching and research areas of the UniSC.^{15,16} Dating back to the early 2000s, visionary approaches implemented allowed regional students to align their studies with sustainable development goals.^{6,15,16} The microbiology stream utilised partnerships between the UniSC, local and state governments and regional industries.^{15,16} A purposefully created stepwise approach enabled students to make connections with their surrounding-environments and be responsive to the needs of the region by utilising microbiology as a tool. Examples of student learnings included water quality, waste management, bioremediation, biological control of plant

Table 1. Examples of UNESCO's recommended *Learning Objectives* for Education related to the SDGs,⁸ which were embedded into microbiology teaching at the UniSC.

SDG	Cognitive learning objectives	Socio-emotional objectives	Behavioural learning objectives	Suggested UNESCO topics for learning
SDG #2: Zero Hunger	1. The learner understands the need for sustainable agriculture to combat hunger and malnutrition worldwide.	1. The learner is able to collaborate with others and to promote sustainable agriculture.	1. The learner is able to evaluate, participate in and influence decision-making related to public policies concerning the promotion of sustainable agriculture.	1. Concepts and principles of sustainable agriculture, including climate-resilient practices, organic farming, biodynamic farming, permaculture and Agro forestry. 2. Main drivers and root causes of hunger and malnutrition, including the relation between climate change and food security and the depletion of soil quality.
SDG #3: Good Health and Well-being	1. The learner knows conceptions of health, hygiene and well-being and can critically reflect on them. 2. The learner knows facts and figures about the most severe communicable and noncommunicable diseases, and the most vulnerable groups and regions concerning illness, disease and premature death.	1. The learner is able to create a holistic understanding of a life of health and well being.	1. The learner is able to plan, implement, evaluate and replicate strategies to promote health.	1. Chemicals, pollution and contamination of air water and soil 2. Severe communicable and non-communicable diseases. Direct strategies to promote health and well-being, e.g. vaccines
SDG #6: Clean Water and Sanitation	1. The learner understands water as a fundamental condition of life itself, the importance of water quality and quantity, and the causes, effects and consequences of water pollution and water scarcity. 2. The learner understands the concept of Integrated Water Resources Management (IWRM) and other strategies for ensuring the availability and sustainable management of water and sanitation, including flood and drought risk management.	1. The learner is able to participate in activities of improving water and sanitation management in local communities.	1. The learner is able to cooperate with local authorities in the improvement of local capacity for self-sufficiency. 2. The learner is able to contribute to water resources management at the local level.	1. Water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies, water patents, landscaping for groundwater recharge as well as integrated water resources management.
SDG #14: Life Below Water	1. The learner understands basic marine ecology, ecosystems, predator-prey relationships, etc. 2. The learner understands threats to ocean systems such as pollution and overfishing and recognises and can explain the relative fragility of many ocean ecosystems including coral reefs and hypoxic dead zones.	1. The learner is able to argue for sustainable fishing practices. 2. The learner is able to show people the impact humanity is having on the oceans biomass loss, acidification, pollution, etc.) and the value of clean healthy oceans.	1. The learner is able to identify, access and buy sustainably harvested marine life.	1. Management and use of marine resources (renewables and non-renewables): global commons and overfishing, quotas and how they are negotiated, aquaculture, seaweed, mineral resources. 2. Ocean pollutants: plastics, microbeads, sewage, nutrients and chemicals.
SDG #17: Partnerships for the Goals	1. The learner knows the concepts of global governance and global citizenship. 2. The learner recognises the importance of cooperation on and access to science, technology and innovation, and knowledge sharing. 3. The learner knows concepts for measuring progress on sustainable development.	1. The learner is able to raise awareness about the importance of global partnerships for sustainable development. 2. The learner is able to work with others to promote global partnerships for sustainable development and demand governments' accountability for the SDGs.	1. The learner is able to become a change agent to realise the SDGs and to take on their role as an active, critical and global and sustainability citizen. 2. The learner is able to contribute to facilitating and implementing local, national and global partnerships for sustainable development. 3. The learner is able to support development cooperation activities.	1. Global citizenship and citizens as change agents for sustainable development 2. Cooperation on and access to science, technology and innovation, and knowledge sharing 3. Capacity-building to support national plans to implement all the SDGs.

diseases replacing hazardous pesticides with environmentally friendly ones and implementation of diverse microbially mediated solutions to regional problems.^{6,15–32}

UniSC's microbiology stream has also facilitated incremental building of research projects having similar problems (e.g. pollution in aquaculture, marine environments) encountered within the same region that Australia shares (e.g. Vietnam).^{29–32} This approach has been in line with the UN's South to South Co-operation involving the countries of the 'Global South' that aims to meet the development goals and objectives of the countries involved through sharing knowledge, skills, expertise and resources.³³ The outputs of regionally focussed projects undertaken at the UniSC by the microbiology stream students, which are aligned with the UNESCO's *Learning Objectives* (cognitive, socio-emotional, and behavioural), are listed in the reference section.^{17–32}

Conclusions

For the currently well-structured SDGs to be realistic and achievable by 2030, the HEIs will play an important and catalytic role for the definition and implementation of effective strategies. UniSC microbiology stream alignment with the OECD and UNESCO's recommendations has illustrated the value of incremental build-up of knowledge from regional to global level. The UniSC approach has also proved useful for development of partnerships in the South-East Asia Pacific region with countries sharing similar problems. The stepwise approach involves 'regional engagement' first, then proceeding to 'engagement of similar regions'.⁶ Such incremental build up exemplified here can thus facilitate timely delivery of the 2030 SDG targets. In conclusion, microbially mediated technologies will undoubtedly find solutions to many of the current global problems, so microbiology education has to equip graduates with the skills and knowledge needed for the timely delivery of the SDGs.

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Biography



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Microbiology Australia updates

Microbiology Australia (MA) continues to gain greater recognition globally, now being listed by the *Directory of Open Access Journals* (DOAJ), an online directory that indexes and provides access to high-quality, open access, peer-reviewed journals. Inclusion in DOAJ has the benefits of raising visibility of MA content and, importantly, demonstrates best practice editorial and publishing standards (which also helps distinguish MA from the plethora of predatory open access journals out there). More information on the benefits of indexing in DOAJ can be found at: <https://doaj.org/apply/why-index/#why-your-journal-should-be-indexed-in-doj>

Other databases listing MA include Scopus and Clarivate's Emerging Sources Citation Index (ESCI). MA is a member of COPE (Committee on Publication Ethics) and requires authors to list conflicts of interest and sources of funding.

Most importantly, MA aims to meet the needs of members of *The Australian Society for Microbiology*. Melinda and Tess (pictured here) were proud to receive the print copy of the most recent issue.

