



Sustainable Development Goals Course Inventory: A Preliminary Study at The Chinese University of Hong Kong

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Abstract

Higher education institutions (HEIs) have been powerful drivers for achieving the Sustainable Development Goals (SDGs). Through education for sustainable development (ESD), HEIs provide broad knowledge, innovative technologies and creative solutions to SDGs. Mapping what has been done to contribute to ESD is the first step to discovering further possibilities to contribute to sustainable development. Using the 17 SDGs as the framework, this study aimed to develop the SDG course inventory and understand the landscape of ESD across the university curriculum of The Chinese University of Hong Kong (CUHK). All active courses offered by the eight faculties, nine colleges, and five other course-offering units in 2021 were automatically shortlisted by 847 keywords. A total of 581 courses mapped into 17 SDGs were manually selected and analyzed. Our findings showed that all 17 SDGs were covered by the curriculums at CUHK. SDG10 (Reduced Inequalities) and SDG3 (Good Health and Well-being) were the two main components of ESD, while SDG6 (Clean Water and Sanitation), SDG14 (Life below Water), and SDG1 (No Poverty) were the least focused. Landscape analysis showed that the Faculty of Education and Faculty of Medicine had primary focuses on SDG3 (Quality Education) and SDG4 (Good Health and Well-being), respectively, while other faculties covered a wide variety of SDGs. This study revealed the strengths and gaps of ESD and provided essential information for the development of ESD at CUHK. It also served as a foundation for a more rigorous SDG course inventory study in the future.

Keywords: Education for Sustainable Development; Higher Education Institution; SDG Course Inventory; SDG Landscape; Sustainable Development Goals

1. Introduction

Sustainable development is one of the most critical issues in our world today. It is defined as the development that meets the needs of the present world without compromising the needs of our future generation (World Commission on Environment and Development, 1987). In 2015, The United Nations (UN) announced the framework of the 17 Sustainable Development Goals (SDG), calling for the emergency of universal actions to contribute to sustainability, including ending poverty, reducing inequalities, preserving oceans and forests, and ensuring health, justice, and prosperity (*The 17 Goals*, n.d.). On the path towards the success of achieving SDGs, the role of Education for Sustainable Development (ESD) in Higher Education Institutions (HEIs) has had a significant expansion over the last few years (Singh & Blessinger, 2023). ESD in HEIs educates students with knowledge, understanding, and values connected with sustainable development and empowers students with competencies to shape a sustainable future (*What You Need to Know About Education for Sustainable Development*, 2023). HEIs do not only serve as traditional education institutions for transferring knowledge on SDGs but also link societies with young and future leaders, facilitate the collaboration between scientific and political communities, and lead the local and global responses to sustainable development (Singh & Blessinger, 2023; Kestin, 2017).

Under the daunting challenges driven by undiminished population growth, social distress, conflicts, and catastrophes, the need to improve the integration of ESD in HEIs is continuously increasing over the years (Hill & Wang, 2018). However, the lack of support from the administration and management departments, the reliance on silo approaches in teaching and learning by universities, and the absence of structural approaches to monitor ESD have hindered the implementation of ESD in HEIs (Chang & Lien, 2020; Leal Filho et al., 2017). To facilitate ESD in HEIs, recognizing what a university has contributed to the SDGs across all areas or within specific areas is a great starting point for discovering possibilities for more profound engagement (Kestin, 2017). Mapping courses with related sustainable development in course inventory studies can reveal the landscape of ESD and help identify the priorities, challenges, and opportunities for the development of ESD at HEIs (Brugmann et al., 2019). In the course inventory studies conducted by the universities in Taiwan and Toronto, the 17 SDGs were used as the framework to reveal the course distribution of SDG-labelled courses across the university curriculums (Brugmann et al., 2019; Chang & Lien, 2020). The University of Hong Kong also mapped its common core courses with SDGs to facilitate the implementation of the current ESD and reveal the underlying potential for further development (Lam, 2023). These studies are good examples of recognizing the Landscape of ESD at HEIs through SDG course inventory studies, and their findings provided meaningful information for the strategic planning of ESD at the university and programme levels.

As the co-founder of The Hong Kong Chapter of the UN Sustainable Development Solutions Network, The Chinese University of Hong Kong (CUHK) has been actively engaged in nurturing sustainability-minded, socially empowered university members to transfer novel ideas into action to meet the grand challenges of sustainable development (Lam, n.d.). Faculties, colleges¹, and other course offering units have offered courses related to sustainable development over the years. One of the specific actions in the university's strategic plan 2021–25 is to incorporate sustainable development into courses or programmes across the university (*CUHK Strategic Plan 2021–2025*, n.d.). For instance, CUHK developed the SDG Study Scheme to enhance ESD across the University GE Curriculum (*SDG Study Scheme*, n.d.). Other

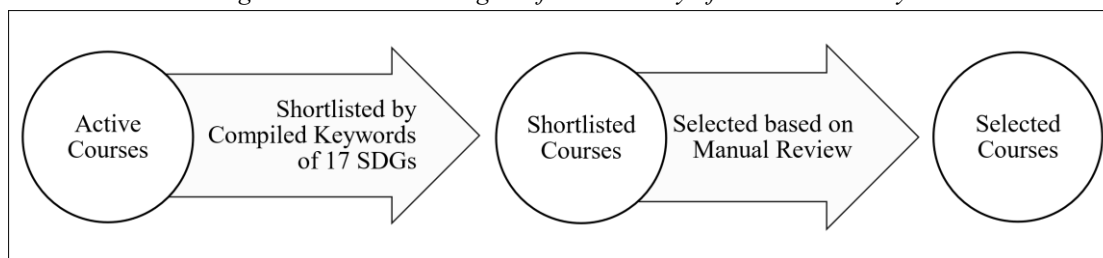
¹CUHK is the only university having a college system in Hong Kong. All full-time undergraduates are affiliated to one of the nine colleges. The colleges at CUHK focused on students' lives and encourage them to make services contributing to social responsibility (*A Unique College System*, n.d.).

schemes, programmes, and courses related to sustainability have been continuously developed at the faculty and college levels. With a large-scale implementation of ESD, a comprehensive study of the SDG course inventory to recognize the landscape of ESD is an important starting point for discovering possibilities for deeper engagement and identifying synergies across the university (Kestin, 2017). Given this, we conducted this preliminary study to briefly understand the distribution, strengths, and gaps in the landscape of ESD at CUHK. This preliminary study aimed to develop the SDG course inventory across all teaching units at CUHK. The experience gained and challenges met in this preliminary study were essential for developing a more rigorous and comprehensive study of the landscape for ESD in the future.

2. Materials and Methods

Sustainability course inventory has been studied using three popular methods: keyword search of course catalogue, review of course titles and descriptions, and survey of academic deans, chairs and instructors (briefly reviewed by Brugmann et al., 2019). Based on the framework of 17 SDGs, this preliminary study of SDG course inventory at CUHK adopted a combined method of keyword search and manual review (Figure 1). A complete list of all active courses at CUHK, offered by eight faculties, nine colleges, and five other course-offering units², was retrieved from the Registry of CUHK in September 2021. The Compiled List of SDG Keywords (a total of 847 keywords categorized by the 17 SDGs) provided by Monash University and the SDSN-Australia/Pacific (Kestin et al., 2017) was used to filter the titles of all active courses. Active courses with titles containing at least one keyword for a particular SDG were shortlisted for that SDG. Active courses with titles containing keywords for multiple SDGs were shortlisted for multiple SDGs. After this automated keyword filtering, our research group members reviewed the course contents and learning objectives specified in the course descriptions to determine whether the courses were related to the designated SDGs. The selected courses were regarded as SDG-related courses in this study.

Figure 1. Schematic Diagram for the Survey of Course Inventory

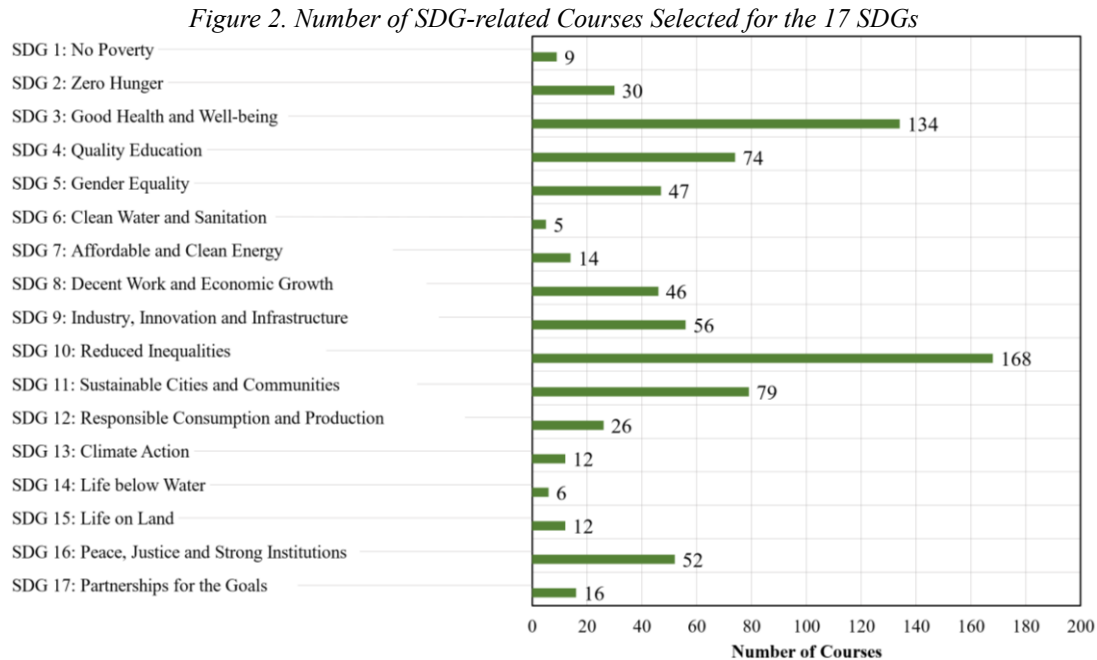


3. Results

The automated filtering of total active courses using the 847 SDG keywords generated a list of 1493 shortlisted courses. A manual review based on the course descriptions resulted in 581 selected SDG-related courses (39% of shortlisted courses) across the 22 teaching units. Since a selected course could be related to multiple SDGs, the number of course entries for all 17 SDGs (786 entries) was more than the number of selected courses. Our survey showed that the 581 selected courses were distributed across all the 17 SDGs (Figure 2). SDG10 (Reduced Inequalities) showed the most abundant related courses, with 168 selected courses accounting for 29% of all selected SDG-related courses at CUHK. SDG3 (Good Health and Well-being)

²The other course-offering units were Office of Academic Links, Office of University General Education, the Minor Programme in Entrepreneurship and Innovation, Co-operative Education Programme, and Centre for China Studies.

had the second most abundant course (134 courses, 23%), followed by, in descending order, SDG11 (79 courses, 14%), SDG4 (74 courses, 13%), SDG9 (56 courses, 10%), SDG16 (52 courses, 9%), SDG5 (47 courses, 8%), SDG8 (46 courses, 8%), SDG2 (30 courses, 5%), SDG12 (26 courses, 4%), SDG17 (16 courses, 3%), SDG7 (14 courses, 2%), SDG13 (12 courses, 2%) and SDG15 (12 courses, 2%), SDG1 (9 courses, 2%), SDG14 (6 courses, 1%), and SDG6 (5 courses, 1%) (Figure 2).



This study illustrated the distribution of required units of the SDG-related courses selected for the 17 SDGs, which are associated directly with allocating teaching efforts for the courses. The results showed that most selected courses of all SDGs required three units (Figure 3). Over 90% of the selected courses for SDG5, SDG7, SDG8, and SDG12 required a minimum of three units. For SDG1, SDG2, SDG6, SDG9, SDG10, SDG11, SDG13, and SDG16, 80% or more of the selected courses required a minimum of three units. At least 67% of the selected courses for SDG3, SDG4, SDG14, SDG15, and SDG17 required a minimum of three units (Figure 3).

Figure 3. Distribution of Required Units of the SDG-related Courses selected for the 17 SDGs

	Number of Courses	Unit					
		1	2	3	4	5	6
SDG 1: No Poverty	9	0%	11%	89%	0%	0%	0%
SDG 2: Zero Hunger	30	0%	20%	80%	0%	0%	0%
SDG 3: Good Health and Well-being	134	7%	17%	67%	4%	1%	1%
SDG 4: Quality Education	74	3%	24%	69%	3%	0%	1%
SDG 5: Gender Equality	47	0%	6%	94%	0%	0%	0%
SDG 6: Clean Water and Sanitation	5	0%	20%	80%	0%	0%	0%
SDG 7: Affordable and Clean Energy	14	0%	0%	100%	0%	0%	0%
SDG 8: Decent Work and Economic Growth	46	4%	2%	93%	0%	0%	0%
SDG 9: Industry, Innovation and Infrastructure	56	5%	7%	88%	0%	0%	0%
SDG 10: Reduced Inequalities	168	1%	10%	88%	0%	1%	1%
SDG 11: Sustainable Cities and Communities	79	4%	8%	86%	1%	1%	0%
SDG 12: Responsible Consumption and Production	26	4%	4%	92%	0%	0%	0%
SDG 13: Climate Action	12	8%	8%	83%	0%	0%	0%
SDG 14: Life below Water	6	0%	33%	67%	0%	0%	0%
SDG 15: Life on Land	12	0%	33%	67%	0%	0%	0%
SDG 16: Peace, Justice and Strong Institutions	52	4%	8%	88%	0%	0%	0%
SDG 17: Partnership for the Goals	16	12%	19%	69%	0%	0%	0%

Note: (1) The percentages in the heatmap represent the proportions of the selected courses distributed in each required unit for each SDG. (2) The column "Number of Courses" presents the number of SDG-related courses selected for each SDG, the same as the course numbers in Figure 2.

This study also revealed the landscape of SDG-related courses across different teaching units at CUHK. A total of 549 (95%) selected courses were offered by the eight faculties, 19 courses (3%) offered by colleges, and 13 courses (2%) by other course offering units (Figure 4). The Faculty of Social Science had the highest number of courses (172 courses), while the Faculty of Law showed the least (18 courses). No faculty covered all 17 SDGs. SDG3 (Good Health and Well-being), SDG10 (Reduced Inequalities), and SDG11 (Sustainable Cities and Communities) were covered by all eight faculties, and SDG1 (No Poverty), SDG6 (Clean Water and Sanitation), and SDG14 (Life below Water) were the least covered by only two faculties. Faculty of Social Science showed the broadest coverage of all SDGs except SDG14 (Life below Water). Some faculties offered courses that were highly focused on certain SDGs. For instance, 92% of selected courses in the Faculty of Education and 86% of selected courses in the Faculty of Medicine were related to SDG4 (Quality Education) and SDG3 (Good Health and Well-being), respectively (Figure 4).

Figure 4. Distribution of the SDG-related Courses Selected for the 17 SDGs across the 22 Teaching Units at CUHK

			SDGs																
Number of Courses			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Faculty																			
Arts	—	91	1%	5%	2%	11%	19%	0%	0%	5%	4%	57%	11%	0%	0%	0%	1%	5%	1%
Business Administration	—	40	0%	2%	2%	0%	0%	0%	0%	15%	20%	28%	12%	2%	0%	0%	0%	2%	28%
Education	—	61	0%	2%	8%	92%	2%	0%	0%	0%	0%	16%	2%	0%	0%	0%	0%	21%	0%
Engineering	—	43	0%	0%	44%	5%	0%	0%	23%	5%	42%	2%	2%	33%	2%	0%	0%	0%	0%
Law	—	18	0%	0%	6%	0%	6%	0%	6%	11%	6%	33%	28%	0%	11%	6%	0%	33%	6%
Medicine	—	95	0%	2%	86%	1%	1%	0%	0%	2%	1%	20%	4%	1%	0%	0%	0%	0%	0%
Science	—	31	0%	32%	26%	0%	0%	3%	0%	0%	0%	3%	13%	6%	23%	16%	16%	0%	0%
Social Science	—	172	4%	4%	7%	3%	15%	2%	2%	12%	8%	35%	27%	4%	1%	0%	2%	15%	1%
College																			
Chung Chi	—	1	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%
CW Chu	—	0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lee Woo Sing	—	4	0%	50%	25%	0%	0%	0%	0%	0%	25%	0%	0%	25%	0%	0%	25%	0%	0%
Morningside	—	1	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%
New Asia	—	1	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%
S.H. Ho	—	1	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Shaw	—	7	14%	14%	29%	0%	14%	0%	0%	0%	14%	43%	0%	0%	0%	0%	0%	14%	0%
United	—	3	0%	0%	0%	0%	0%	0%	0%	67%	100%	0%	0%	0%	0%	0%	0%	0%	0%
Wu Yee Sun	—	1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%
Other Course Offering Units																			
Office of University General Education	—	3	0%	33%	33%	0%	0%	0%	0%	0%	67%	0%	0%	0%	0%	0%	33%	0%	0%
Others	—	10	0%	0%	0%	0%	0%	0%	0%	40%	20%	10%	10%	0%	0%	0%	0%	10%	20%

Note: (1) The percentages in the heatmap represent the proportions of the number of courses selected for each SDG. Since the courses offered by each teaching unit could be selected for one or more SDGs, the total percentage for each teaching unit was equal to or greater than 100%. (2) The column “Number of Courses” presents the total number of all selected SDG-related courses offered by each teaching unit. Two selected courses were jointly offered by the Faculty of Business Administration and the Faculty of Social Science. These two courses were included in both faculties, which causes the total number of courses to be 583 instead of 581 in this figure. (3) “Others” in “Other Course Offering Units” referred to the Office of Academic Links, Office of University General Education, The Minor Programme in Entrepreneurship and Innovation, Co-operative Education Programme, and Centre for China Studies.

4. Discussion

Mapping what has been done to support and contribute to the ESD across the university is the first step to discovering further possibilities for deeper engagement in ESD (Kestin, 2017). This preliminary study explored the SDG course inventory of CUHK by identifying SDG-related courses across the 22 teaching units, including faculties, colleges, and other course-offering units. Our findings showed that the selected SDG-related courses covered all SDGs, while the number of SDG-related courses was not equally distributed across the 17 SDGs (Figure 2). SDG10 (Reduced Inequalities) and SDG3 (Good Health and Well-being) had the highest number of related courses, indicating that health and equality were the primary focuses of ESD at CUHK. For SDG10, 90% of the selected courses (168 courses) had a teaching effort of three or more required units (Figure 3) and were covered by all eight faculties at CUHK (Figure 4). Most of the SDG10-related courses were offered by the Faculty of Social Science (60 courses) and the Faculty of Arts (40 courses) (Figure 4). The course descriptions of these courses illustrated theories, concepts, methodologies, and examples that were highly related to the equality issues about human rights, policy, culture, and religion. SDG3 (Good Health and Well-being) was the second main focus of ESD at CUHK. It had 134 courses (Figure 2) offered by

all the faculties (Figure 5), and more than 70% of these courses had a teaching effort of three or more required units (Figure 3). Aligned with its vision and mission of empowering good healthcare and human well-being, the Faculty of Medicine has strived to connect what it taught with sustainability (Faculty of Medicine, the Chinese University of Hong Kong, n.d.). It had the highest contribution to SDG3, in which 86% of selected courses related to the goal of “Good Health and Well-being” (Figure 5).

Apart from the strength of ESD for health and equality, this study also revealed the gaps in which ESD at CUHK could be enhanced. Eradicating poverty is a pivotal goal (Goal 1: End Poverty in All Its Forms Everywhere, n.d.), but SGD1 was among the least focused SDGs at CUHK. Among the 581 selected SDG-related courses, only one from the Faculty of Arts, seven from the Faculty of Social Science, and one from Shaw College had course titles and descriptions directly related to SDG1 (No Poverty) (Figure 4). Providing more SDG1-related courses or shaping the existing course to address poverty issues could be one of the significant enhancements of ESD at CUHK. Similar enhancements could be made for the other less addressed SDGs, such as SDG6 (Clean Water and Sanitation), SDG7 (Affordable and Clean Energy), SDG13 (Climate Action), SDG14 (Life below Water), and SDG15 (Life on Land). These SDGs all belong to the environmental pillar of sustainability (Kostoska & Kocarev, 2019), and many of them were currently offered by the Faculty of Science and Faculty of Engineering (Figure 4), which had in part compensated for the relative lack of environmental focuses in the courses offered by other faculties. ESD for these SDGs could be enhanced if these courses focused not only on the scientific knowledge or technology per se related to environmental issues but also on how they are related to the underlying socioeconomic causes, the needs of the people affected, and both technological and policy solutions for these SDGs in real-world situations.

This study also revealed the landscape of ESD across different teaching units at CUHK. Two patterns of course distribution were observed across the faculties: focused SDGs and diffused SDGs. For instance, the Faculty of Education focused on SDG4 (Quality Education). About 92% of the selected courses were related to this SDG (Figure 4). Similarly, the Faculty of Medicine focused on SDG3 (Good Health and Well-being) and 86% of its selected courses were linked to SDG3 (Figure 4). This pattern was caused by the high correlation of the subject area and the contents of SDGs. The course titles and descriptions frequently pinpointed the specialized medical and educational aspects to empower students with knowledge and skills to address the needs of education and health issues, respectively, and thus SDG3 and SDG4 were focused. On the contrary, some faculties such as Social Science (16 SDGs), Arts (12 SDGs), and Law (11 SDGs) demonstrated the most diffused pattern to cover a wide variety of SDGs across the economy, environment and society pillars for sustainability (Figure 4). The two patterns of SDG course distribution were also observed in the SDG course inventory study in Taiwan, and the advantages and disadvantages of both patterns were discussed (Chang & Lien, 2020). For example, the faculty that focused on specific topics tended to develop SDG-related courses with in-depth content specific to the faculty’s subject area, and thus, students were empowered with professional knowledge and skills on specific issues. However, courses offered in this pattern did not cover the width of SDGs, resulting in a lack of SDG content beyond the faculty’s subject area. For the diffused pattern, on the contrary, students could acquire knowledge, including theories, concepts, and cases related to a wide variety of SDGs. Ideally, courses covering multiple SDGs should be offered in sufficient amounts. However, this required allocating abundant resources for teacher training, coordination, and adjusting the course syllabi to cover multiple SDGs (Zamora-Polo et al., 2019; Chang & Lien, 2020).

Understanding the SDG landscape across the university curriculum is a great starting point for further engagement with SDGs. In this study, we surveyed the SDG course inventory

across the 22 teaching units at CUHK and identified the strengths and gaps in its commitment to ESD. It should be noted that the SDG course inventory and landscape analysis presented in this study were preliminary results. A few improvements should be made to ensure a more accurate evaluation of the ESD situation at CUHK. Firstly, the list of active courses should be updated according to the current ESD policy at CUHK. For example, CUHK launched the university-wide Credit-bearing Service Learning Programme in response to diverse societal needs in 2023, and the colleges have been the main implementation force of the Programme. Compared with the small number (3%) of SDG-related courses in this study (Figure 4), a significant increase in SDG-related courses is expected in the subsequent study. Secondly, the use of SDG keywords for shortlisting should be reviewed. Choosing keywords is critical for automatically filtering active courses in course selection. Apart from the compiled list of SDG keywords provided by Monash University and the SDSN-Australia/Pacific (Kestin et al., 2017) that was used in this study, other institutions such as University of Auckland, European Commission, and Elsevier Data Repository have suggested different sets of SDG keywords to filter and select SDG-related contents (*SDG Mapper*, n.d.; *The University of Auckland SDG Keywords Mapping*, n.d.; Rivest et al., 2021). They should be reviewed to choose the most appropriate one for the context at CUHK. Among them, the SDG keywords provided by Elsevier Data Repository were generated based on a machine learning model and have been widely discussed in multiple educational research, such as the Impact Rankings of Times Higher Education (Rivest et al., 2021). These keywords could be used for shortlisting in the next study, and the machine learning model of Elsevier Data Repository may help further select SDG-related courses before manual review. Thirdly, to ensure a rigorous selection process, manual selection of SDG-related courses should be done by at least two researchers to independently review the shortlisted courses for all 17 SDGs using standardized criteria. Finally, inspired by Brugmann et al. (2019), academic deans, chairs, or course instructors could also be invited to review and comment on the selection results to complete the SDG course inventory study.

5. Conclusion

This study successfully developed a preliminary SDG course inventory at CUHK. SDG-related courses were selected using SDG keywords, followed by manual selection. The strengths and gaps for the ESD were identified by the distribution of selected courses across the 17 SDGs and the ESD landscape at the faculty and college levels. The findings in this study provided helpful information for the academic deans, chairs, and senior management to understand the current situation of ESD and contributed to the exploration of further improvement of ESD at CUHK. Other HEIs interested in developing SDG course inventory and landscape analysis could reference this study.

Acknowledgements

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