Article

Expanding Student Engagement in Sustainability: Using SDG- and CEL-Focused Inventories to Transform Curriculum at the University of Toronto

Rashad Brugmann [1], Nicolas Côté [2], Nathan Postma [2], Emily A. Shaw [3,*], Danielle Pal [2] and John B. Robinson [4]

[1] Faculty of Applied Science and Engineering, University of Toronto, Toronto, ON M5S 1A4, Canada; r.brugmann@mail.utoronto.ca

[2] Faculty of Arts and Science, University of Toronto, Toronto, ON M5S 3G3, Canada; nicolas.cote@mail.utoronto.ca (N.C.); nathan.postma@mail.utoronto.ca (N.P.); danielle.pal@mail.utoronto.ca (D.P.)

[3] London School of Economics and Political Science, London WC2A 2AE, UK

[4] Munk School of Global Affairs & Public Policy, University of Toronto, Toronto, ON M5S 1H8, Canada; johnb.robinson@utoronto.ca

* Correspondence: emily.shaw@mail.utoronto.ca; Tel.: +44-7789-992729

check for updates

Abstract: The Expanded Student Engagement Project (ESE) has developed three comprehensive inventories which aim to increase student knowledge of sustainability-related course content and increase student engagement in on- and off-campus, curricular, and non-curricular sustainability projects at the University of Toronto (U of T). The first is a sustainability course inventory (SCI) generated using keyword search based on the UN Sustainable Development Goals (SDGs). This is the first SCI that has been based on the SDGs. The inventory identified 2022 unique sustainability courses and found that SDG 13 had the greatest representation and SDG 6 had the least. The second inventory is a community-engaged learning (CEL) sustainability inventory which found 154 sustainability-focused CEL courses and identified 86 faculty members who teach sustainability CEL. Finally, an inventory of sustainability co-curricular and extracurricular opportunities revealed that U of T has 67 sustainability-focused student groups and identified 263 sustainability-focused opportunities. These inventories are an important foundation for future initiatives to increase student engagement in sustainability on campus and in the community. The ESE will integrate this data into U of T's course management system and use the inventories to develop a new sustainability pathways program.

Keywords: sustainable development goals; SDGs; higher education institutions; sustainability in higher education; agent of change; curriculum innovation; sustainability course inventory; student engagement

1. Introduction

The University of Toronto's President's Advisory Committee on the Environment, Climate Change, and Sustainability (CECCS) has developed a project intended to support undergraduate student engagement with sustainability issues that challenge the university and its neighbouring communities. This project, titled the Expanded Student Engagement Project (ESE), is working to expand student knowledge of sustainability-related course content and increase both on- and off-campus student engagement through sustainability focused curricular and non-curricular projects. The ESE's work presented here was conducted by five undergraduate research assistants and their supervisor, chair of the CECCS, over a period of 14 months.

The motivation for this work was to identify existing sustainability opportunities at the University of Toronto (U of T) and provide a foundation for the development of future opportunities and sustainability programs. This paper investigates the process by which the ESE created its primary deliverables: three inventories which catalogue (1) undergraduate courses with sustainability content (2) undergraduate courses with sustainability focused community-engaged learning (CEL) opportunities and (3) undergraduate co-curricular and extracurricular opportunities actively promoting sustainability at the U of T. Additionally, we discuss the process of clustering the first inventory around a novel framework derived from the United Nations (UN) Sustainable Development Goals (SDGs), and clustering the second inventory by adapting McRae and Johnson's Global Work-Integrated Learning Framework [1]. This paper presents some of the first course inventory methodologies in the literature. Further, although Yale University has organized faculty research interests using the SDGs [2], this paper presents the first usage of the SDGs to identify and cluster sustainability courses at higher education institutions (HEIs). We seek to emphasize the practical use of the SDGs as indicators for sustainability course content. We demonstrate how the inventories work in service of embedding sustainability pedagogy into curricula across the numerous departments operating at U of T.

This paper is intended to serve as a case study for other HEIs working to expanding student engagement in sustainability. We have paid particular attention to the many tensions that appeared during the development of our inventories. It is our hope that the practical lessons presented in their resolutions will prove useful to sustainability practitioners at other HEIs. To achieve this goal, we will begin this paper by grounding our work in the theoretical frames which detail the changing role of the university in society, as well as curriculum innovation for sustainability education. Following this review we discuss relevant contextual factors at U of T to provide a basis for comparative analysis between institutions. The methodologies for creating these inventories are then closely examined, including a review of methods used by other HEIs and our use of the SDG framework, before the results are presented. To conclude, the relevance of this work to the creation of sustainability pathways and the future work of the ESE are discussed.

2. Context

The role of the University as an actor in society has been changing from its traditional role as a knowledge institution. Its new purpose manifests a wider, outward facing scope for University activities. In other words, collaboration with external partners is becoming standard practice for HEIs such that the human capital, research and expertise already produced by the University have the greatest impact in society [3–5]. Thus, the University emerges as an Agent of Change (AOC) in its immediate community through mutually beneficial relationships within its local context. Further, with knowledge transfer among HEIs becoming ever more consistent, there is meaningful potential to expand the impact of these collaborations globally and in a large variety of local contexts.

Another change in HEIs is a greater emphasis on experiential learning to solve pressing issues identified by society [6]. Specifically, this has involved creating more opportunities for solutions-based pedagogy, often guided by collaboration with partners outside academia (this could include operational staff at the university, civil society organizations, or private sector actors) [7]. This educational strategy is called the "Living Lab" approach at U of T, also called "real-world laboratories," "urban living labs," and "sustainability learning labs" [8–10]. HEIs employing the model demonstrate a few consistent principles across "Living Lab" activities [9,11,12]:

(1) Formal and equitable collaboration with both operational and community partners to identify and solve real sustainability issues;
(2) Training of career ready graduates through external placements;
(3) Emphasis on promoting and expanding experiential learning opportunities;
(4) Intentional knowledge transfers beyond academic circles; and
(5) Institutional commitment to transdisciplinary thinking [4,5,11,13–15].

Living Lab activities which engage students also significantly impact their educational experience and foster sustainability thinking.

It is widely acknowledged that sustainability is a perspective inextricably tied to complex and systemic problems, and its approaches are necessarily framed by the attempt to develop relevant practical solutions that integrate theories, practices and insights from diverse bodies of knowledge [16–19]. Hence, as Aktaş suggests, "a viable way to increase the role of sustainability in higher education is to foster interdisciplinary research and teaching" [20] (p. 354). Although U of T's School of the Environment offers interdisciplinary B.A. and B.Sc. programs which span the natural sciences, social sciences, and humanities, it is the vision of the ESE to make such options available throughout all undergraduate programs at U of T. Creating widely available interdisciplinary training in sustainability requires going beyond the disciplinary structure of degree programs to create an overarching and interdisciplinary trajectory in sustainability. Every department is relevant to sustainability research and can be represented in curricular sustainability offerings.

In addition, as Wright, Cain, and Monsour argue, to generate the mindset required for transformative sustainability education, curriculum development must adopt more experiential, community-integrated, and practice-oriented approaches to teaching [21]. With the support of campus leaders and administrators, curriculum innovation for sustainability should look like "creative and critical application of knowledge and skills (that) are supported by authentic experience within the classroom." [21] (p. 2). Such sustainability curriculum innovation in HEIs requires top-down support [22,23]. To this end the ESE aims to provide administrative tools for the development of interdisciplinary and eventually transformative sustainability experiential learning initiatives.

A motivating curriculum structure that encourages interdisciplinarity and experiential sustainability learning is Sustainability Pathways. The ESE's concept of sustainability pathways derives from the University of British Columbia (UBC)'s sustainability curriculum initiative called the Sustainability Learning Pathways (SLP) [24]. The main goal of the SLP is that any student, regardless of their degree program, will have access to an education in sustainability through a learning trajectory complementing and weaving through their disciplinary education. The UBC SLP program outlines the following attributes for a trajectory of for-credit sustainability pathway courses:

(1) Accessible to all undergraduate students regardless of degree program;
(2) Interdisciplinary;
(3) Can be completed by students through their existing degree program;
(4) Involves research, co-curricular projects and/or community-engaged learning courses; and
(5) Provides a coherent sustainability education [24].

Recent developments in sustainability leadership at the University of Toronto have identified such development as a priority for the institution. Understanding the policy and structural context of the University of Toronto is important to situate how such widely available interdisciplinary and experiential sustainability opportunities could be developed.

The University of Toronto is the largest HEI in Canada, with over 89,000 full-time and part-time undergraduate and graduate students [25]. It has three campuses across the Greater Toronto Area; the University of Toronto St. George (UTSG) is the university's main campus and is located in downtown Toronto. Two smaller campuses are located outside of downtown Toronto in Mississauga (University of Toronto Mississauga, UTM) and in Scarborough (University of Toronto Scarborough, UTSC). Each campus has a Sustainability Office, which is tasked with ensuring the sustainability of Facilities and Services operations.

In 2016, U of T faced significant pressure from students to divest from fossil fuels. Subsequently, the Office of the President outlined new goals and commitments for sustainability action in the 2016 report *Beyond Divestment: Action on Climate Change* which included the creation of the President's Advisory Committee on Environment, Climate Change, and Sustainability (CECCS): a committee of faculty, staff, students and alumni who are tasked to ensure that the goals of the report are

implemented [26]. After four months of operating, the CECCS published the *Annual Report 2017* which outlined the strategy and action items for the CECCS as well as setting the priorities for three subcommittees: the Campus as a Living Lab Subcommittee (CLL), the Agent of Change Subcommittee (AOC), and the Curriculum Innovation Subcommittee (CI) [3]. Each subcommittee has priorities and action items that are consistent with the literature explored in the sections above. The ESE works to achieve the objectives of the CI subcommittee and acts as the informal operating arm. This work is summarized in the ESE's four central goals:

(1) Create a sustainability inventory that is made available to students interested in choosing sustainability related courses;
(2) Create a list of faculty teaching in the sustainability area that is available to all those faculty members, hopefully contributing to a greater sense of common identity and community;
(3) Contribute to the creation of curricular 'sustainability pathways' for U of T students; and
(4) Develop more curricular and co-curricular student engagement opportunities related to sustainability, in collaboration with U of T organizations, specifically through the use of the community-engaged learning inventory.

In its *Annual Report 2018*, the CECCS identifies significant progress on these items related to curriculum innovation, as well as some additional highlights which cross-cut the committee's operations:

(1) The CLL subcommittee has identified six living lab projects and is developing a template for student engagement alongside a Charter of Principles for these projects;
(2) The AOC subcommittee has prepared a typology of forms of engagement with partners on sustainability projects;
(3) On behalf of the CI subcommittee, the ESE project developed inventories of undergraduate sustainability courses, sustainability-oriented community-engaged learning courses, and of student clubs with a sustainability focus; and
(4) The CI subcommittee has begun work on implementing sustainability pathways in four divisions [27].

U of T does not have an interdisciplinary academic division devoted to developing sustainability curriculum across academic disciplines, resulting in limited financial and labour resources available for such purposes [28]. As well, U of T has less of a pre-existing culture and research interest in sustainability compared to universities in British Columbia and Quebec [28].

Despite these challenges, there is great potential for effective curriculum innovation in sustainability education at U of T due to its size and existing interdisciplinary program structures such as those in the Faculty of Arts and Science (FAS) [29]. In addition, U of T is engaged in several inter-institutional networks which seek to foster knowledge transfer and communication of best practices, notably the Association for the Advancement of Sustainability in Higher Education (AASHE) [30] and the University Climate Change Coalition (UC3) [31].

In addition to these opportunities to embed and connect sustainability education throughout the university, U of T, along with every university and college in the province, has signed a Strategic Mandate Agreement (SMA) with the Government of Ontario's Ministry of Advanced Education and Skills Development [32]. These SMAs outline "System-Wide" and "Institution-Specific" targets to formalize "shared objectives and priorities" between educational and governmental entities (p. 6). Importantly for the ESE, one of U of T's SMA metrics commits the university to "the expansion of high-quality, pedagogically-sound work-integrated learning and experiential learning (WIL/EL) opportunities across undergraduate, graduate and professional programs" (p. 4). The U of T Task Force on Experiential Learning is responsible for achieving this priority and has released a white paper that standardizes the definition of experiential learning in the U of T context. The white paper concludes by recommending that the university better catalogue its experiential learning opportunities [8], thus demonstrating high-level administrative support for inventory work.

3. Methods

We shaped this paper as a case study to illustrate the challenges which arose throughout the project, and the reasons for choosing particular solutions. To paraphrase Bruno Latour, a case study opens the possibility to show a step-by-step project in-the-making rather than a ready-made solution [33]. The case study as a communicative approach has been adopted by other HEIs wanting to outline their development of sustainability programs, commitment to curriculum innovation and establishment of living labs [34–36]. As Dmochowski noted in a case study of the University of Pennsylvania (Penn), "the purpose of this paper is to share the strategy used at [Penn] and provide an evaluation of its success and guidance to others creating similar programs" [37]. This format is a critical asset for developing sustainability programs at other HEIs like the ones developed at the University of Toronto.

In this following section we will review the methods used to create the three inventories of sustainability opportunities available to undergraduate students at U of T.

3.1. Sustainability Course Inventory Method

Sustainability course inventories (SCIs) are common practice for universities who participate in sustainability reporting systems, such as the AASHE Sustainability Tracking, Assessment, and Rating System (STARS) [38]. Course inventories increase awareness of sustainability course offerings and highlight the inherent interdisciplinarity of sustainability [37]. Additionally, SCIs provide a metric to track changes in the amount of focus on sustainability in the curriculum across the university [39] and offer increased access to sustainability education opportunities at institutions.

A review of sustainability course inventories developed by North American universities revealed three popular methods to identifying courses for SCIs:

(1) Review of course titles and descriptions by the department, office, or group that is creating the inventory (e.g., [40–42])
(2) Survey of academic deans, chairs, or instructors to identify sustainability courses (e.g., [43,44])
(3) Keyword search of course catalogue (e.g., [45–47])

Many HEIs develop inventories using combinations of the above methodologies. Surveys of faculty members are sometimes conducted to confirm the results of inventories done by reviewing courses or keyword searches [43,45,48]. This method provides validation of the inventory results but does not rely on a high survey response rate to create a complete inventory.

The U of T Sustainability Course Inventory was developed using a keyword search of Course Finder [49], the central and exhaustive database of the tri-campus undergraduate courses. This methodology was chosen because resources were not available to individually review the more than 8000 undergraduate courses at U of T. Further, university regulations prevented us from using a survey method to identify courses. Finally, the method is transparent and requires least subjective judgement, making it easy to operationalize for updating the inventory in future years [50]. Graduate courses are not included in the SCI because U of T does not have a central graduate course catalogue in which a keyword search could be conducted.

The keywords used for the SCI were developed using the United Nation's Sustainable Development Goals (SDGs). Two to seven keywords were chosen for each SDG to describe each Goal as completely and precisely as possible without overlapping with the other SDGs. The keywords were selected by the ESE team based on a list of SDG keywords provided by the Sustainable Development Solutions Network (SDSN) Australia/Pacific Branch [50] and approved by the members of the CECCS.

The keyword search results were reviewed by course title and course description when necessary, and non-sustainability courses were removed from the inventory. This secondary filtering process is subjective but transparent, and a list of deleted courses was kept available. Such filtering was required because several keywords refer to different topics based on context, such as "environment" in "business environment". Courses were tagged with all SDGs for which they returned a keyword. About 25% of all search results were filtered out.

The taxonomy of SDGs and keywords is presented in Table 1. An effort was made to use a similar number of keywords for each SDG however priority was given to selecting a set of keywords that spanned, and are unique to, the problem area of each SDG. Additional effort was made to minimize repetition of keywords, however exceptions were made for *water* (SDGs 6 and 14), *conserv** (SDGs 14 and 15) and *pollute* (SDGs 14 and 15), as they were identified as essential keywords which could not be limited to one SDG. The keyword *sustainab** was not included because it is not specific to one SDG, and we found that it did not yield any courses that were not already identified by other keywords.

Table 1. Sustainable Development Goal keywords used to create the sustainability course inventory (SCI) (Sustainable Development Goal (SDG) text from [51]).

Sustainable Development Goal	Keywords [1]
Goal 1 End poverty in all its forms everywhere	*poverty, income distribution, wealth distribution, socio economic*
Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture	*agriculture, food, nutrition*
Goal 3 Ensure healthy lives and promote well-being for all at all ages	*health, well being*
Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	*educat*, inclusive, equitable*
Goal 5 Achieve gender equality and empower all women and girls	*gender, women, equality, girl, queer*
Goal 6 Ensure availability and sustainable management of water and sanitation for all	*water, sanitation*
Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all	*energy, renewable, wind, solar, geothermal, hydroelectric*
Goal 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	*employment, economic growth, sustainable development, labour, worker, wage*
Goal 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	*infrastructure, innovation, industr*, buildings*
Goal 10 Reduce inequality within and among countries	*trade, inequality, financial market, taxation*
Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable	*cities*, urban, resilien*, rural*
Goal 12 Ensure sustainable consumption and production patterns	*consum*, production, waste, natural resources, recycl*, industrial ecology, sustainable design*
Goal 13 Take urgent action to combat climate change and its impacts	*climate, greenhouse gas, environment, global warming, weather*
Goal 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development	*ocean, marine, water, pollut*, conserv*, fish*
Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	*forest, biodiversity, ecology, pollut*, conserv*, land use*
Goal 16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	*institution, justice, governance, peace, rights*

[1] An asterisk next to an abbreviated word is syntax for the search engines used to search all variants of that abbreviation. For example, searching *educat** returns results including *educate*, *education*, and *educator*.

The Sustainable Development Goals were designed as a framework to identify and cluster sustainability courses because of their international adoption, expert formulation, and comprehensiveness on the topic of sustainability [52] (Le Blanc argues that the SDGs have better integration across sectors than their predecessors, the MDGs. This integration is understood as improved comprehensiveness of

the interconnected challenges in sustainability.) The SDGs consist of a set of 17 goals, 169 targets, and 243 indicators that UN member states designed and adopted to use as a framework for development policy until 2030 [53]. They are an extension of the Millennium Development Goals (MDGs) and were adopted by world leaders in 2015 as a part of the 2030 Agenda for Sustainable Development [51]. These goals are not legally binding, therefore governments are expected to design their own process for implementation of policy to further these goals [54]. Goal 17, "Strengthen the means of implementation and revitalize the goal partnership for sustainable development," was excluded from our methodology, as it encompasses the act of achieving the other goals rather than bringing a new perspective to sustainability, making it poorly-fitting for this purpose.

Since the development of the SDGs, the United Nations (UN) and its affiliated organizations have strongly encouraged the use of the goals to frame problem solving in higher education institutions [55]. The UN Sustainable Development Solution Network (SDSN), is a UN General-Secretary organization working to develop and coordinate global research and technological expertise to promote practical solutions for sustainable development, specifically the implementation of the SDGs [55]. It argues that universities play a critical role in sustainable development, as the task of achieving the SDGs is so large, universities have the potential to accelerate action in SDGs. The SDGs provide a new way to communicate to the public about the relevancy of HEIs, especially as drivers of solving global problems while also providing a single framework for addressing global problems [50]. These arguments for engaging with the SDGs all relate to the growing role of HEIs to train students to develop problem-solving skills [5,56]. Yet, the use of the SDGs as global indicators is often contested, even with specific targets and indicators for the goals, the goals are still described as broad, vague, and confusing [54]. Our judgement was that, despite these concerns, the SDGs provided a powerful basis for assessing the sustainability content for U of T courses.

3.2. CEL Sustainability Inventory Method

The Community-Engaged Learning (CEL) Sustainability Inventory is an inventory of CEL courses at U of T in which students work on sustainability projects. The inventory seeks to identify opportunities for students to contribute to for-credit projects working on sustainability in a community, locally or internationally. The definition of community-engaged learning used by the inventory was adopted to align with the definition of CEL set out in the previously mentioned U of T white paper on experiential learning. CEL is viewed as an experiential learning activity "in which students contribute to meaningful projects within a community for the purpose of addressing existing needs of individuals, agencies or organizations that are not currently being met, as well as enhancing student learning and development" [8]. CEL opportunities are a type of living lab activity in which students contribute solutions to real sustainability challenges with the guidance of external partners.

To identify CEL sustainability courses, we again used a keyword search methodology. This methodology was used for the same reasons as for the SCI, however different keywords were needed to identify CEL courses. The CEL keywords were: *placement, *community, *experiential, *internship, *partner, *client, and *service. The ESE team then assessed the search results by reading each course description and documented the courses which satisfied two criteria: (1) they explicitly mentioned integration of CEL, and (2) they included CEL opportunities that were likely to address challenges related to sustainability. In an effort to foster a community of sustainability educators and partners at the university, the instructor name(s), email(s), and max course enrolment were recorded where available. The CEL sustainability inventory was developed separately from the SCI because CEL courses offer an educational experience for which students may search specifically.

A challenge that arose when developing this inventory methodology was the level of subjectivity present in the second screening criteria mentioned above. Information about the projects students would work on was not available to our team because (1) the variety of projects possible in a course is not listed in the course descriptions; and (2) a centralized list of all community partners involved in curricular projects does not exist at U of T. Thus, without knowing the partners involved, nor the

projects offered, we were required to assess whether a course captured by the CEL keywords was likely to have sustainability focused placement opportunities. The difficulty of this judgement is seen in the course APS111: Engineering Strategies & Practice I. One group of engineering students in APS111 (Engineering Strategies & Practice I) may design a net-positive student space for a client, but a different cohort in the same course designs a production line process. Our team decided to apply an inclusive filter wherein the potential presence of sustainability projects was sufficient for inclusion in the CEL inventory. In this instance, APS111 was included in the inventory.

Another challenge, which also appeared with the SCI, was organizing CEL inventory data in a way that communicated the strengths and gaps present in the current course offerings. Colleagues at the Center for Community Partnerships, a U of T administrative unit focused on developing experiential learning opportunities, recommended the "Global Work Integrated Learning (WIL) Curricular Framework" [1]. This framework allowed the ESE to cluster the CEL inventory based on "type" of placement, such as Applied Learning versus Internship courses. We further refined the data by sorting the courses by academic division. The clustering achieved its purpose—as will be discussed in the result section—thus we highly recommend seeking out clustering frameworks that prove relevant to each HEI context.

3.3. Sustainability Co-Curricular and Extracurricular Inventory Method

The Sustainability Co-Curricular and Extracurricular Inventory is a two-part inventory which lists all non-course-based sustainability opportunities for students at U of T. The first part of the inventory is a list of the sustainability-focused co-curricular activities at the university which are recognized by the U of T Co-curricular Record (CCR) [57]. The CCR is a database of student clubs, programs, and other co-curricular opportunities maintained by central administration. If students participate in a CCR recognized club, they can gain distinction for extra-curricular involvement on their academic record. The ESE believes that increasing the visibility of these opportunities through inventory work is an effective way to expand student engagement because such participation is already incentivized by the University.

The Co-Curricular Inventory was developed using the same SDG keyword-search methodology as the SCI. The keywords were searched in the Opportunity Directory on the CCR website.

The second part of the inventory is a list of sustainability-focused student groups at the U of T St. George campus. It was developed in a collaborative effort with the Sustainability Commission of the University of Toronto Students Union (SCUTSU) and the University of Toronto Sustainability Office (UTSO), to provide a shareable resource for students. It lists all sustainability-focused extracurricular student groups at the university, including those that are not recognized by the CCR. Given U of T's scale, the ESE believed creating this resource would render club initiative operating in disparate corners of the university visible to one another, thus opening potential for collaboration between student groups on sustainability projects.

The extracurricular inventory was developed by reading club descriptions on ULife, the official U of T online clubs directory [58], by canvassing interpersonal student group networks, and through other university websites and networks. The inventory is organized by affiliation or topic, including subject-focused groups, college-based groups, and student unions.

4. Results

4.1. Sustainability Course Inventory Results

The SCI found 2022 sustainability courses, which represents 25% of the 8158 undergraduate courses offered at U of T. Unique courses were defined as a course with a unique course code in its term (i.e., Fall or Winter). Different lecture sections of the same course were not counted as unique. The U of T SCI documents the following information: course code, course title, credits, campus, department, term, year level, total number of SDGs, keywords, the SDG(s) to which the course is related, and a link to the

course description. A sample page of the inventory is provided in Figure 1. The inventory is hosted on the website of the U of T Sustainability Office, available at: http://www.fs.utoronto.ca/SustainabilityOffice/Resources/SustainabilityCourses (See Supplementary Materials).

Course Code	Course Title	Campus	Department	Term	SDGs Covered
WGS347H5	Indigenous Feminisms and Decolonization	Mississauga	Historical Studies	2018 Fall	SDG 5, SDG 16
CIV401H1	Design and Optimization of Hydro and Wind Electric Plants	St. George	Civil Engineering	2018 Fall	SDG 7
CHM211H5	Fundamentals of Analytical Chemistry	Mississauga	Chemical and Physical Sciences	2018 Fall	SDG 13
RLG213H1	Reading Sacred Texts	St. George	Department for the Study of Religion	2018 Fall	SDG 13
MIE516H1	Combustion and Fuels	St. George	Mechanical & Industrial Engineering	2018 Fall	SDG 9, SDG 14, SDG 15
HMB441H1	Genetics of Human Disease	St. George	Human Biology Program	2018 Fall	SDG 3
ESS462H1	Global Biogeochemical Cycles	St. George	Earth Sciences	2018 Fall	SDG 14
WGS451H1	Independent Study in Women and Gender Studies Issues	St. George	Women and Gender Studies Institute	2018 Fall	SDG 5
JGE331H1	Resource and Environmental Theory	St. George	Geography and Planning	2018 Fall	SDG 13, SDG 14, SDG 15, SDG 16

Figure 1. A condensed sample page of the University of Toronto (U of T) Sustainability Course Inventory. (SDG = Sustainable Development Goal).

The SCI was compared with results from other Canadian HEIs that report sustainability courses through AASHE STARS [59]. Figure 2 shows that the maximum percentage of undergraduate courses that are sustainability course offerings is 32%, the minimum is 1%, and the median is 10%. U of T is in the upper quartile of these institutions. However it is difficult to draw conclusions by comparing inventory results with other self-reporting HEIs, because institutions may use different definitions of "sustainability courses" and different methods for identifying and counting courses.

The sustainability courses are found in six academic divisions across the university's three campuses. The Faculty of Kinesiology & Physical Health is the only division which offers undergraduate courses but does not have any identified sustainability courses. Table 2 shows the repartition of sustainability courses by division and year level.

The inventory reveals that most sustainability courses at U of T are third- and fourth-year courses (42% and 30% of all sustainability courses, respectively). Most divisions offer the most sustainability courses in third year, however the Faculty of Applied Science & Engineering (FASE) offers significantly more sustainability courses (58%) in fourth year. This is for several reasons: some FASE 400-level courses are undergraduate/graduate mixed classes; the largest number of engineering courses are offered in fourth year overall; and, all engineering students take a fourth-year capstone design course which generally considers some aspect of sustainability.

Part of the work of creating the SCI included identifying the total number of undergraduate courses offered as this information was not readily available from university administration. Table 3 presents the number sustainability courses as a portion of total undergraduate courses by division and year level. These findings reveal that whereas the Faculty of Arts and Science (FAS) offers the most sustainability courses overall, there is a higher concentration of sustainability courses in the Faculty of Applied Science & Engineering (FASE), University of Toronto Mississauga (UTM), University of Toronto Scarborough (UTSC), and the John H. Daniels Faculty of Architecture, Landscape, & Design (FALD).

The highest concentration of sustainability courses is in FALD, in which 47% of undergraduate courses contain sustainability content. Impressively, 67% of third-year courses offered by FALD include sustainability content, compared to 30% of third-year courses across the university.

Tables 2 and 3 show that just 8% of all sustainability courses are offered in first year, which represents 18% of all 100-level courses. However, further research found that these courses have high enrolment; therefore, they are important for future curriculum innovation initiatives as they have the capacity to reach many students.

The SCI findings reveal that the most common SDG content in U of T sustainability courses are Goals 13 (climate change), 16 (peaceful and inclusive societies), and 5 (health, well-being) (Figure 3). These SDGs are represented in 25%, 20%, and 19% of total courses in the inventory respectively. These results reflect the focus of sustainability courses across U of T, however the results may be more useful at the divisional or departmental level.
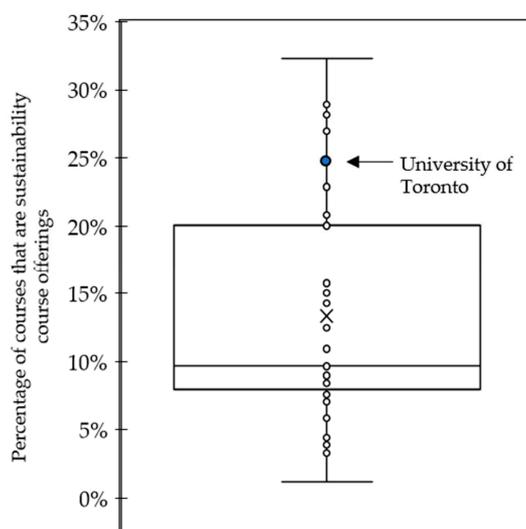

Figure 2. Percentage of undergraduate sustainability course offerings at Canadian higher education institutions (HEIs) with data from the Advancement of Sustainability in Higher Education Sustainability Tracking, Assessment, and Rating System (AASHE STARS) [59]. Courses that include sustainability encompass both "sustainability courses" and "courses that include sustainability" in the STARS framework. The cross represents the mean of the data; the blue dot indicates the U of T Sustainability Course Inventory (SCI).

Table 2. Representation of undergraduate sustainability courses by academic division and year level.

Academic Division	100-Level	200-Level	300-Level	400+ Level [1]	Total
Faculty of Arts and Science	81	174	329	260	844
Faculty of Applied Science & Engineering	10	18	46	116	190
University of Toronto Mississauga	29	102	235	111	477
University of Toronto Scarborough	32	122	202	104	460
Faculty of Music	0	1	2	4	7
John H. Daniels Faculty of Architecture, Landscape, & Design	4	6	29	5	44
Faculty of Kinesiology & Physical Education	0	0	0	0	0
Total	**156**	**423**	**843**	**600**	**2022**

[1] 400+ Level courses refer to both undergraduate and mixed undergraduate/graduate courses.

Table 3. Portion of sustainability courses by academic division and year level.

Academic Division	100-Level	200-Level	300-Level	400+ Level	Total
Faculty of Arts and Science	24%	23%	26%	20%	**23%**
Faculty of Applied Science & Engineering	23%	22%	30%	49%	**37%**
University of Toronto Mississauga	25%	26%	37%	26%	**30%**
University of Toronto Scarborough	12%	32%	35%	22%	**27%**
Faculty of Music	0%	1%	2%	2%	**1%**
John H. Daniels Faculty of Architecture, Landscape, & Design	44%	25%	67%	28%	**47%**
Faculty of Kinesiology & Physical Education	0%	0%	0%	0%	**0%**
Total	**18%**	**24%**	**30%**	**22%**	**25%**
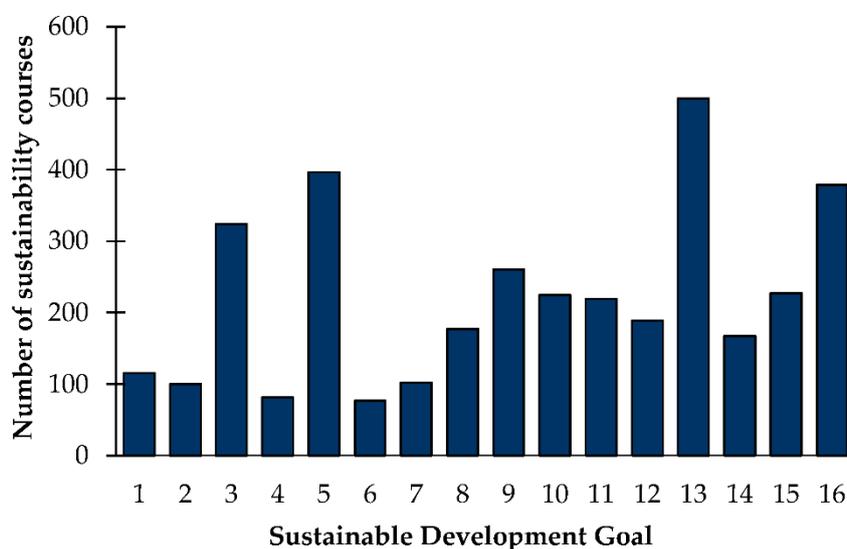
Figure 3. Number of sustainability courses covering each SDG. Note that courses may cover more than one SDG.

On the level of the academic division, emphasis on SDGs in particular subject areas becomes more apparent. For instance, in UTSC, UTM, and the Faculty of Arts and Science at UTSG, SDG 3 (health, well-being) and SDG 5 (gender equality) together represent more than half of the sustainability courses. In the Faculty of Applied Science and Engineering, more than half of the sustainability courses are represented under SDG 9 (sustainable infrastructure and innovation) and another quarter under SDG 7 (sustainable energy). Another interesting finding of the SDGs by subject area is that SDG 13 (climate change) does not represent the majority of sustainability courses in any one academic division, despite being the most represented SDG in the inventory.

Further analysis of the inventory sought to identify bias in the course results which may have resulted from using different numbers of keywords for each SDG. No relationship was found between the ratio of number of courses to number of keywords between different SDGs. The ratio of courses per keyword varied from 17 courses per keyword for SDG 7 (6 keywords) and 162 courses per keyword for SDG 3 (2 keywords).

The number of SDGs covered by a course was considered indicative of the degree of sustainability focus in the course. Many SDGs suggests that the course is multidisciplinary and teaches many sustainability issues. Further, the research efforts at Yale University which used the SDGs to identify

sustainability scholarship found that using the SDGs as a clustering scheme is a productive way to identify transdisciplinary connections and build sustainability networks [2].

4.2. CEL Sustainability Inventory Results

The CEL Sustainability Inventory includes 154 CEL courses with sustainability content at U of T, which represents 36% of the 425 CEL courses identified by the keyword search. The CEL Sustainability includes course code, course title, credits, campus, department, term, division, associated keywords, and a hyperlink to the course description. A sample page from the inventory is provided in Figure 4.

Course Code	Course Title	Campus	Department	Term	Division
CSC454H1	The Business of Software	St. George	Computer Science	2019 Winter	Faculty of Arts and Science
SOC315H1	Domestic Violence	St. George	Sociology	2019 Winter	Faculty of Arts and Science
HST330H1	Population Health	St. George	University College	2019 Winter	Faculty of Arts and Science
GGR313H5	Gender and the City	Mississauga	Geography	2019 Winter	University of Toronto Mississauga
WRI411H5	Professional Writing and Communication Internship II	Mississauga	Institute of Communication and Culture	2019 Winter	University of Toronto Mississauga
CHM399Y5	Research Opportunity Program	Mississauga	Chemical and Physical Sciences	2019 Winter	University of Toronto Mississauga
FRED06H3	Language Practice VIII: Oral French	Scarborough	Centre for French and Linguistics (UTSC)	2019 Winter	University of Toronto Scarborough
CCT410H5	CCIT Internship I	Mississauga	Institute of Communication and Culture	2019 Winter	University of Toronto Mississauga
MIE315H1	Design for the Environment	St. George	Mechanical & Industrial Engineering	2019 Winter	Faculty of Applied Science & Engineering
CIV523H1	Geotechnical Design	St. George	Civil Engineering	2019 Winter	Faculty of Applied Science & Engineering

Figure 4. A condensed sample page of the U of T community-engaged learning (CEL) Sustainability Inventory.

Table 4 summarizes the CEL Sustainability Inventory by academic division, summarizing the faculty teaching CEL, across how many courses, and the total student enrolment therein. The courses are also tagged using an adapted version of McRae and Johnson's Global Work-Integrated Learning Framework [1], summarized in Table 5. The framework was changed to exclude the categories Apprenticeship, Clinic, and Co-op as they did not align with our definition of CEL.

Table 5 reveals how clustering the CEL inventory reveals gaps and trends in CEL sustainability course offerings. For example:

(1)　The Faculty of Applied Science & Engineering offers vast Applied Research Sustainability CEL courses.
(2)　The University of Toronto Scarborough does not offer any Sustainability Internship courses, whereas these courses make up over half (58%) of the University of Toronto Mississauga Sustainability CEL offerings.

(3)   Applied Research Sustainability courses only comprise 16% of all Sustainability CEL courses at U of T. Curricular Community Service Learning and Internship offerings are predominant with 36% and 27% of total U of T Sustainability CEL courses respectively.

Table 4. Number of faculty, sustainability community-engaged learning (CEL) courses, and max enrolment in sustainability CEL courses.

Academic Division	Instructors Teaching Sustainability CEL	Total Sustainability CEL Courses	Max Student Enrolment
Faculty of Arts and Science	34	63	1783
Faculty of Applied Science & Engineering	18	15	1492
University of Toronto Mississauga	24	38	1173
University of Toronto Scarborough	10	34	878
Faculty of Music	0	0	0
John H. Daniels Faculty of Architecture, Landscape, & Design	N/A [1]	3	20
Total	**86**	**154**	**5346**

[1] Instructors were identified as available on the U of T Course Finder. Instructor names were not available for the Faculty of Architecture at the time of the inventory, and therefore were not counted.

Table 5. Sustainability CEL courses clustered into categories from McRae and Johnson's Global Work-Integrated Learning Framework [1].

Academic Division	Applied Research	Curricular Community Service Learning	Internship	Field Placement	Practicum/Clinical Placement	Work Experience
Faculty of Arts and Science	6	29	16	2	7	3
Faculty of Applied Science & Engineering	12	2	2	0	0	0
University of Toronto Mississauga	2	10	22	0	3	1
University of Toronto Scarborough	5	14	0	0	12	3
Faculty of Music	0	0	0	0	0	0
John H. Daniels Faculty of Architecture, Landscape, & Design	0	1	2	0	0	0
Total	**25**	**56**	**42**	**2**	**22**	**7**

These data are highly instrumental and compelling. They are the raw data with which curricula interventions could be justified. As a concrete example, the ESE argued in its Annual Report (2017) that there is clearly potential to expand the amount of Applied Research course offerings on the Mississauga and Scarborough campuses, and fortunately these may be the easiest to develop. Applied Research courses like ENV461 (The U of T Campus as a Living Lab of Sustainability) pull clients from the everyday operating departments of the University itself. In other words, the projects and clients are already present on campus. All that remains is finding a faculty member willing to organize the clients and evaluate the students' work.

The ESE explored the relationship between the results of our SCI inventory and the CEL inventory. Initially, the team's assumed that if we used Excel to cross-reference the inventories and reveal duplicates that many courses would appear. Both inventories capture sustainability courses, but with different sets of keywords as outlined in the methodology sections of both inventories. Yet, in cross-referencing the 2022 SDG courses with the 154 CEL courses the ESE team found only 65 courses that conformed

to both sets of keywords. The disconnect between perception and the inventory's reality was found in the particular language used in CEL course descriptions. These course descriptions were often general about the types of projects or placements offered because they change regularly. The SDG keywords sought to capture substantive phrases which were not found in the course descriptions and therefore there is limited intersection between the inventories.

4.3. Sustainability Co-Curricular and Extracurricular Inventory Results

The Sustainability Co-Curricular Inventory keyword search identified 263 sustainability-focused opportunities for students which are approved for the university's Co-Curricular Record. The CCR inventory includes the name of the opportunity, number of positions available to students, keywords, related SDGs, and a hyperlink to a description of the position.

In the Extracurricular Inventory 67 sustainability-focused student groups were identified with the help of the Students Union Sustainability Commission and other sustainability student networks. It includes the group name, how the group was identified for the inventory, and the school year that the contact was last updated. The inventory also includes personal contact information for the club executives to help interested students contact the clubs directly to become involved.

These two inventory lists are not mutually exclusive, however they meet two different objectives for students searching for sustainability-focused opportunities. Student networks have reported to us that they look for CCR opportunities when they are searching for official work placements or internships, whereas they look for lower-commitment, student group involvement on the ULife website and other club listings. Sample pages of the Co-Curricular and Student Groups Inventory are provided in Figure 5.

The ESE is pleased to report that the Sustainability Commission of the University of Toronto Students Union used the first version of our Extracurricular Inventory to hold Sustainability Commissions throughout the 2017–2018 school year. Sustainability student groups were identified and brought together for a visioning process to identify gaps in U of T's sustainability infrastructure. Projects to reduce energy consumption, expand composting programs, and reduce food packaging were undertaken and student leaders pledged the unique resources of their clubs in a deeply collaborative manner. We believe this is an excellent first step towards creating a network of sustainability champions at U of T.

(a)

Group	Source	Contact Last Updated (Academic Year)
General Sustainability		
University of Toronto Environmental Resource Network	Website	2017–2018
University of Toronto Student Union Sustainability Commission	SO Connection	2017–2018
Environmental Justice Collective	ULife	2016–2017
Leap Chapter UofT	ULife	2017–2018
Regenisis UofT		2016–2017
Greenpeace Student Network		2016–2017
UofT Environmental Action	UTERN	2016–2017

Figure 5. *Cont.*

	Activity	Positions	SDGs Covered
(b)	Development League, Faculty of Kinesiology & Physical Education	1	SDG 4
	Urban Non-Violent Initiatives Through Youth (UNITY), Student Organization	8	SDG 11, SDG 13
	Waawaahte Northern Lights Initiative	1	SDG 4
	ILead: Graduate Group, Faculty of Applied Science & Engineering	7	SDG 2
	Student Staff, Factor-Inwentash Faculty of Social Work	N/A	SDG 3, SDG 4, SDG 5
	Urban Studies Student Union (URSSU), Student Organization	7	SDG 11, SDG 12
	Student Staff, John H. Daniels Architecture, Landscape & Design	N/A	SDG 4, SDG 6, SDG 9, SDG 11, SDG 12, SDG 13, SDG 14, SDG 15
	Camp U of T	1	SDG 3, SDG 13
	Rotman Commerce Pride Alliance, Student Life—Rotman Commerce, Student Organizations	6	SDG 4

Figure 5. Condensed sample pages of the U of T (**a**) Co-Curricular and (**b**) Extracurricular Sustainability Inventory. Student contacts have been omitted for privacy.

5. Ongoing and Future Work

The creation of the three sustainability inventories is a fundamental step towards the third objective of the ESE, to develop sustainability pathways accessible to all students within their degree program. We have developed a proposal for a three-tiered pathways program which uses the inventories to identify curricular and non-curricular opportunities for student engagement in sustainability. The first tier, Sustainability Citizen, acknowledges co-curricular and extracurricular involvement in sustainability extracurricular activities. The second, Sustainability Scholar, is a curricular pathway where students would earn a certificate for completing a trajectory of existing for-credit courses. The third, Sustainability Leader, is a more intensive pathway through which students follow a trajectory of co-curricular activities, curricular courses, international experience, and a capstone course. The SCI is a central tool for the development of such Sustainability Scholar and Sustainability Leader programs. The number of SDGs to which a course is tagged can be used to indicate the degree to which they are sustainability-focused, and a variety of SDGs can be represented in each pathway to ensure interdisciplinary groups of courses. Similarly, the CEL Sustainability Inventory and Sustainability Co-curricular and Extracurricular Inventories are critical to lists of opportunities for building the Sustainability Citizen and Sustainability Leader pathways. Work on the pathways is ongoing within several academic divisions at the university.

Beyond contributing to the development of sustainability pathways, future work for the ESE includes confirming the results of the SCI through a survey of all faculty and instructors. This feedback will help validate the results of the keyword search, identify any courses not found through the search, and flag any courses which contained the keywords but which the instructor does not believe is a sustainability course. Challenges exist to releasing such a survey due to the university's restrictions on mass emails to faculty and staff.

Additionally, future work exists to make the inventories highly accessible to students. In addition to hosting the SCI on the website of the UTSO, we hope future developments will allow the inventory to be integrated into U of T's major course selection platforms, making sustainability course options more visible to students.

We hope to expand the SCI to include graduate courses. There is not a central catalogue of graduate courses and therefore this demands increased resources. If it is not possible to conduct a keyword search, a different inventory method could be investigated.

To continue building a community of sustainability educators at the university, and to increase experiential learning opportunities in sustainability, a workshop is being planned in collaboration with the U of T Centre for Community Partnerships to help instructors identify methods to increase CEL in their courses.

6. Conclusions

There is growing movement for universities to take a more active role in society by conducting solution-driven research and engaging with community partners, for the benefit of both students and the broader community [4,5,20]. In 2017, the University of Toronto formed a Presidential Advisory Committee on Environment, Climate Change, and Sustainability which set goals for the university to contribute [3]. Under the directive of the Curriculum Innovation subcommittee of the CECCS, the Expanded Student Engagement project set out four goals to identify sustainability content in the undergraduate curriculum and to provide guidance towards creating a transformative sustainability education through experiential learning.

The first goal—creating a set of sustainability inventories—was achieved. A keyword search methodology was developed using 16 of the 17 UN Sustainable Development Goals to create an SCI. The number of 2022 undergraduate sustainability courses was identified, 25% of all undergraduate courses. Further, a CEL Sustainability Inventory was developed which identified 154 CEL courses with sustainability content. These courses were clustered by type of learning activity using an adapted version of McRae and Johnson's Global Work-Integrated Learning Framework. Finally, inventories were developed of sustainability-focused co-curricular and extracurricular opportunities available to students at the university. Two hundred and sixty three university-recognized opportunities and 67 student groups were identified. These inventory methods, now in place, are designed to be easily updated in future years. These course inventory methodologies are some of the first presented in the literature and may be useful to other HEIs who wish to undertake a similar initiative. The second goal—creating a list of faculty teaching sustainability and sustainability-CEL courses—was achieved through the SCI and CEL Sustainability Inventory. During the keyword search, faculty teaching of each sustainability course was identified. This list has been made available to the CECCS.

The ESE's future research developments and goals focus on the third and fourth goal. The third goal is to contribute to the creation of curricular sustainability pathways for all U of T students. Several steps forward have been made towards this goal by using the course inventories to inform strategies for pathways courses and engagement opportunities. As described above, the ESE will continue to work with the CECCS to further develop the pathways. Finally, the fourth goal of the ESE is to develop more curricular and co-curricular student engagement opportunities related to sustainability. The creation of the CEL Sustainability Inventory is a necessary first step to identify courses where these opportunities can be provided and the ESE is currently working on hosting workshops to develop these opportunities further.

The inventories work as infrastructure to support a bottom-up groundswell of sustainability engagement in the University of Toronto. They are designed to connect instructors who teach sustainability and CEL content, enhance sustainability programs through collaboration, provide a meaningful tool for curriculum innovation in sustainability, increase student enrolment in sustainability courses by effectively communicating their presence, and increase awareness of opportunities in sustainability outside of the classroom. Clustering the inventories highlights the gaps, unexpected connections, and areas of growth for sustainability initiatives from actors across HEIs. Hence, through achieving the above four goals, the ESE hopes to meaningfully support the integration of sustainability content into all aspects of students' academic experience at U of T. If the ESE is

successful, a new generation of leaders will have the opportunity and tools to address sustainability challenges faced in our local and global communities.

References

1. McRae, N.; Johnston, N. The Development of a Proposed Global Work-Integrated Learning Framework. *Asia-Pac. J. Coop. Educ.* **2016**, *17*, 337–348.

2. Goodall, M.; Moore, E. *Yale Scholarship and the Sustainable Development Goals*; Yale Office of Sustainability: New Haven, CT, USA, 2015; Available online: https://sustainability.yale.edu/academics-research/scholarship-and-sdgs (accessed on 19 January 2019).

3. *President's Advisory Committee on the Environment, Climate Change, and Sustainability*; Annual Report 2017; University of Toronto: Toronto, ON, Canada, 2017; Available online: http://www.president.utoronto.ca/the-2017-annual-report-of-the-presidents-advisory-committee-on-the-environment-climate-change-and-sustainability (accessed on 19 January 2019).

4. Robinson, J.; Berkhout, T.; Campbell, A. The University as an Agent of Change for Sustainability. In *Policy Horizons Canada*; University of British Columbia: Vancouver, BC, Canada, 2011.

5. Samarasekera, I.V. Universities need a new social contract. *Nature* **2009**, *462*, 160–161. [CrossRef] [PubMed]

6. Domask, J.J. Achieving goals in higher education: An experiential approach to sustainability studies. *Int. J. Sustain. High. Educ.* **2007**, *8*, 53–68. [CrossRef]

7. Munro, A.; Marcus, J.; Dolling, K.; Robinson, J.; Wahl, J. Combining forces: Fostering sustainability collaboration between the city of Vancouver and the University of British Columbia. *Int. J. Sustain. High. Educ.* **2016**, *17*, 812–826. [CrossRef]

8. University of Toronto. *Rethinking Higher Education Curricula: Increasing Impact Through Experiential, Work-Integrated, and Community-Engaged Learning*; University of Toronto: Toronto, ON, Canada, 2017.

9. Schäpke, N.; Bergmann, M.; Stelzer, F.; Lang, D.J. Labs in the Real World: Advancing Transdisciplinary Research and Sustainability Transformation: Mapping the Field and Emerging Lines of Inquiry. *GAIA Ecol. Perspect. Sci. Soc.* **2018**, *27*, 8–11. Available online: https://www.ingentaconnect.com/contentone/oekom/gaia/2018/00000027/a00101s1/art00005# (accessed on 19 January 2019). [CrossRef]

10. Wittman, A.; Crews, T. *Engaged Learning Economies: Aligning Civic Engagement and Economic Development in Community-Campus Partnerships*; Campus Connect; Campus Compact: Boston, MA, USA, 2012; Available online: https://compact.org/engaged-learning-economies-linking-civic-engagement-and-economic-development/ (accessed on 19 January 2019).

11. Menny, M.; Palgan, Y.V.; McCormick, K. Urban Living Labs and the Role of Users in Co-Creation. *GAIA Ecol. Perspect. Sci. Soc.* **2018**, *27*, 68–77. [CrossRef]

12. Krütli, P.; Pohl, C.; Stauffacher, M. Sustainability Learning Labs in Small Island Developing States: A Case Study of the Seychelles. *GAIA Ecol. Perspect. Sci. Soc.* **2018**, *27*, 46–51. [CrossRef]

13. Waheed, M.H. *A Revolution for Post-16 Education—Part 1: A Case for the Living Lab*; The Environmental Association for Universities and Colleges: Cheltenham, UK, 2017.

14. Waheed, M.H. *A Revolution for Post-16 Education—Part 2: How do Living Labs Work?* Environmental Association for Universities and Colleges: Cheltenham, UK, 2017.
15. Brundiers, K.; Wiek, A. Educating Students in Real-world Sustainability Research: Vision and Implementation. *Innov. High. Educ.* **2011**, *36*, 107–124. [CrossRef]
16. Komiyama, H.; Takeuchi, K. Sustainability science: Building a new discipline. *Sustain. Sci.* **2006**, *1*, 1–6. [CrossRef]
17. Costanza, R.; Stern, D.; Fisher, B.; He, L.; Ma, C. Influential publications in ecological economics: A citation analysis. *Ecol. Econ.* **2004**, *50*, 261–292. [CrossRef]
18. Porter, A.L.; Roessner, J.D.; Cohen, A.S.; Perreault, M. Interdisciplinary research: Meaning, metrics and nurture. *Res. Eval.* **2006**, *15*, 187–196. [CrossRef]
19. Rafols, I.; Meyer, M. Diversity and network coherence as indicators of interdisciplinarity: Case studies in bionanoscience. *Scientometrics* **2010**, *82*, 263–287. [CrossRef]
20. Aktaş, C.B. Reflections on interdisciplinary sustainability research with undergraduate students. *Int. J. Sustain. High. Educ.* **2015**, *16*, 354–366. [CrossRef]
21. Wright, M.F.; Cain, K.D.; Monsour, F.A. Beyond Sustainability: A Context for Transformative Curriculum Development. *Transform. Dialogues Teach. Learn. J.* **2015**, *8*, 1–19.
22. Blake, J. *Community Engagement Towards a Sustainable Future: PedRIO Paper 3*; Pedagogic Research Institute and Observatory, University of Plymouth: Plymouth, UK, 2018; Available online: https://www.plymouth.ac.uk/research/institutes/pedagogic/pedrio-occasional-papers (accessed on 19 January 2019).
23. Pedagogic Research Institute and Observatory. *Third Annual Report: 2013*; Pedagogic Research Institute and Observatory, University of Plymouth: Plymouth, UK, 2013; p. 36. Available online: https://www.plymouth.ac.uk/research/institutes/pedagogic (accessed on 19 January 2019).
24. UBC Sustainability Initiative. *Transforming Sustainability Education at UBC: Desired Student Attributes and Pathways for Implementation*; UBC Sustainability Initiative: Vancouver, BC, Canada, 2013.
25. Universities Canada Enrolment by University 2017. Available online: https://www.univcan.ca/universities/facts-and-stats/enrolment-by-university/ (accessed on 5 November 2018).
26. Gertler, M.S. *Beyond Divestment: Taking Decisive Action on Climate Change*; University of Toronto: Toronto, ON, Canada, 2016; p. 45.
27. *President's Advisory Committee on the Environment, Climate Change, and Sustainability*; Annual Report 2018; University of Toronto: Toronto, ON, Canada, 2018; Available online: http://www.president.utoronto.ca/the-2018-annual-report-of-the-presidents-advisory-committee-on-the-environment-climate-change-and-sustainability (accessed on 19 January 2019).
28. Bieler, A.; McKenzie, M. Strategic Planning for Sustainability in Canadian Higher Education. *Sustainability* **2017**, *9*, 161. [CrossRef]
29. University of Toronto Faculty of Arts and Science Program Enrolment—Current Students. Available online: http://www.artsci.utoronto.ca/current/program/enrolment-instructions/index_html (accessed on 5 November 2018).
30. AASHE Home. Available online: http://www.aashe.org/ (accessed on 18 January 2019).
31. The University Climate Change Coalition. Available online: https://secondnature.org/initiative/uc3-coalition/ (accessed on 18 January 2019).
32. *Strategic Mandate Agreement between the Ministry of Advanced Education and Skills Development and University of Toronto 2017–2020*; University of Toronto; Government of Ontario Ministry of Advanced Education and Skills Development: Toronto, ON, Canada, 2017; Available online: https://www.utoronto.ca/sites/default/files/University%20of%20Toronto%20SMA%202017-20%20%28for%20publication%29.pdf (accessed on 19 January 2019).
33. Latour, B. *Science in Action: How to Follow Scientists and Engineers through Society*; 11. print.; Harvard Univ. Press: Cambridge, MA, USA, 2003; ISBN 978-0-674-79291-3.
34. Vezzoli, C.; Penin, L. Campus: "lab" and "window" for sustainable design research and education: The DECOS educational network experience. *Int. J. Sustain. High. Educ.* **2006**, *7*, 69–80. [CrossRef]
35. Evans, J.; Jones, R.; Karvonen, A.; Millard, L.; Wendler, J. Living labs and co-production: university campuses as platforms for sustainability science. *Curr. Opin. Environ. Sustain.* **2015**, *16*, 1–6. [CrossRef]
36. Hill, L.M.; Wang, D. Integrating sustainability learning outcomes into a university curriculum: A case study of institutional dynamics. *Int. J. Sustain. High. Educ.* **2018**, *19*, 699–720. [CrossRef]

37. Dmochowski, J.E.; Garofalo, D.; Fisher, S.; Greene, A.; Gambogi, D. Integrating sustainability across the university curriculum. *Int. J. Sustain. High. Educ.* **2016**, *17*, 652–670. [CrossRef]

38. Urbanski, M.; Rowland, P. STARS as a Multi-Purpose Tool for Advancing Campus Sustainability in US. In *Sustainable Development and Quality Assurance in Higher Education*; Fadeeva, Z., Galkute, L., Mader, C., Scott, G., Eds.; Palgrave Macmillan: London, UK, 2014; pp. 153–182. ISBN 978-1-349-49873-4.

39. White, G.B.; Koester, R.J. STARS and GRI: Tools for Campus Greening Strategies and Prioritizations. *Sustain. J. Rec.* **2012**, *5*, 100–106. [CrossRef]

40. Colorado State University Colorado State University | Scorecard | Institutions | AASHE STARS. Available online: https://stars.aashe.org/institutions/colorado-state-university-co/report/2017-02-07/ (accessed on 5 November 2018).

41. Western University Western University | Scorecard | Institutions | AASHE STARS. Available online: https://stars.aashe.org/institutions/university-of-western-ontario-on/report/2018-02-01/ (accessed on 5 November 2018).

42. Yale University Yale University | Scorecard | Institutions | AASHE STARS. Available online: https://stars.aashe.org/institutions/yale-university-ct/report/2018-06-29/ (accessed on 5 November 2018).

43. University of Alberta University of Alberta | Scorecard | Institutions | AASHE STARS. Available online: https://stars.aashe.org/institutions/university-of-alberta-ab/report/2017-06-30/ (accessed on 5 November 2018).

44. Drogos, D.J. Sustainability Curriculum Inventory and Literacy Assessment: The Influence of Values on Knowledge of and Perceived Importance of Sustainability Components. Master's Thesis, Southern Illinois University Carbondale, Carbondale, IL, USA, 2013. Theses Paper 1316. Available online: https://opensiuc.lib.siu.edu/cgi/viewcontent.cgi?article=2330&context=theses (accessed on 19 January 2019).

45. California State University, Los, Angeles California State University, Los Angeles | Scorecard | Institutions | AASHE STARS. Available online: https://stars.aashe.org/institutions/california-state-university-los-angeles-ca/report/2016-06-06/ (accessed on 5 November 2018).

46. Southern Illinois University Carbondale Southern Illinois University Carbondale | Scorecard | Institutions | AASHE STARS. Available online: https://stars.aashe.org/institutions/southern-illinois-university-carbondale-il/report/2016-11-23/ (accessed on 5 November 2018).

47. University of Pennsylvania University of Pennsylvania | Scorecard | Institutions | AASHE STARS. Available online: https://stars.aashe.org/institutions/university-of-pennsylvania-pa/report/2018-02-21/ (accessed on 5 November 2018).

48. University of Toronto Course Finder. Available online: http://coursefinder.utoronto.ca (accessed on 18 January 2019).

49. Wilfrid Laurier University Wilfrid Laurier University | Scorecard | Institutions | AASHE STARS. Available online: https://stars.aashe.org/institutions/wilfrid-laurier-university-on/report/2013-12-20/ (accessed on 5 November 2018).

50. Sustainable Development Solutions Network—Australia/Pacific. *Getting Started with the SDGs in Universities: A Guide for Universities, Higher Education Institutions, and the Academic Sector*; SDSN: Melbourne, Australia, 2017.

51. *Transforming Our World: The 2030 Agenda for Sustainable Development*; United Nations General Assembly: New York, NY, USA, 2015.

52. Le Blanc, D. Towards Integration at Last? The Sustainable Development Goals as a Network of Targets: The sustainable development goals as a network of targets. *Sustain. Dev.* **2015**, *23*, 176–187. [CrossRef]

53. United Nations General Assembly. *Work of the Statistical Commission Pertaining to the 2030 Agenda for Sustainable Development*; United Nations General Assembly: New York, NY, USA, 2017; p. 25.

54. Janoušková, S.; Hák, T.; Moldan, B. Global SDGs Assessments: Helping or Confusing Indicators? *Sustainability* **2018**, *10*, 1540. [CrossRef]

55. Sustainable Development Solutions Network Sustainable Development Solutions Network | Vision and Organization. Available online: http://unsdsn.org/about-us/vision-and-organization/ (accessed on 5 November 2018).

56. Grin, J. The politics of transition governance in Dutch agriculture. Conceptual understanding and implications for transition management. *Int. J. Sustain. Dev.* **2012**, *15*, 72. [CrossRef]

57. University of Toronto Career & Co-Curricular Learning Network. Available online: https://clnx.utoronto.ca/ccr/overview.htm (accessed on 18 January 2019).
58. University of Toronto Ulife. Available online: https://www.ulife.utoronto.ca/ (accessed on 18 January 2019).
59. Association for the Advancement of Sustainability in Higher Education STARS Participants & Reports. Available online: https://stars.aashe.org/institutions/participants-and-reports/ (accessed on 5 December 2018).