



SUSTAINABLE CURRICULUM REPORT CONCORDIA UNIVERSITY: FACULTY OF ARTS & SCIENCE

SUSTAINABILITY ACTION FUND & CONCORDIA ACADEMIC PLAN 2012-2016

Written & Edited by: Chris Elvidge, Christina Bell, Mikayla Wujec,
Rosemarie Schade, James Grant.

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2090 rue MacKay Z-304, Montreal, QC, H3G 1M8, www.safconcordia.ca

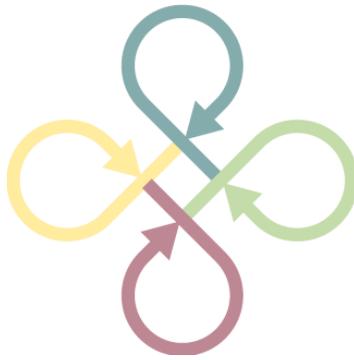


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EXECUTIVE SUMMARY

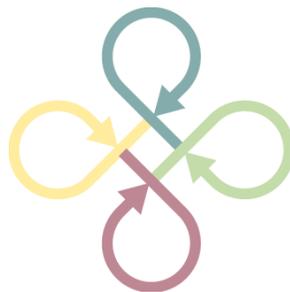
With the goal of quantifying the extent of sustainability coverage and highlighting areas for improvement in the undergraduate curriculum at Concordia University, the Sustainability Action Fund has partnered with the Academic Plan 2012-2016 to conduct the Sustainable Curriculum Project. This report represents the first step of this project, and involved analyzing all available descriptions of courses offered by the Faculty of Arts and Science at Concordia University. The methodology employed in this analysis is described in detail and provides a template for future evaluations of new courses in Arts and Science as well as extending to the other Faculties at Concordia.

KEY FINDINGS:

- Of the 1245 courses, 109 (8.8%) feature some sustainability content, with the highest proportion of these sustainability content courses occurring in the Social Sciences (68.8%), followed by the Humanities (16.5%) and the Sciences (14.7%).
- Considering the proportions of sustainability content courses within each academic sector, Social Sciences offer the most sustainability content (75 out of 469 courses: 16.0%), followed by the Sciences (16 out of 223 courses: 6.9%) and the Humanities (18 out of 553 courses: 3.3%).
- Overall, the distribution of sustainability sub-topics or spheres (Social, Environmental, Economic, Practical) tends to follow the distribution of these areas in the academic sectors, with most Science courses covering Environmental aspects of sustainability, and most Social Sciences and all Humanities courses covering Social aspects.
- Courses scoring the highest in sustainability content tend to be clustered at the 200- and 400-levels, suggesting that courses with the greatest coverage of sustainability are generally inaccessible to students from outside of particular academic programs or streams.

IMMEDIATE APPLICATIONS:

- 1) Indexing of sustainability content courses on the Concordia website to provide a virtual roadmap for students wishing to enhance this aspect of their educational experience.
- 2) Generating a list of Professors and Lecturers by area of expertise, based on indexed Sustainability content courses, who are willing and available to offer guest lectures in pre-existing courses in order to contribute to the continued development of sustainability within the curriculum.
- 3) Inform the development and integration of participation in sustainability initiatives, most notably in pedagogy, into professorial assessments and generate institutional support for sustainability-oriented faculty members.
- 4) Provide a metric to balance the delivery of sustainability content across academic sectors, initially by developing or modifying courses in the Humanities and Science to increase sustainability content to the level delivered in the Social Sciences. Future developments can then aim to increase sustainability content equitably across all sectors.
- 5) Inform the development of additional academic programs, such as an undergraduate Major and a formalized graduate degree in sustainability through a combination of course development and increasing the accessibility of existing courses to students not enrolled in specific programs.



INTRODUCTION

Concordia University has a long tradition of implementing sustainability-oriented initiatives across its campuses. As defined by the World Commission on Environment and Development (1987), sustainability is the goal of meeting present needs without compromising the ability of future generations to do the same. Achieving this requires equal consideration of social, environmental, economic and practical factors in developmental planning. It is particularly important that universities promote sustainable initiatives as the basic mandate of academic institutions is to educate those individuals who will occupy key positions and determine the directions of societal changes in the near future (Orr 1991) and to ensure that students are exposed to innovative, interdisciplinary approaches towards addressing contemporary issues.

To emphasize the extent of ongoing sustainability initiatives at the University, in 2012 Concordia conducted its second Sustainability Tracking, Assessment and Ranking System ([STARS[®]](#)) assessment. Based on criteria established by the Association for the Advancement of Sustainability in Higher Education ([AASHE](#)), STARS[®] assigns a score to educational institutions based on their 1) Academic, 2) Engagement, 3) Operations and 4) Planning & Administration initiatives towards sustainability (AASHE 2013). Concordia University has thus far excelled in the latter three categories, with several concrete Sustainable initiatives at the institutional and facilities levels in addition to community education and resource programs. The academic coverage of sustainability, however, has received considerably less attention (scoring an “F” grade on the STARS[®] assessment) apart from the establishment of a Minor in Sustainability Studies offered through the Loyola College for Diversity and Sustainability.

In 2012, the Sustainability Action Fund (SAF), a student fee levy group that provides funding and resources to sustainability-oriented student projects, partnered with the [Concordia Academic Plan 2012-2016](#) (Objective 4.2: “Expand opportunities for students to exercise ethics, citizenship, critical engagement, and global awareness in their courses, research, and co-curricular activities”;) to create the Sustainability Curriculum Project. This is a three-year initiative that aims to quantify the extent of sustainability content currently offered in the curriculum of the Faculty of Arts and Science and is intended to provide direction and tools to facilitate the development of sustainability-oriented courses, programs and academic initiatives across the University. This report is the first major

contribution to the Sustainability Curriculum Project, providing a comprehensive picture of the current extent and availability of sustainability content in the curriculum by presenting a catalogue of existing sustainability content courses and identifying which topical aspects of sustainability receive coverage within and across courses. Most notably, access to this information will allow undergraduate students seeking to incorporate sustainability into their educational experiences to do so.

Several other academic institutions, including some Canadian comprehensive universities similar to Concordia (e.g. [Simon Fraser University](#)) have already catalogued their courses offering sustainability content. Using AASHE criteria, courses have been identified as either sustainability-related or sustainability-focused, depending on the amount of content devoted to the topic. This initiative extends beyond simply cataloguing sustainability content courses and assigning them to a single content category by evaluating and listing course coverage based on the four topical spheres of sustainability (Social: cultural and sociological aspects; Environmental: physical, chemical, biological, ecological aspects; Economic: management, development and use of resources, influenced by Social and Environmental constraints; and Practical: advocacy, political campaigning, implementation and governance). Additionally, each course was examined for accessibility (i.e., course level and number of prerequisites) in an attempt to quantify the availability of sustainability content to students across academic disciplines.

REPORT APPLICATIONS

In addition to providing a course selection tool for students, quantifying the extent of sustainability content currently offered will serve to identify academic areas that may benefit from increased representation, as well as highlight topics that may benefit from increased focus during the growth and expansion of additional programs such as an undergraduate Major or a graduate degree in sustainability. Determining the extent of sustainability content in the academic curriculum will also allow Concordia to fully participate in all aspects of the STARS[®] program. This report is intended to facilitate both the “greening” of the undergraduate curriculum and the development of innovative approaches to Sustainability education by:

- Providing a tool to inform the selection of courses by students based on:
 - Department or Academic Unit;
 - Academic sector (Humanities, Science, Social Sciences); and
 - Sphere of sustainability (Environmental, Economic, Social, Practical);
- Identifying areas for growth and improvement in the existing sustainability content by the various Academic Units;
- Highlighting the extent of interdisciplinary partnerships and collaborations related to sustainability within the Faculty of Arts and Science and, eventually, the University-at-large, as well as opportunities for additional interdisciplinary integration;
- Recognizing those Academic Units which currently rank relatively highly in their Sustainability content; and
- Providing information for self-reflection by Professors, Departments and Departmental Chairs in considering their satisfaction with individual and collective delivery of sustainability content to undergraduate students.

METHODS

1. Collection of course descriptions

During the summer of 2013, the Chairs of each of the 27 Academic Units (Departments, Colleges and Institutes) within the Faculty of Arts and Science were contacted and asked to provide detailed outlines for all courses offered during the 2012-2013 academic year. Two issues arose at this point:

- i. Not all Academic Units have a central repository of detailed course outlines. As a result, some of the participating Academic Units were not able to provide information on all of their courses.
- ii. Certain Academic Units (5 out of 27) did not provide any course information, and their courses were evaluated based exclusively on their brief blurbs from the [2012-2013 Undergraduate Course Calendar](#). Consequently, we conducted a paired comparison of sustainability content between blurbs and outlines for several courses with both sources of information available.

2. Identification of Sustainability content

Course outlines and blurbs were converted to text (.txt) files and analyzed with [Yoshikoder](#), a multilingual, freeware content analysis program developed by the Weatherhead Center for International Affairs at Harvard University. In keeping with the general methodology used by other academic institutions in assessing the sustainability content of their courses, the text files were searched for 121 keywords representing aspects of the different topical spheres of sustainability (Environmental: 36; Social: 38; Economic: 28; Practical: 19; Table 1).

Course descriptions which were found to contained at least one of these keywords were then individually examined by a single researcher in order to allow (i) the identification and elimination of false-positive results (for example, the word “conservation” appears in the phrase “conservation of energy” in Physics courses, which is not related to sustainability) and (ii) the assigning of the appropriate sustainability sphere in cases where an identified keyword may be ambiguous when considered out of context. For example, “ecological ethics” may refer to Environmental or Social aspects of sustainability under the present criteria, while “environmental protection” appears under both the Environmental and Economic sphere headings.

Topical Sphere of Sustainability	Table 1: Keywords
Environmental (36)	air pollution; antipollution; bio-centric; biodiversity; bio-regions; bio-safety; carbon offset; clean energy; climate change; conservation; deep ecology; eco-centric; ecological; ecological ethics; ecological footprint; ecological principle; ecology; ecosystem service evaluation; environmental; environmental ethics; environmental protection; environmental values; farming; fisheries; forestry; global warming; life cycle; organic agriculture; pollution; pollution control; protected areas; renewable; solar power; sustainability; sustainable; water.
Social (38)	Aboriginal traditional knowledge; anti-colonial; anti-oppression; commons; democratic; disaster relief; eco-politics; ecological ethics; environmental justice; environmental policies; environmental policy; ethics; food safety; food security; food sovereignty; global governance; holistic; holistic health; holistic health education; human population; human reproduction; humane education; indigenous rights; interconnected; interdependent; interdisciplinary; minority rights; native rights; NGO; NGOs; peace; population growth; public health; resource management; social action; stakeholder; urban agriculture; women's rights.
Economic (28)	alternative economics; carbon market; cooperatives; corporate social responsibility; de-growth; ecological economics; ecological principle; economic quality; ecosphere; ecosystem services; environmental impact management; environmental management; environmental protection; environmental regulations; environmental standards; green accounting; green marketing; local economy; locanomics; poverty; poverty alleviation; property protection; social accounting; socio-economic; sociological principle; sustainable development; time banks; triple bottom line.
Practical (19)	activism; anti-oppression; community engagement; community organizing; consulting; cooperation; experiential learning; facilitation; group facilitation; hands-on; internship; outreach; participatory; problem based learning; public participation; service learning; sustainable action; sustainable application; sustainable practice.

Other universities have followed very similar approaches, albeit with significantly fewer keywords. For example, a sustainability curriculum inventory was assembled at the [University of North Carolina – Chapel Hill](#), utilizing only eight keywords (global, environment, sustainability/sustainable, urbanization, biodiversity, footprint, renewable, conserve) that represent a small subset of those used in this initiative. Additionally, dividing keywords by sphere of sustainability provides a measure of the degree

of representation of sustainability topics in the curriculum which has not been included in other reports.

3. Comparison of brief versus detailed course descriptions

For any given course, the detailed outline contained a greater number of words than the corresponding brief blurb in the Undergraduate Calendar. Consequently, courses for which no full outline was available may have been under-represented in the subset of courses which feature some sustainability content due to smaller word counts and decreased frequencies of sustainability-related keywords. To estimate the significance of any effects of this potential sampling bias on the identification of courses offering some sustainability content, as well as to provide a justification for incorporating both forms of description in this course inventory, the keyword search was run on both Calendar blurbs and full outlines for all courses with both descriptions available in eight Academic Units. This sample comprised four Science and four Humanities Departments, with two Departments in each sector selected based on offering a relatively larger number of sustainability content courses and the remaining two offering a relatively small number. The number of keyword results were compared using linear correlations, which provides statistical and visual evidence for similarity (or a lack thereof) of keyword content between more- and less-detailed course descriptions.

4. Quantification of sustainability content

The amount of sustainability content in individual courses was scored in two ways:

- i. Courses were assigned a sustainability content score on an ordinal scale by a single researcher as follows:

- 0:** No sustainability content. This was the most common score, and any course description which had registered a keyword hit but received a content score of 0 was considered to be a false-positive and excluded from future analyses.
- 25:** Some sustainability content, covering only one sphere.
- 50:** Sustainability content covering more than one sphere OR extensively covering one particular sphere.
- 75:** sustainability content covering three spheres OR extensive coverage of two spheres

100: Sustainability content covering all four spheres OR extensive coverage of three spheres OR focus on practical applications in addition to extensive coverage of at least one other sphere.

This method provides clear scoring criteria that provide both a clear protocol to replicate the scoring process and some flexibility in scoring, whereby a course covering one or two spheres in great detail can receive a higher score than a course which briefly surveys more spheres.

- ii. Courses were designated as “sustainability-related” or “sustainability-focused” in keeping with AASHE and STARS terminology as follows:

Sustainability-related: content covers only one sphere and/or the course scored 50 or less.

Sustainability-focused: content covers two or more spheres in detail and/or the course scored 75 or greater.

5. Quantification of course accessibility

Courses were assigned an accessibility score based on the following criteria:

- 2:** No prerequisites. Course is fully accessible by undergraduates outside of the program or Department. Typical of 200-level courses.
- 1:** Some prerequisite(s), limited to 200-level courses. Course is potentially open to students from outside of the program or sector. Typical of 300-level courses.
- 0:** Prerequisites are of the 300-level. Course is inaccessible to students from outside of the Department. Typical of 400-level courses.

Some courses listed 300-level prerequisites as well as “or with permission of instructor”. In these cases, an accessibility score of “1” was assigned. Courses with a prerequisite of “or permission of the Department” were assigned a score of “0” due to the potential for increased bureaucratic obstacles in the *ad hoc* process of admission decisions.

6. Comparison of sustainability curriculum at Concordia with other comprehensive universities

- i. The names of each of the 15 Canadian comprehensive universities which appeared in the 2013 Maclean's magazine [OnCampus](#) university report were searched on Google along with the keyword "sustainability" (e.g. "Concordia University sustainability"). If this search term did not produce a relevant result for any university, the phrase "Sustain curriculum" was searched within the university website. These two search terms were sufficient to locate information on sustainability initiatives within each university, which were then scored on an ordinal scale by presence and prevalence of the following criteria:
 - 4: A detailed inventory of individual courses offering some sustainability content.
 - 3: A list of academic programs, Departments or other units that feature some sustainability content.
 - 2: Detailed information on campus-based green initiatives, resources and contact information.
 - 1: Highlighting sustainability-oriented research within certain Academic Units (e.g. forestry research).
- ii. None of the websites of the Canadian comprehensive universities hosted an inventory report on sustainability in the undergraduate curriculum such as the current document, even in the cases of universities which provide complete and indexed lists of individual courses featuring some sustainability content. Consequently, the current report and the research methods was informed by and compared to similar initiatives made available by American universities, which may be inappropriate for direct comparisons with Concordia due to differences in mission, size and academic scope.

Table 2. Comparison and ranking of sustainability content¹ on the websites of Canadian comprehensive universities as defined by [Maclean's 2013 University Ranking](#).

University	Sustainability on the web	Score
Simon Fraser	Fully indexed website with complete list of courses offering sustainability content	4
Victoria	Fully indexed website with complete list of courses offering sustainability content	4
Waterloo	Campus-based green initiatives	2
New Brunswick	Sustainability-related research	1
Guelph	Campus-based green initiatives	2
Carleton	Sustainability-related research; campus-based green initiatives; academic programs offering some sustainability content	3
Memorial	Sustainability office; sustainability-related research	2
York	Departments, faculties and academic programs offering some sustainability content	3
Regina	Campus-based green initiatives	2
Windsor	Campus-based green initiatives; sustainability office	2
Wilfred Laurier	Fully indexed website with complete list of courses offering sustainability content	4
Ryerson	Campus-based green initiatives; sustainability office	2
Concordia	Campus-based green initiatives; sustainability office; departments, faculties and academic programs offering some sustainability content	3
UQAM	Campus-based green initiatives	2
Brock	Campus-based green initiatives; sustainability-related research	2

RESULTS

1. Collection of course descriptions

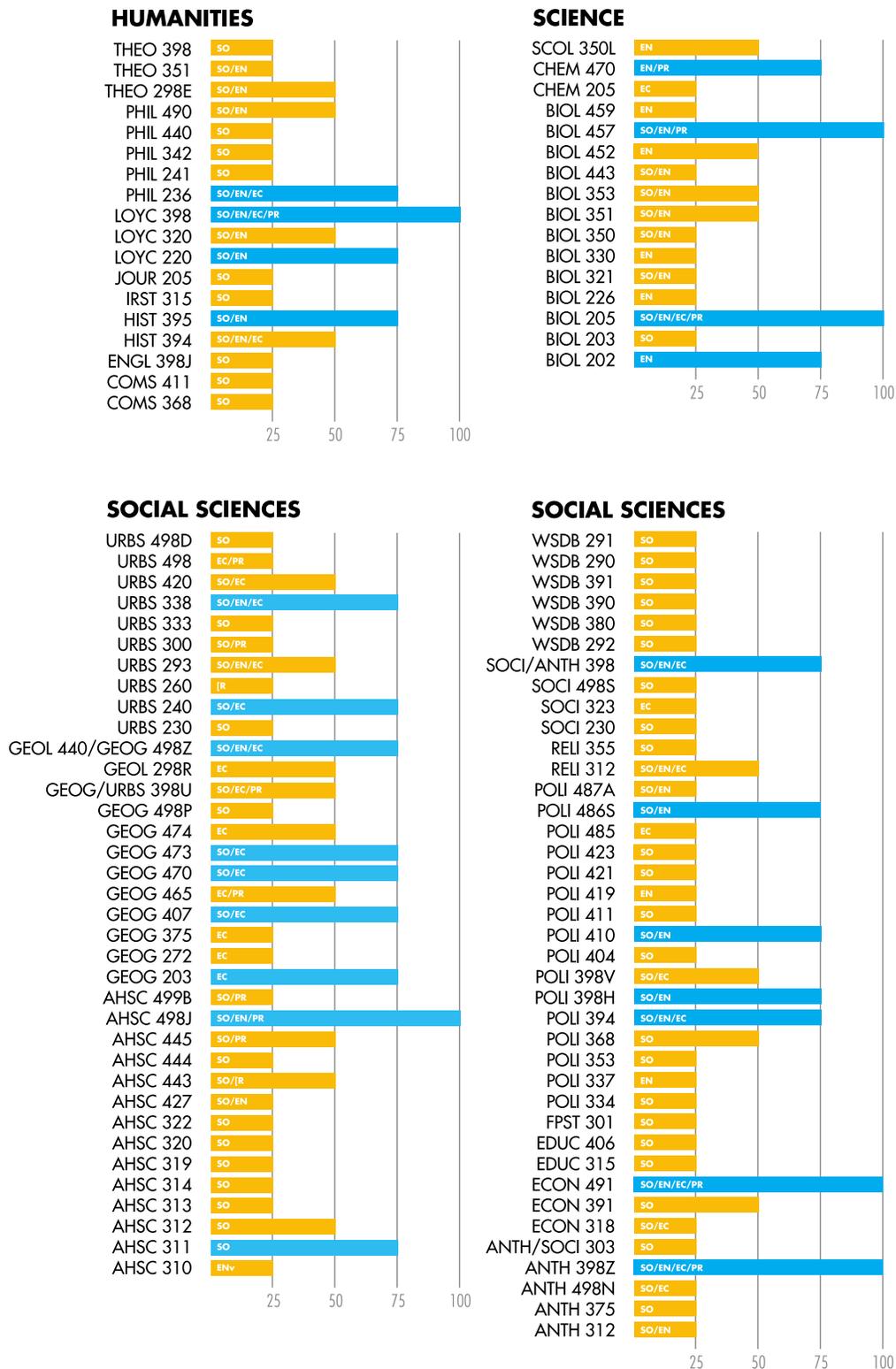
Five Academic Units (the Departments of History; Education; Religion; Communication Studies; and Journalism) were not able to provide full course outlines, and were therefore represented only via the brief blurbs in the 2012-2013 Course Calendar. Amongst those Academic Units that submitted course outlines, the samples consisted of only those courses that were actually offered during the 2012-2013 academic year, whereas the full lists of courses in the Course Calendar (i.e., including courses which were listed on the Calendar but not offered) were used for those Departments that did not participate.

A total of 1245 course descriptions (772 course outlines and 473 blurbs) from all 27 Academic Units within the Faculty of Arts and Science were examined for sustainability content (Appendix 1). Of these, 109 individual courses (8.8%) in 21 Academic Units (77.8%) were found to offer some sustainability content (Figure 1; Appendix 2). In the Social Sciences, sustainability content courses are over-represented relative to the Faculty-wide average (75 out of 469 courses: 15.9%; Table 2), while they are under-represented in the Science (16 out of 223 courses; 7.2%) and Humanities (18 out of 553 courses; 3.3%) courses included in this dataset. Considered collectively, the proportions of courses offering sustainability content in each of the three academic sectors differ significantly from the proportions predicted by the overall frequency of sustainability content courses (i.e., differing from 8.8%; $\chi^2_2 = 47.6, P < 0.0001$).

Table 2: Summary of Academic Units, courses included in the content analysis, and frequencies of courses offering sustainability content (SCC = Sustainability content course). ¹Numerals in parentheses are the numbers of Academic Units in each sector which offer at least one Sustainability content course.

Sector	# Academic Units	# Courses	# SCCs	% SCCs
Humanities	11 (7) ¹	553	18	3.3%
Science	7 (3) ¹	223	16	7.2%
Social Sciences	9 (9) ¹	469	75	15.9%

Figure 1. Complete list of sustainability content courses ($n = 109$) divided by sector ((a): Humanities; (b): Science; (c,d): Social Sciences), content score, and Sphere of coverage. Blue bars indicate sustainability-related courses (content score ≤ 50), green bars indicate sustainability-focused courses (content score > 50). So = Social; En = Environmental; Ec = Economic; Pr = Practical spheres of sustainability.



2. Identification of Sustainability content

By far the best-represented sphere of sustainability in the Faculty of Arts and Science curriculum is Social (87 courses or 79.8% of the 109 courses with sustainability content), followed by Environmental (42 courses or 38.5%), Economic (31 courses or 28.4%) and Practical (15 courses or 13.8%; Figure 2).

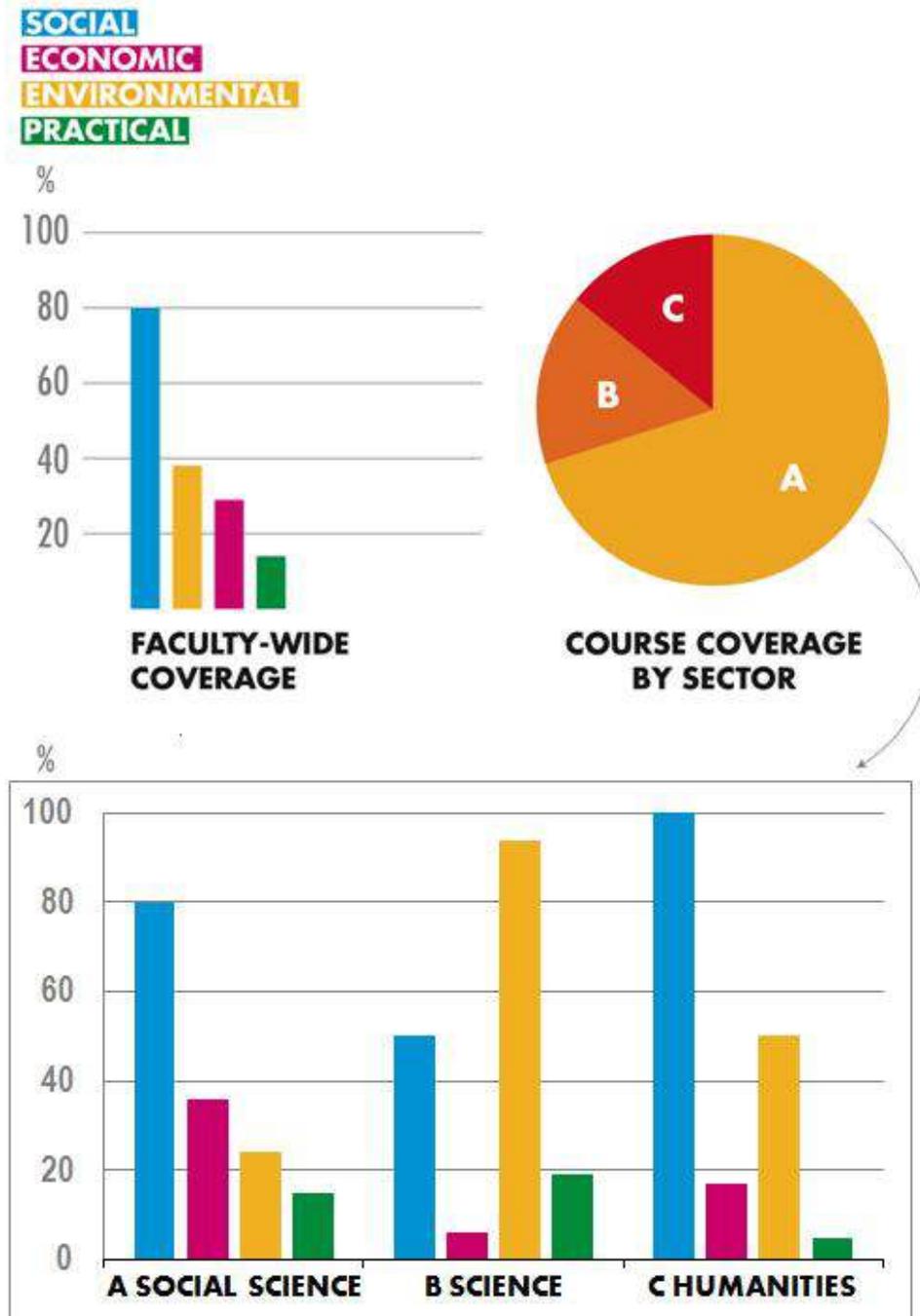


Figure 2: Faculty-wide percentages of courses ($n = 109$ total courses) offering some sustainability content by sphere of sustainability.

In addition, 62 (56.9%) out of the 109 sustainability content courses addressed one sphere, 47 (43.1%) two or more spheres, and 15 (13.8%) three or more spheres (Figure 3). Only four courses (~ 4%) addressed all four spheres (Figure 2) as defined in this study, with one course offered by each of the Departments of Biology; Sociology and Anthropology; Economics; and Loyola College for Diversity and Sustainability. A detailed summary of coverage of each topical sphere by course level and Academic Unit is presented in Appendix 3 (Table A3.1). The distribution of courses featuring sustainability content across sectors (Humanities, Science, Social Sciences) within the Faculty of Arts and Science is featured in Figure 3.

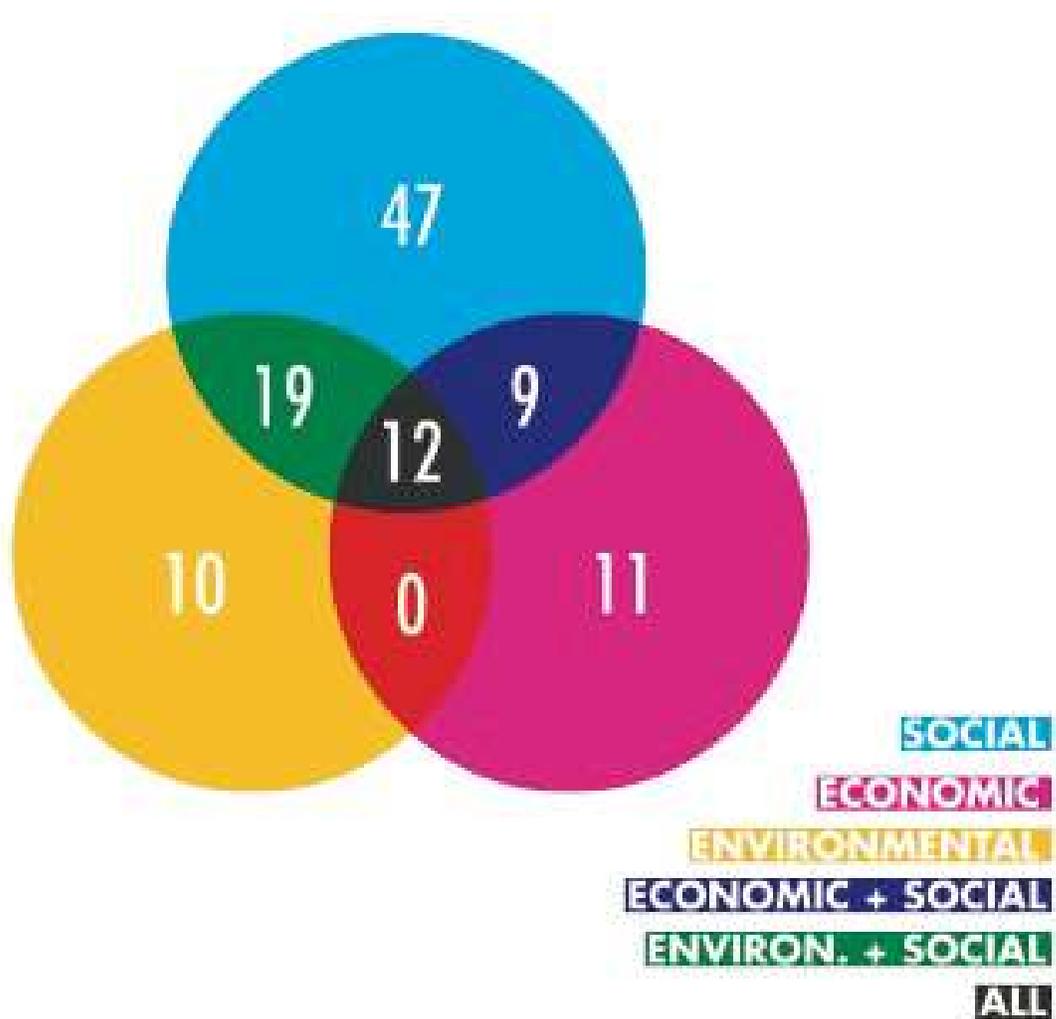


Figure 3. Venn diagram depicting the number of courses represented in each traditional sphere of sustainability (Environmental, Economic, Social), and those representing multiple spheres (*n* = 108 total courses). One course covering only Practical aspects is excluded from this figure.

Coverage of each topical sphere tends to be more extensive in both the Science and Social Sciences sectors, with ~94% of Science courses featuring some Environmental content, 50% some Social content, ~6% Economic and ~19% Practical aspects of sustainability (Figure 2). Within the Social Sciences, 80% of sustainability content courses cover the Social sphere, 36% Economic, 24% Environmental and 15% Practical (Figure 2). Within the Humanities sector, all sustainability content courses feature coverage of the Social sphere and half of those also include coverage of Environmental aspects, with 17% covering the Economic and 5% the Practical spheres (Figure 2). The distribution of sustainability content by sphere across the academic sectors generally reflects the topics covered in each sector. For example, the most focus is given to Environmental aspects in Science, while Economics receives the most coverage in the Social Sciences, which includes the eponymous Department. Similarly, it is unsurprising to find that several of the Academic Units which did not offer any sustainability content in this dataset, as sustainability and many course subjects are not necessarily complementary. Introductory language courses offered by the Department of Classics, Modern Languages and Linguistics and theoretical courses offered by the Department of Mathematics and Statistics, as two examples, do not offer sustainability content and attempting to do so may fall well outside their respective purviews.

3. Comparison of brief versus detailed course descriptions

The number of sustainability-related keywords in course outlines and blurbs were compared for 382 courses with both types of descriptions available in the following Departments: Biology; Physics; Psychology; Geography, Planning and Environment; Classics, Modern Languages and Linguistics; English; Political Science; and Sociology and Anthropology. Of these, 64 courses (16.8%) had a sustainability keyword appear in at least one type of description (i.e., 87.2% of the courses had zero keywords in either description), and within this subset there was a significant positive relationship between the number of keywords in the blurbs and the outlines (Pearson's $r_{64} = 0.325$, $P < 0.01$; Figure 4). In this comparison, the total number of keywords in each type of course description was used, whereas in the evaluation of sustainability content, the total numbers of keywords were reduced following the elimination of false-positive results by a single evaluator. The occurrence of more keywords in some course blurbs than in the corresponding outlines (Figure 4) based on total keyword hits is due to these false-positives in this comparison of descriptions. Furthermore, the results of the

keyword search were used to select descriptions of individual courses for subjective examination for Sustainability content, and not as the bases for the inclusion of courses in the content analyses or the content scores.

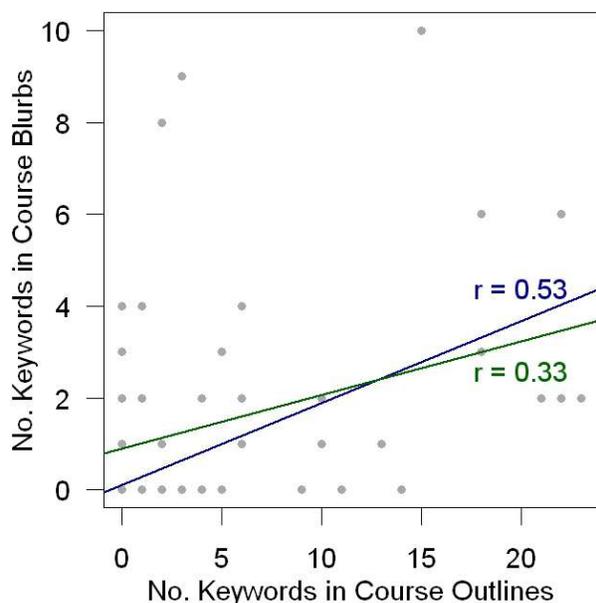


Figure 4. Comparison of the total number of sustainability-oriented keywords in detailed course outlines versus brief course blurbs for all courses in the comparison dataset (n = 382 courses, blue line) and for all courses with a keyword in either type of description (n = 64 courses, green line) as revealed through text analysis via Yoshikoder software.

Despite the positive relationship between total number of keywords in both types of description and the occurrence of more keywords in the blurbs than the outlines for certain courses, more course outlines contained keywords overall than did the blurbs (54 vs 32), and 20 courses had at least one keyword appear in both type of description. Consequently, we may have underrepresented the sustainability content of courses by as much as 50% for those four Departments that were only represented by the brief blurbs from the Academic Calendar. Individual Units offering no courses with sustainability content, however, were unlikely to be affected by bias arising from the use of brief course blurbs. For example, the courses offered by the Departments of Classics, Modern Languages and Linguistics; Physics; and Psychology are all represented by detailed course outlines, and neither type of course description contained sustainability keywords. The lower relative frequencies of sustainability keywords in brief course blurbs is especially likely to result in the exclusion of special or reserved courses at the 300- and 400-levels, as several Academic Units list some “398/498: Special/Advanced Topics in . . .” courses with uninformative descriptions, such as “Specific topics for these courses, and prerequisites relevant in each case, will be stated in the Undergraduate Class Schedule and Course Guide”.

4. Quantification of sustainability content

Out of the 109 courses with sustainability content, six courses scored “100” on the ordinal content scale described above. These courses are found in Loyola College for Diversity and Sustainability and the Departments of Biology; Economics; Sociology and Anthropology; and Applied Human Sciences. In addition, 18 courses scored “75”, 21 courses scored “50” and 64 courses scored “25” (Table 3). The number of courses that received a score of “25” closely matched the number of courses which only cover one topical sphere (64 versus 63) as predicted by the scoring methodology described above. The proportion of courses offering high levels of sustainability content tended to cluster at the upper and lower course levels, with 28.6% of 200-level sustainability content courses (6 out of 21 courses), 14.3% of 300-level courses (7 out of 49), and 28.3% of 400-level courses (11 out of 39) being sustainability-focused. In keeping with the STARS[®]-standard designations and the criteria developed during this initiative, 85 of these courses are sustainability-related and 24 are sustainability-focused.

Department		Total	100	75	50	25	0
Humanities	Classics, Modern Languages and Linguistics	126					126
	Communication Studies	73				2	71
	English	67		1		1	65
	Études françaises	24					24
	History	129		1	1		127
	Journalism	35				1	34
	Liberal Arts College	8					8
	Loyola College for Diversity and Sustainability	5	1	1	1		2
	Philosophy	46		1	1	3	41
	School of Canadian Irish Studies	15				1	14
	Theological Studies	26			1	2	23
Science	Biology	41	2	1	3	7	28
	Chemistry and Biochemistry	25		1		1	23
	Exercise Science	23					23
	Mathematics and Statistics	65					65
	Physics	9					9
	Psychology	55					55
	Science College	5			1		4
Social Sciences	Applied Human Sciences	40	1	1	3	9	26
	Economics	26	1		1	1	23
	Education	101			0	2	99
	Geography, Planning and Environment	45		7	6	9	23
	Political Science	60		4	2	10	44
	Religion	135			1	1	133
	School of Community and Public Affairs	6				1	5
	Simone de Beauvoir Institute	7				6	1
	Sociology and Anthropology	49	1	1		7	40
Total		1245	6	18	20	65	1136

Table 3. Departmental summary of courses included in the dataset and distribution of sustainability content. Scoring criteria: **100**- sustainability-focused, covering ≥ 3 topical spheres or emphasis on Practical applications in addition to coverage of one other sphere; **75**- sustainability-focused, covering ≥ 2 topical spheres; **50**- sustainability-related, covering ≥ 1 sphere extensively; **25**- sustainability-related, covering 1 Sphere; **0**- no sustainability content.

5. Quantification of course accessibility

Not surprisingly, the most accessible courses are offered at the introductory 200-level (Table 4). Courses offered at the 300-level tend to have one or more prerequisites and therefore received intermediate accessibility scores, while courses at the 400-level typically require several prerequisites and tend to be inaccessible to most students from different (non-stream) programs. One exception to this is a single course offered by the Department of Sociology and Anthropology, which lists “or Permission of Instructor” as a prerequisite. Detailed summaries of accessibility by Sustainability content score (Appendix 3, Table A3.2) and course level (Appendix 3, Table A3.3) are available for each Academic Unit.

Sustainability Content	Course Level		
	200	300	400
25	2	1	0
50	1.33	0.91	0
75	2	0.67	0
100	2	1	0.25

Table 4. Summary of mean course accessibility (2 = most accessible; 0 = least accessible) by course level and sustainability content score (100 = most content; 25 = least content) of the 109 sustainability courses.

6. Comparison of sustainability curriculum at Concordia with other comprehensive universities

Of the 15 comprehensive universities in Canada ranked by *Maclean's* magazine in 2013, only three (Simon Fraser, Victoria and Sir Wilfred Laurier Universities) have completed sustainability curriculum inventories similar to this document and made the results available online in the form of a course index within their Course Calendars. Concordia's website received a score of 3 along with York and Carleton (Table 5), while eight universities scored 2. One lone university received a score of 1, as that particular website featured the least sustainability-oriented content in terms of campus initiatives, resource availability, research and curriculum. Based on the criteria used to assign scores (information on the extent of sustainability initiatives readily available on the websites), including an index of courses with sustainability content would result in Concordia receiving a score of 4 and joining the upper echelon of comprehensive universities in terms of sustainability initiatives.

As to the extent of sustainability content in the curriculum, there is no data readily available from other universities for comparison to our results. While three other Canadian comprehensive universities have catalogued and indexed their sustainability content courses on their websites and in their online Course Calendars, these lists of courses are provided without any information on the overall percentages of courses with this content within individual Academic Units or Faculties. Consequently, it is not possible to assess whether the overall rate of sustainability coverage (8.8%) in courses offered by the Faculty of Arts and Science compares favourably with that of other institutions. This is the first course inventory of its kind to assign topical sphere designations to sustainability content courses, providing another potential tool to students seeking to tailor their own curricula by selecting courses based on topic of coverage.

DISCUSSION

Sustainability content and accessibility in the Faculty of Arts and Science

Approximately one-tenth (8.8%) of courses offered by the Faculty of Arts and Science feature some amount of sustainability content. It is not possible at present to compare these results across comprehensive universities in Canada as other institutions have not made their frequencies of sustainability content courses available, although some have already indexed those courses on their websites. Considering the distribution of sustainability content courses across the three academic sectors in the Faculty of Arts and Science, Social Sciences offer the most content proportionally, followed by Science and then Humanities. To a very large extent, this distribution does not imply that different sectors are better or worse at delivering sustainability content, and is instead a general reflection of the particular topics covered in the different sectors. For example, the Department of Economics is listed in Social Sciences, where the greatest coverage of Economic aspects of sustainability occurs (Figure 2). Certain Departments in Science, such as Physics; and Mathematics and Statistics, both offer traditional or “pure” subjects that may not be conducive or appropriate to the inclusion of sustainability content. Similarly, the many non-English language courses offered at Concordia occur in the Department of Classics, Modern Languages and Linguistics in the Humanities sector, and it is unlikely that an introductory language course would cover any aspect of sustainability.

Despite these intrinsic barriers to offering sustainability content in certain subject areas, those Academic Units which may be expected to offer this type of content (e.g. Biology; Economics; Loyola College for Diversity and Sustainability; Geography, Planning and Environment; etc.) currently appear to do so. However, continued attention to the inclusion of Sustainability aspects in the revision of existing course offerings and during the development of new courses and interdisciplinary collaborations is desirable. On this last note, although it was not a goal of the present initiative, a qualitative evaluation of the 1245 courses included in this inventory indicates that only a very small number of courses are cross-listed between Academic Units. Many of the existing cross-listed courses are, in fact, offered by different programs within an Academic Unit, for example code-sharing SOCI/ANTH courses offered by the Department of Sociology and Anthropology. Potential implications of this include: 1) duplication of subject matter (e.g. different introductory courses covering the same topic being offered concurrently) and 2) evidence of historic limitations on adopting certain

interdisciplinary approaches to appropriate course offerings. For example, courses covering certain aspects of ecology or environmental sciences may be offered independently by the Departments of Biology or Geography, Planning and Environment. These classifications may provide artificial barriers to students seeking to incorporate affected topics into their curricula, as courses offered outside of their core streams may be considered Elective or Optional based on their listings, instead of course content.

Higher-scoring sustainability content courses tend to be slightly clustered at the 200- and 400-levels. The main advantage to offering sustainability content at the 200-level include relatively high accessibility of the content to a wide range of students due to the introductory courses having fewer prerequisites, although some science courses which require CEGEP-level prerequisites deviate from this pattern. Introductory courses also tend to cover a wider range of topics with little depth of focus in any particular area. Advanced 400-level courses, by contrast, tend to offer much more detailed coverage of the subject matter, while being less accessible to students from other programs, Academic Units and sectors. An additional issue with the delivery of sustainability content at the upper levels is that the specific content of special courses (e.g. 298/398/498 course codes) is indiscernible from the brief blurbs in the Course Calendar. Students meeting the course prerequisites from outside of the specific academic stream may be particularly reticent to register or apply for admission to these high-content courses due to their pedagogical format (e.g. seminars versus lectures), class size and/or uncertainties about the particular subject covered.

Potential improvements to this Curriculum Inventory project

As described above, this initiative employed 117 sustainability-oriented keywords for digital text analyses of course descriptions to generate a short list of courses which were then manually evaluated for sustainability content. Similar initiatives have used as few as eight keywords. Despite the conscious effort to be as inclusive as possible in selecting potential keywords, the lexicon of sustainability-oriented keywords is ultimately subjective and soliciting suggestions from new collaborators and sources will almost certainly result in the expansion of the keyword list. As such, it is entirely possible that some existing courses which offer sustainability content were not included in this inventory as a result of their course descriptions employing different terminologies than were used in the keyword search. In order to rectify any such unintentional omissions, and to provide a mechanism

by which new courses can be included in this inventory, we suggest and recommend that all parties involved in teaching (Lecturers, Professors, Program Advisors, Department Chairs, etc.) review those courses offered by their respective Academic Units which have been identified as offering sustainability content for both suitability for inclusion and to identify any potential omissions. The criteria described in the Methods section are sufficient to inform *ad hoc* evaluations of sustainability content, including new keywords, via detailed course descriptions and will allow both omitted and newly developed courses to receive content scores and sphere assignments.

Potential improvements to the sustainability curriculum

First and foremost, increasing interdisciplinary teaching collaborations by cross-listing courses and recognizing or modifying existing non-stream courses as meeting course prerequisites will increase the accessibility of sustainability content courses to all interested undergraduates within the Faculty. In terms of course development, the Faculty at large may benefit from differentiating between sustainability-related and sustainability-focused courses. Maximizing the delivery of sustainability content to students may result from preferentially developing sustainability-related courses at the introductory (200) and intermediate (300) levels, with sustainability-focused courses cross-listed between disciplines at the intermediate (300) and advanced (400) levels. Such a course level/sustainability content dichotomy will allow sustainability coverage to expand and compliment the subject matter of relevant programs in the same fashion as core content, with lower-level courses briefly surveying a broad array of topics and upper-level courses exploring certain topical aspects in much greater depth. Increasing accessibility and improving the level of sustainability content at the 300 level may serve to facilitate access to the 400-level content courses.

Development of new programs of study (e.g. an undergraduate Major or graduate programs in sustainability) would benefit from studied consideration of this inventory. Most importantly, ensuring that students are exposed to the three traditional aspects of sustainability (Environment, Social and Economic), as well as Practical applications, should be a central aim of Concordia's sustainability curriculum development. To this end, increasing interdisciplinary collaborations via cross-listing courses may also result in an immediate increase in sustainability content courses available to interested students without the development of additional courses. In fact, increasing the accessibility,

by whatever mechanism, of existing sustainability content courses to students will prove doubly beneficial by also conserving course development resources should existing content become available to new academic-stream students.

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For more information on the Sustainable Curriculum Project or to request the Appendix for this report, please contact the Sustainability Action Fund at saf@concordia.ca

