UBC Sustainability: Assessing Student Perceptions and Knowledge Levels Across Faculties

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Abstract

There is much academic debate surrounding the myriad definitions of sustainability, and this debate is compounded by sometime competing perspectives inherent in a diversity of academic fields of inquiry. We used a two-part questionnaire to gauge whether student faculties predicted student perceptions of sustainability, as well as exploring participants' objective knowledge levels on sustainability. Without proving causation, our results show significantly different definitions of sustainability across faculties of Arts, Science and Business at University of British Columbia, while also illustrating a disproportionate representation of environmentally aspected definitions compared to the economic and social aspect in popular perception.

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In the context of this study, the concept of 'Sustainability' originated with the Bruntland Commission's definition of "Sustainable Development" as "meeting the needs of the present generation while not compromising the ability of future generations to meet their needs" (Brundtland, 1987).This definition is founded equally on the three sub-categories (Environmental, Economic, and Social sustainability) which have come to be known collectively as the "three pillars of sustainability" (Brundtland, 1987; Vallance, 2011).

In recent years, the University of British Columbia (UBC) has promoted a highly visible Sustainability platform, with ambitious waste reduction targets, infrastructural upgrades such as district heating, and an increasing proliferation of sustainability related courses and degree programs. However "Sustainability" is often viewed as an ambiguous term, only vaguely defined on its own and containing a multitude of complementary (and sometimes competing) definitions within its umbrella (Owens, 2003; Santillo, 2007; Vallance, 2011). As such, it is imperative for UBC to foster a comprehensive and evenly understood definition of the concept in order to create a culture of sustainability throughout campus. So long as there is a potential for competing perceptions of sustainability to hinder UBC's efforts to encourage people towards increasingly sustainable behaviours, the school will likely face challenges in achieving the targets of its platform.

We suspect that this issue is compounded by the diversity of academic backgrounds (and thus potential diversity of conceptual perspectives) at a university such as UBC. In order to help UBC more effectively communicate its sustainability platform across campus, it seems worthwhile to research which sustainability-related concepts and terms are used most prevalently

among UBC's student population, and in particular to try and determine whether or not a student's academic background has an effect on their perceptions of sustainability.

　　　To examine these questions we have developed a survey in which we hypothesize that academic exposure to concepts and ideas which prioritize one "pillar of sustainability" at the expense of the others might result in a student's faculty/ academic field of inquiry having a predictive quality regarding their conceptual definition of sustainability as a whole. We further question whether or not the prevalence of environmental sustainability terms in marketing and media might influence student perceptions of sustainability, and manipulate our study to include both recall and recognition based conditions. As suggested by Ryals and Cleary (2012)**,** we hypothesize that participants will tend to favour more salient environmental definitions under cognitively demanding recall based conditions, whereas responses under the less taxing recognition condition will more accurately reflect accrued academic exposure. In addition to this qualitative analysis of perceptions, we attempt to assess objective knowledge levels across faculties in the hopes of gaining insight to the efficacy of UBC's efforts to promote and educate its student population regarding key concepts of sustainability to date. As this section of our survey is exploratory, we made no predictions regarding the results.

　　　Numerous studies investigating sustainability knowledge in student populations have been conducted on previous occasions. One study in particular conducted at Ohio State University in conjunction with the University of Maryland produced a measure, the Assessment of Sustainability Knowledge survey (ASK: Zwickle, Koontz, Slagle, & Bruskotter, 2014), consisting of 28 items testing various facets of sustainability knowledge. The measure was rigorously tested by its authors during development and found to be predictive of knowledge concerning the "three pillars of sustainability" our study aims to investigate. We will use a modified version of this survey to explore objective sustainability knowledge levels amongst our participants.

Methods

　　　92 undergraduate students from the faculties of Arts, Science and the Sauder School of Business were sampled for this study. Of this sample population, 35 students were enrolled in the faculty of Arts, 27 in the faculty of Science and 29 in the Sauder School of Business. The gender of our participants was unevenly skewed towards a female majority (58 females to 31 males). One participant identified as non-gender binary and another preferred not to disclose this information. Participants' academic "years of study" were more evenly distributed: 20 first year students, 18 second year, 25 third year, 16 fourth year, and 8 students in a fifth year or above completed the questionnaire. Four participants preferred not to disclose this information. As the demographic information we measured did not affect the testing of the main hypotheses, participants who chose not to disclose such information were still included in the main experiment.

To test our first hypothesis participants were asked to complete a word association task. The aim of the task was to have participants provide the five words that they felt best reflected their understanding of the concept 'sustainability'. Our second hypothesis required the use of two methods to achieve this, of which each individual participant completed only one. The first method involved a word generation task (WG) wherein participants were produced five words ad lib (i.e. without prompt), and the second involved a word list task (WL) wherein five words were chosen from a predefined set of terms. This set of 87 terms provided was generated through a review of academic literature regarding definitions of sustainability, and the terms were equitably distributed among the categories of Environmental, Economic, and Social sustainability (Brown, Hanson, Liverman, & Merideth, 1987; Costanza & Patten, 1995; Vallance, Perkins, & Dixon, 2011; White, 2013).

The words participants produced in each condition were coded by three raters into three categories (each reflecting one of the "three pillars of sustainability") in order to evaluate any trends in participants' responses. The coded word frequencies collected under the WL condition were used to test our first hypothesis: whether a students' faculty causes significant trends in word frequencies towards a specific pillar of sustainability. The coded word frequencies under the WG condition were then compared to these results to test our second hypothesis, in which it was predicted that participants' reliance on their faculty of recall would have an impact on their responses.

The second section of the survey used a modified version of Ohio State University's ASK survey (Zwickle et al., 2014), in which we replaced any USA specific questions with questions rating participants' exposure to and familiarity with the concept of sustainability, as well as their motivation to participate in sustainability focused initiatives. The objective portion of the test consisted of 15 multiple-choice questions, and participants' responses were measured according to the number of correct answers.

In order to account for any confounds in the data due to the cueing (priming) of sustainability terms in either word production method or the ASK, we randomly assigned and counterbalanced the conditions and order in which participants completed the two sections of the study. Of the 92 surveys completed, 20 were under the WL condition, 21 under the counterbalanced WL condition, 23 under the WG condition, and 25 under the counterbalanced WG condition. The order in which tasks were completed was not found to have a significant impact on the results of the survey.

Over a 14-day sample period, participants completed surveys at either the Student Union Building, Sauder Cafe, or Ponderosa Commons. Our study was also hosted on qualtrics.com and circulated online via social media. In the second week of sampling, as an incentive to attract a greater number of participants, we received a $50 UBC Bookstore gift card by UBC SEEDS as a draw prize for participating in our survey. Unfortunately the anonymous nature of our survey and the timing of the donation meant that only participants who chose to provide their email addresses in the second week were eligible to receive the incentive.

Results

To address our hypothesis regarding the effect of cognitive recall/ recognition on responses, the coded responses of the WG condition were statistically analysed. Response percentages were calculated for the average frequency of each term type (environmental, economic & social) per faculty, see figure 1. Each faculty produced a greater number of environmental terms than either economic or social. To further examine this trend towards environmental terms, a chi square test was applied to analyse whether the specific words produced in each category were significantly different. Examination of words produced by term type (environmental, economic & social) revealed that the distributions were significantly different, $\eta^2(258, N=139) = 378$, $p < .001$, indicating significant difference in participants' responses between word types. When examining word distributions per type of word between faculties, both environmental and social words were found not to be significantly different, $\eta^2(62, N=53) = 42.0$, n.s., $\eta^2(62, N=55) = 80.7$, n.s. respectively, whilst economic words were significantly different, $\eta^2(26, N=21) = 38.1$, $p = .059$. These results indicate that of the words each faculty produced, there was significant overlap in the environmental and social terms, but not the economic terms. So the leaning towards an environmental perception seems to be defined in part by similar words for all faculties represented in our sample.

Our second hypothesis necessitated a second condition, the WL task, in order to manipulate the way in which words were being considered. For this condition, similar word percentages were calculated for comparison to WG percentages as demonstrated in figure 2. As the figure illustrates there was a shift away from environmental words in the WL condition, the percentage of environmental words decreased for all three faculties, whilst economic terms unanimously rose for all faculties. Social words rose in percentage for both arts and business students, but fell for science students. To examine whether these word percentages reflect actual changes in specific words produced, a chi-square test was again used to examine the word distributions. The test examined for differences in words produced between word production conditions by type and faculty and found multiple significant results, see table 1. Comparisons of the word production conditions were found to produce significantly different words for all word types in each faculty, except economic terms of business students and social terms of science students.

Our final measure, the ASK survey, was given to each participant to test objective sustainability knowledge. For each faculty's mean knowledge scores, see table 2. These results were then analysed comparing how factors such as demographics, experience of sustainability initiatives/events, number of classes taken, etc. affected mean knowledge scores across the faculties. Four one-way ANOVA tests, two t-tests and one simple linear regression were conducted, of which results are displayed in table 3.

For the main effect of faculty post hoc comparisons employing Tukey HSD confirmed that participants in the faculty of Science produced significantly higher mean scores than both

Arts ($p = .001$, $d = .949$) and Business participants ($p = .022$, $d = .759$). There were no significant differences between the mean scores of Arts and Business participants ($p = .650$, $d = .219$).

Tukey HSD comparisons for the main effects of participant familiarity with the concept of sustainability revealed that participants rating their familiarity as 'very familiar', had mean knowledge scores significantly higher than participants who had neutral familiarity ($p = .045$, $d = .988$) or were unfamiliar ($p = .016$, $d = 1.30$). Participants who reported familiarity had mean scores significantly higher than unfamiliar participants ($p = .097$, $d = .860$), but were not significantly different from very familiar participants ($p = .381$, $d = .527$).

Discussion

While our analysis shows a significant difference in responses according to faculty, we were unable to prove causation, and therefore our first hypothesis was not supported. Nevertheless, our experiment suggested some interesting factors regarding to how students at UBC tend to perceive the concept of 'sustainability'. The difference in results between our WG and WL conditions supports our second hypothesis, suggesting that a popular perception of environmental sustainability influences student responses irrespective of faculty. When participants were given a word association task that shifted cognitive demand from recall to that of recognition, the trends in word types chosen shifted too. Environmental, economic, and socially aspect responses occurred more proportionately in this second condition. We suggest that this recognition-based distribution is a truer reflection of participants' academic understandings of sustainability. This interpretation supports our second hypothesis while simultaneously helping to explain our inability to prove causation in the use of the WG condition to test our first hypothesis.

It is important to recognize a number of limitations inherent in the execution of our research. First, time constraints and a short sampling period limited the focus of our study only to 3 faculties and only had 92 participants. The fact that the data only represents only a minority portion of UBC's population calls into question the representational reliability of our results when extrapolated across UBC's entire student population. Second, although our tests indicated 'fair' inter-rater reliability, the coding of words into the three categories added a layer of subjectivity to our analysis that might have affected the validity of our results. Third, our inability to control the environments in which participants' completed the online versions of our survey may have allowed for the presence of unforeseen cues or confounds, which could have had an effect on participants' responses. Fourth, as a small number of participants failed to complete the assigned tasks or indicated confusion regarding the meaning of some of the survey's questions, there is some indication that a more carefully crafted survey would have produced more reliable results. Finally, the uneven application of incentives in our sampling via a $50 Gift Card may have introduced confounds regarding participants' motivations when completing the questionnaire, possibly effecting their effort and time spending on producing answers, and by extension the results of the study.

Despite these limitations, however, we think that the results of our study illustrate at the very least an uneven understanding of Sustainability across the three faculties (Arts, Business, Science). We recommend that UBC devote its considerable resources to undertake a larger scale version of the study in which the number of participants is maximized across all faculties and programs. Participants' disproportionate use of environmentally aspected definitions in the WG condition suggest that UBC should make an effort to increase the salience of economic and social concepts throughout its platform in order to promote a more holistic understanding of the "three pillars of sustainability" in its student population. The results of the ASK suggest that there is significant room for improvement in the objective sustainability related knowledge levels amongst undergraduate students, particularly in the faculty of Arts and Business. As both number of sustainability-related classes taken and experience with extracurricular sustainability initiatives were found as a significant predictors for participants' mean knowledge scores, we recommend that UBC consider including a mandatory sustainability curriculum in all undergraduate programs.

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Note:

   Due to delays in communications with the stakeholders, we were unable to incorporate
any feedback into the design of our study. As such we are unsure how much, if at all, our results
will be of use to them. We hope they will! Furthermore these same delays in communication
resulted in a delayed start to our sampling period. This likely played a role in preventing us from
achieving a more representative sample, and potentially had an effect on our results.
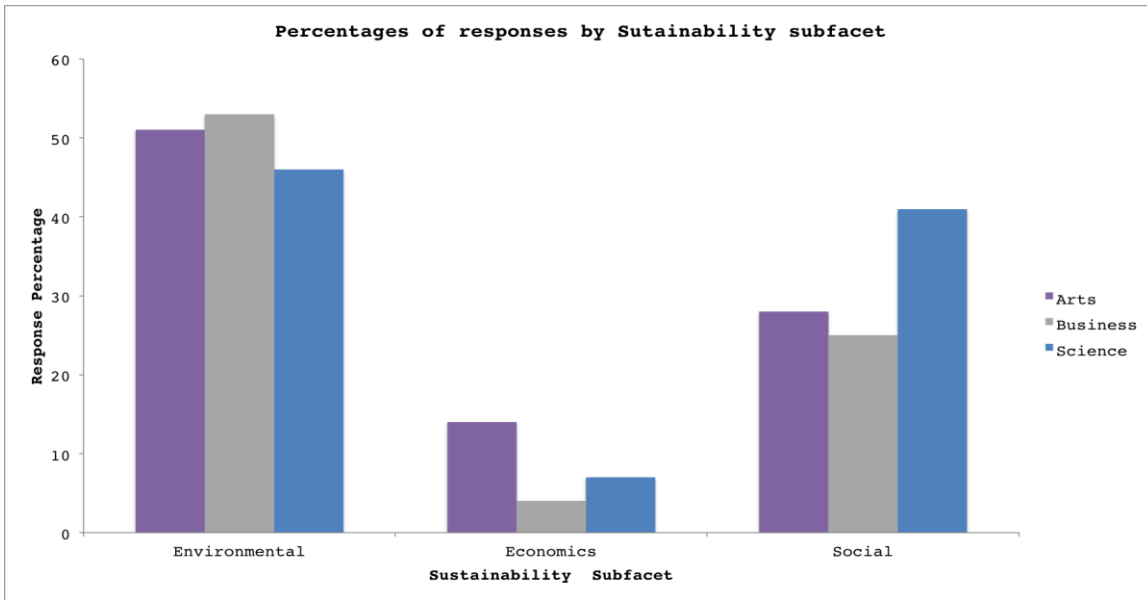
Appendix A

Figure 1. Percentage of responses by Sustainability subfacet per participants' faculty
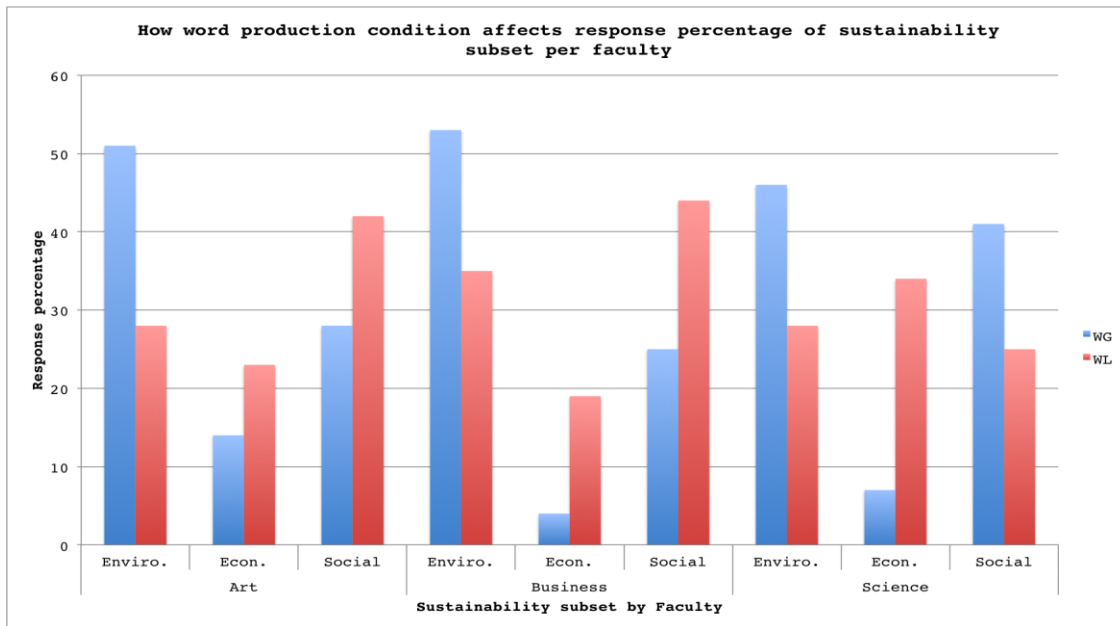

Figure 2. Comparison of response percentages for WG and WL tasks for each sustainability subfacet across each faculty

Appendix B

Table 1.
Chi square p-values comparing word distributions from both word production conditions

	Arts	Business	Science
Environmental	.017	< 0.01	.006
Economic	.032	.393	.033
Social	.038	.025	.343

Table 2.
Mean knowledge scores and standard deviations for each participant faculty

Faculty	Mean	SD
Arts	9.06	2.41
Business	9.57	2.22
Science	11.24	2.18

Table 3.
ASK survey ANOVA, Regression and t-test results

One-way ANOVAs				
Main effect	df	F	η	p
Faculty	(2,86)	6.88	.138	.002
Familiarity	(3,85)	4.21	.129	.008
Year of study	(5,83)	0.30	.180	.914
Easiest campus action to gain knowledge	(4,84)	0.67	.030	.614
UBC sustainability platform influence on:				
Elective choice	(3,85)	0.73	.025	.532
Attendance at UBC	(3,85)	1.13	.038	.339
Independent t-tests				
Variable	df	t	p	μ
Gender	(85)	0.67	.505	.154
Initiative/event experience	(87)	3.46	.001	.737
Simple linear regression				
Variable	R^2	B	$SE\ B$	β
No. Sustainability classes taken	.245	.529	.217	.254
	F	η	p	
	5.91	.064	.017	

Appendix C

Every version of our survey was prefaced with this consent form, in which participants were made aware of the study's format, scope, and anonymous nature, as well as being provided with the contact info for each group member and Dr. Zhao. Participants who agreed to provide consent proceeded to complete a randomized version of the questionnaire (each individual section is presented in the following appendices)
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Consent Form

Welcome to our study. We are running a survey on perceptions of sustainability as our group project for the PSYC 321-Environmental Psychology course. The survey will take about 5-10 minutes to complete. You will answer a series of questions on sustainability in the survey.   Your participation in this survey is entirely voluntary and anonymous. You can refuse to participate or withdraw from the survey at any time. Your identity will be kept strictly confidential. All documents will be identified only by code number and stored securely. You will not be identified by name in any reports of this study. Data in this survey will only be accessed by the students, the course instructor, and the teaching assistant. Results of this study will be used to write a research report. There are no risks associated with participating in this survey.   If you have any questions about the study, please contact us below.

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Name: Christopher Walker
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You can also contact the course instructor, Dr. Jiaying Zhao, assistant professor in the Department of Psychology and the Institute for Resources, Environment and Sustainability at UBC. Dr. Zhao can be reached at at 604-827-2203, or environmentalpsychology321@gmail.com.   If you consent to participate in this study, please proceed to the next section.

Thank you for choosing to participate in our study.The following series of questions will be used to assess overall engagement with and knowledge of sustainability concepts at UBC. Some questions are simple Yes/No answers and others are in a multiple-choice format, please choose the option that most reflects your opinion.

Appendix D

Word List Condition

Q1 Thank you for choosing to participate in our study.The following survey is being used to gather information on students' understandings/perceptions of the concept of 'Sustainability'. Your task is to examine the following list of term/phrases and select five that most reflect your understanding/perception of the concept 'Sustainability'

Environmental Legalization	Alternative Housing Models	Green Chemistry	Human Potential
Ecosystem Management	Organic Agriculture	Human Security	Supply-Chain Management
Public Transit	Anthropocentrism	Environmental Accounting	Planetary Limits
Full Employment	Green Belts	ISO 4000 Standards	Inter-generational Equity
Corporate Social Responsibility (CSR)	Eco-Strategies	Equitable Incomes	Hybrid Vehicles
Utilitarianism	Natural Capital	Transportation Infrastructure	Mutualism
Industrial Ecology	Social Capital	Health and Safety	Environmental Engineering
Global Warming	Efficient Allocation of Resources	Recycling	Social Justice
'Factor X'	Patterns of Production or Consumption	Eco-design	Protecting Wildlife habitats
Water Conservation	Conservation of Natural Resources	Globalization	Future Generations
Economic Resilience	Social Equity	Urban Design	'Zero-Growth Economy'
Human Scale	Ethical Investment	Food Security	Ecosystem capacity
Health & Well-being	Cost of Mitigation Vs. BSU (Business as Usual)	Degradation	Sustainable Consumption
Preservation of Natural Landscapes	Clean Production	Education	Urban Growth Boundaries
Social Responsibility	Ecosystem Recovery	'Livable' Cities	Purification

Zero-Waste	Energy Efficiency	Integrated Pollution Prevention and Control (IPPC)	Socio-cultural traditions
Healthy Communities	Community Organization	Social Panels	Preservation of Agricultural Land
Reduction or Elimination of CO2 Emissions	Biodiversity	Bio-centrism	'Polluter Pays' Principle
Limits to Population Growth	Product Innovations	Utopian Ideal	Local and global connections/flows
Distribution of Wealth	Species Extinction	Development	Reduced Demand
'Maximum Sustainable Yield'	Renewable Energy	'Green-washing'	Lifestyle Sacrifices
Ecosystem Services	Urban Agriculture	Reduction of Automobile use	

Word Generation Condition Question

Q1 Thank you for choosing to participate in our study.Your task is to write the first 5 terms/phrases that come to mind when you consider this concept. Please write your responses in the following space.

Appendix E

Sustainability familiarity questions:

Q2a How would you rate your level of familiarity concerning 'Sustainability' ?
- Very Unfamiliar
- Unfamiliar
- Neither Familiar or Unfamiliar
- Familiar
- Very Familiar

Q2b Have you ever taken a UBC course that covered 'Sustainability' topics?
- Yes
- No

Q2c If so, how many?

Appendix F

Participant engagement questions

Q3a Do you have previous experience participating in sustainability initiatives, events, or programs?
- ❍ Yes
- ❍ No

Q3ai If no, would you like to participate in such activities in the future?
- ❍ Yes
- ❍ No

Q3b Which of the following is the most accessible way for you to engage in sustainability education and action on campus?
- ❍ Sustainability/environmentally orientated classes
- ❍ Extra-curricular organizations/clubs
- ❍ Volunteer work
- ❍ Other _____
- ❍ No opinion

Q3c To what extent would a sustainability component influence your choice of electives in course selection?
- ❍ Highly deterring
- ❍ Somewhat deterring
- ❍ No effect
- ❍ Somewhat influencing
- ❍ Highly influencing

Q3d Did the university's commitment or reputation in sustainability influence your decision to attend UBC?
- ❍ Highly deterring
- ❍ Somewhat deterring
- ❍ No effect
- ❍ Somewhat influencing
- ❍ Highly influencing

Appendix G

ASK survey questions

Q2d What is the most common cause of pollution of streams and rivers?
- ❍ Dumping of garbage by cities
- ❍ Surface water running off yards, city streets, paved lots and farm fields
- ❍ Litter near streams and rivers
- ❍ Waste dumped by factories
- ❍ Don't Know

Q2e Ozone forms a protective layer in the earth's upper atmosphere. What does ozone protect us from?
- ❍ Acid rain
- ❍ Climate change
- ❍ Sudden changes in temperature
- ❍ Harmful UV rays
- ❍ Don't know

Q2f What is the primary benefit of wetlands?
- ❍ Promote flooding
- ❍ Clean the water before it enters lakes, streams, rivers or oceans
- ❍ Keep the number of undesirable plants and animals low
- ❍ Provide good sites for landfills
- ❍ Don't know

Q2g Which of the following is an example of sustainable forest management?
- ❍ Setting aside forests to be off-limits to the public
- ❍ Never harvesting more than what the forest produces in new growth
- ❍ Producing lumber for nearby communities to build affordable housing
- ❍ Putting the local communities in charge of forest resources
- ❍ Don't know

Q2h Which of the following is the most commonly used definition of sustainable development?
- ❍ Creating a government welfare system that ensures universal access to education, health care and social services
- ❍ Meeting the needs of the present without compromising the ability of future generations to meet their own needs
- ❍ Setting aside resources for preservation, never to be used
- ❍ Building a neighborhood that is both socio-demographically and economically diverse
- ❍ Don't know

Q2i Higher levels of education generally lead to [. . .]

○ Lower levels of voter turnout
○ Greater annual earnings
○ Larger family size
○ Higher self-esteem
○ Don't know

Q2j Which of the following populations has the highest rate of growth?
○ North America
○ Europe
○ China
○ Africa
○ Don't know

Q2k Which of the following is a leading cause of the depletion of fish stocks in the Atlantic Ocean?
○ Fishermen seeking to maximize their catch
○ Reduced fish fertility due to genetic hybridization
○ Ocean pollution
○ Global climate change
○ Don't know

Q2l Which of the following is the most commonly used definition of economic sustainability?
○ Maximizing the share price of a company's stock
○ Long-term profitability
○ When costs equal revenue
○ Continually expanding market share
○ Don't know

Q2m What are the potential effects of global climate change?
○ Loss of habitats
○ Less severe weather
○ Loss of ozone layer
○ Decrease in sea level
○ Don't know

Q2n The most significant driver in the loss of species and ecosystems around the world is [...]
○ Over-hunting/over-harvesting
○ Conversion of natural spaces into human developments (farmland, cities, etc.)
○ Acid rain
○ Breeding of animals in zoos
○ Don't know

Q2o Which of the following statements about water is true?
- ○ Globally, water for personal use such as washing dishes, doing laundry, and bathing is the major user of water resources.
- ○ Globally, freshwater reserves (aquifers) are used faster than they are replenished.
- ○ Floods and severe weather will increase the availability of clean drinking water.
- ○ Because water is a free and abundant resource, it is not a major concern for most countries.
- ○ Don't know

Q2p Imagine that we had to pay for all the costs associated with the goods we use every day. What would go into calculating the true costs of a product?
- ○ The cost of raw materials to make the product
- ○ The cost of environmental damage caused by production
- ○ The cost of health care for employees who manufacture the product
- ○ All of the above
- ○ Don't know

Q2q Workers around the world face a variety of social injustices, including low wages, poor working conditions, and lack of access to education. To help improve conditions for these workers you can [...]
- ○ Support corporations that do not allow workers to join labour unions
- ○ Buy the newest products to keep factories around the world open
- ○ Purchase products from companies that conduct business in a socially responsible manner
- ○ Support large corporations because they generally have more money to pay their workers
- ○ Don't know

Q2r Of the following, which would be considered living in the most environmentally sustainable way?
- ○ Recycling all recyclable packaging
- ○ Reducing consumption of all products
- ○ Buying products labeled "Eco" or "green"
- ○ Buying the newest products available
- ○ Don't know

Appendix H

Demographic questions

Q4a What is your gender?
- ❍ Female
- ❍ Male
- ❍ Other
- ❍ Prefer not to say

Q4b What is your current year of study?
- ❍ 1st year
- ❍ 2nd year
- ❍ 3rd year
- ❍ 4th year
- ❍ 5th year or above
- ❍ Prefer not to say

Q4c Which faculty do you currently belong to?
- ❍ Faculty of Arts
- ❍ Sauder School of Business
- ❍ Faculty of Science

Q4d What is your major program?