Transforming Sustainability Education at UBC:
Desired Student Attributes and Pathways for Implementation

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PREFACE

The need for sustainability knowledge, including an understanding of how to apply **sustainability concepts, skills, and values** is increasingly acknowledged within Canada and across the globe[1]. Educational institutions have a responsibility to respond to this need and to equip their students with the competencies and capacities that enable them to effectively contribute to the co-creation of a sustainable future. Universities, in particular, must strive to educate and graduate students who are prepared to tackle the challenges and tough tradeoffs facing our global society today. We need graduates who are motivated by a personal value system that inspires just and mindful action and who can actively participate as innovate members of the workforce and contribute to the emerging green economy. For example, skilled individuals are needed who can prepare and position Canada for an economy independent of carbon-based energy sources, or who have perspectives enabling them to contribute to decisions respecting global justice.

The University of British Columbia has a long and rich history of sustainability teaching and learning. This legacy is exemplified by the diverse array of sustainability-related and sustainability-focused courses currently offered by virtually every faculty across campus and the rich scope of co-curricular options[2]. **Sustainability** and **student learning** are also key commitments of UBC's Place and Promise plan, with UBC's Sustainability Academic Strategy (SAS)[3] expressing the goal that every student at UBC, regardless of their degree program, should have the option to study sustainability.

This living document builds on UBC's foundation of existing curricular and co-curricular options by providing a framework aimed at orienting and connecting disparate sustainability courses and other learning modes. This approach is intended to support discourse leading to the creation of cohesive and progressive sustainability learning experiences for our undergraduate students.

The framework is predicated on the belief that **outstanding sustainability teaching and learning** starts with the goal of producing graduates who have the knowledge, skills and motivation to contribute to crucial elements of society. Graduates must be prepared to understand uncertainty, and be skilled in working responsively, flexibly and adaptively to achieve significant shifts towards a sustainable world. **PART I** of this document defines four dominant knowledge categories or **"**attributes" which a student should acquire to gain proficiency in sustainability at UBC. These attributes are intended to guide the development of program level learning outcomes, which in turn can be used to develop course level learning outcomes[4]. **PART II** of the document provides examples of how different students might study sustainability at UBC and provides steps intended to help the curriculum designer who is tasked with creating curricula that will support sustainability learning at the undergraduate level.

[1] For example: valuing of nature and all people is fundamental to Aboriginal land-claims; long-term and indirect impacts are fundamental sustainability concepts that inform both government and private sector policies; and processes such as life-cycle-assessments and value-chain analysis inform sustainability-oriented decisions.
[2] See www.sustain.ubc.ca/teaching-learning/courses for UBC's listing of undergraduate and graduate sustainability courses.
[3] SAS is a mid-level plan of UBC's Place and Promise; see: www.sas.ubc.ca
[4] Learning outcomes are broad goals that that describe what the learners are supposed to know or be able to do.

PART I: SUSTAINABILITY LEARNING & STUDENT ATTRIBUTES

Sustainability Learning

At the core of sustainability learning are knowledge, skills and values that lead to discourse on how to foster the mutual well-being of people and nature, and such learning requires an understanding and appreciation of **sustainability concepts, processes and values**.

Sustainability learning involves knowing concrete **concepts** which are specific to contemporary sustainability concerns within a given body of knowledge. Such concepts necessarily vary according to issue, discipline, and context. For example: concepts may relate to the history of sustainability and the differences between various sustainability frameworks and world-views, they may relate to the science of climate change or the science of oceans or forests or food webs, or they may relate to social or economic resource inventories and/or resource allocation techniques. This cognitive learning should challenge students to move from remembering and understanding sustainability content, towards evaluating and applying concepts.

Understanding sustainability **processes**, or procedural knowledge related to sustainability, can similarly be context specific, such as learning to apply skills and tools. For example learning how to: conduct a spatial analysis to benchmark changes in biota across time, asset-based community development for cities, value-chain mapping within business, or life-cycle assessments applied to infrastructure. Sustainability processes can also include skills such as learning how to be an effective change agent, a competency that cuts across issues and disciplines. This cognitive learning will start with an ability to describe the fundamental mechanics or steps in the process or procedure and, as the student gains expertise, will enable the application of the knowledge within a variety of unique contexts and challenging situations.

Lastly, sustainability learning also necessitates the examination of personal **values** related to people and place. This requires an exploration of personal attitudes and beliefs relating to equity, justice, technology, and nature, applied within a variety of social contexts, including self, community, others, and ethnicity. Students grounded in sustainability knowledge thus need to participate in course-based activities that explicitly attend to affective learning and the personal development of sustainability-oriented values, attitudes, and beliefs.

Student Attributes

We propose that students graduating with a sustainability background from UBC should have a firm grounding in, and be able to demonstrate, four key attributes. We recognize that a range of innovative pedagogies is critically important to ensure best practices in teaching and learning and we strongly encourage program developers to explore these options in their curriculum development.

For each attribute that follows, we provide:
1. An explanation of the attribute concept;
2. An explanation of how the attribute relates to teaching and learning;
3. A key points summary; and
4. Example learning outcomes derived from the attribute.

ATTRIBUTE 1: The Graduate Demonstrates Holistic Systems Thinking

Holistic system thinking is the means and methods to see, articulate and qualitatively and/or quantitatively measure how human and natural systems work and interact. Fundamental to this way of thinking is **a personal belief/value system** that sustainability depends on, and aspires to, a purposeful, equitable and harmonious integration of human and natural systems. Holistic systems thinking also recognizes that belief/ value systems are continually explored through ongoing and dynamic conversation and experiences. Holistic system thinking also requires a capacity for **synthesis**; the means to propose solutions to complex problems that must be negotiated if we are to achieve a more sustainable world.

Some may recognize holistic thinking by other names: ecological thinking, synergistic thinking or 'joined-up' thinking.

Teaching and learning from an ecological thinking *perspective aspires to be alert to parts and wholes and the relationships between and among them. It is also inclusive and responsive to people and place and reflective and self-critical about cause and effect. While systems-thinking is necessary to holistic thinking, it is also not sufficient as systems-thinking absent of ethical intent will not necessarily achieve sustainability*.

KEY POINTS SUMMARY:

Holistic systems thinking includes:

- An ethical position that aspires to harmonious integration of human & natural systems
- A systemic methodology to see, articulate and measure how human and natural systems 'work' and interact
- A means to solve problems and generate new ideas that make the world a more sustainable place

Holistic systems thinking aspires to learning that is:

- Alert to parts and wholes and the many relationships and interactions between and among them
- Responsive to local conditions and self-critical and reflective

EXAMPLE STUDENTS LEARNING OUTCOMES

- demonstrate a capacity to appreciate that all actions have consequences within, between and among systems
- comprehend systemic limits such as carrying capacity and the ways humans can and do impact ecological systems
- demonstrate the ability to integrate knowledge of social and ecological systems to predict, assess, and analyze the effects of human activities

ATTRIBUTE 2: The Graduate Demonstrates Sustainability Knowledge

Historically universities have been responsible for ensuring students obtain comprehensive knowledge and literacy within their area of study. In addition, sustainability fluency requires the student to gain proficiency in the history and underlying ideas and principles of sustainability, and in the evaluation of competing sustainability models and paradigms. For example students should be able to understand and evaluate frameworks such as triple bottom line, and various interpretations of three or four component sustainability models. It is expected that the student's personal definition of sustainability would evolve dynamically over the course of their education.

Teaching and learning of sustainability knowledge *depends on the student's area of study and involves knowing concepts specific to contemporary sustainability concerns. Sustainability concepts necessarily vary according to issue, discipline, and context. For example, sustainability knowledge may be expressed as an understanding of the chemistry of climate change, or as knowledge of the significance of nature in 19th century American prose on sustainability paradigms. It may be expressed as a demonstrated understanding of other contemporary issues such as beetle-killed forests, dwindling fish stocks, inter-cultural justice, asset-based community development, or the impacts of our dependence on fossil fuels for energy.*

KEY POINTS SUMMARY:

Sustainability knowledge includes a comprehensive understanding of:

- One's particular area of study
- Contemporary sustainability issues
- The history of the underlying ideas and principles of sustainability
- Sustainability models and paradigms
- A personally constructed, and dynamic, definition of sustainability

EXAMPLE STUDENTS LEARNING OUTCOMES

- understand the underlying ideas and principles of sustainability and be familiar with the diverse array of sustainability models and paradigms
- understand contemporary sustainability issues such as climate change, resource depletion and biodiversity loss as well as the complexity of proposed solutions
- understand the history of land use and the changing relationship between humans and nature over time

ATTRIBUTE 3: The Graduate is Aware of and Integrates Across Intellectual Constructs

In order to gain knowledge of self, others, and place, it is important for students to be aware of the ways in which their context informs (or prejudges) their personal perspectives and how these influence the integration of new information. Facilitating students' awareness of their own construing patterns and processes is an important part of learning.

Sustainability learning asks students to confront situations requiring an interpretation of reality that is typically beyond the boundaries of their personal knowledge constructs. For example, how do those schooled in the determinism of science grapple with personal belief systems? Or, how do we reconcile over-consumptive behavior if we are educated to believe that humans are rational? These types of questions must be negotiated if we are to achieve a more sustainable world.

Teaching and learning sustainability requires *students to think and act in new ways by* ***integrating across disciplines*** *to articulate a shared vision and solve complex problems. To ensure respectful interactions with others, students will also need to be aware of, and understand, their own and others' ecologies of knowledge as these are used to interpret experiences and envision new possibilities. Collaboration on complex sustainability issues depends on an awareness of, and respect for, different disciplinary values, perspectives and knowledge.*

KEY POINTS SUMMARY:

Connecting across intellectual constructs includes:

- An awareness of one's personal construction of knowledge
- Engagement in active listening and respectful interactions to work towards a common goal
- Participating in meaningful dialog and consensus building across disciplines

Connecting across intellectual constructs aspires to learning that is:

- Reflective of self and one's perspective, values, and knowledge
- Respectful of others and their perspectives, values, and knowledge
- Integrative and collaborative across disciplinary and personal constructs

EXAMPLE STUDENTS LEARNING OUTCOMES

- appreciate that sustainability demands participation from all disciplines and contributions from society
- empathize with intercultural perspectives and recognize their value to illuminate environmental and social issues
- demonstrate empathy for others and the ability to weigh multiple perspectives

ATTRIBUTE 4: The Graduate Acts to Create Positive Change

To be an effective and successful graduate a student must be able to engage others and implement positive change. The integration and application of holistic thinking, core sustainability knowledge, and the ability to connect across intellectual constructs must be intertwined with a personal value system that inspires **action.**

Critical outcomes of a sustainability education are the acknowledgement of **personal responsibility** and the recognition of an individual's capacity to create change. Students should also understand relevant theories of societal and institutional change so they can make informed decisions on when, and where, to direct their energy and actions. As a change agent, the graduate also appreciates that collaboration and engagement with communities leads to enriched creative problem solving, and contributes to the ongoing development of leadership skills.

Teaching and learning from a change agent perspective *requires students to be competent in active listening, conflict resolution and mediation. They should also have the ability to effectively communicate, involve and inspire others, and adapt to the changing needs of both individuals and society as a whole.*

KEY POINTS SUMMARY:

To act for positive change a student must be:

- Motivated, inspired and equipped to act on their personal beliefs
- Open to critical evaluation of their personal beliefs
- Ethical, curious, committed, competent, empathetic, passionate, persuasive

Graduates can:

- Engage in self-assessment, self-reflection, and analysis
- Communicate effectively both orally and in writing
- Work collaboratively with others in teams to creatively solve problems
- Mediate and resolve conflicts
- Involve others, inspire and excite participants, engender support and commitment
- Adjust to changing needs of both individuals and society as a whole

EXAMPLE STUDENTS LEARNING OUTCOMES

- demonstrate active listening and an ability to participate actively in dialog
- advocate for positive changes through collaboration, mediation and consensus building strategies
- apply skills and knowledge in service to one's community

STUDENT SUSTAINABILITY ATTRIBUTES

Holistic Systems Thinking	Sustainability Knowledge	Awareness & Integration	Acting for Positive Change
Sustainability depends on, and aspires to, a purposeful, equitable and harmonious integration of human and natural systems. Holistic, ecological or synergistic thinking provides means and methods to see, articulate and qualitatively and quantitatively measure how human and natural systems work and interact. Holistic systems thinking also requires a capacity for synthesis and for negotiating solutions to complex problems.	Sustainability depends on comprehensive knowledge within one's area of study. In addition, sustainability knowledge requires students to gain proficiency in the underlying ideas and principles of sustainability, and in the evaluation of different sustainability models and paradigms. Sustainability knowledge also requires students to understand contemporary sustainability issues, particularly those which relate to their own area of study.	Sustainability requires students to be aware of their own constructing patterns and processes: how their context informs their personal perspectives and their integration of new information. Sustainability also requires students to think and act in new ways to solve complex, integrative problems through collaboration between disciplines. Collaboration demands an awareness of, and respect for, different disciplinary values, perspectives and knowledge.	A sustainability graduate has a personal value system that inspires action and recognizes and embraces the individual's capacity to create change. A sustainability graduate is committed to acting on personal beliefs but is flexible and open to critical assessment and modification of those beliefs through self-evaluation. They also appreciate that collaborative and active engagement with communities leads to enriched creative problem solving, as well as and the ongoing development of change agent skills.
Example Learning Outcomes:	**Example Learning Outcomes:**	**Example Learning Outcomes:**	**Example Learning Outcomes:**
1. Demonstrate a capacity to appreciate that all actions have consequences within, between and among systems	1. Demonstrate an ability to critically evaluate competing sustainability models and paradigms	1. Appreciate that sustainability demands participation from all disciplines and contributions from society	1. Demonstrate skills and strategies to enter into dialog and create persuasive arguments relating to sustainability
2. Comprehend systemic limits and the ways humans can and do impact ecological systems	2. Understand the complexity of land use and the changing relationship between humans and nature over time	2. Empathize with intercultural perspectives and recognize their value to illuminate environmental and social issues	2. Advocate for positive change through collaboration, mediation and consensus building strategies
3. Demonstrate the ability to integrate knowledge of social and ecological systems to assess effects of human activities	3. Understand contemporary sustainability issues such as climate change, and resource depletion as well as proposed solutions	3. Demonstrate empathy for others and be able to weigh multiple perspectives	3. Apply skills and knowledge in service to one's community

PART II: SUSTAINABILITY LEARNING PATHWAYS

The UBC Sustainability Academic Strategy pledges that any student regardless of their degree program will have access to an education in sustainability via a learning "pathway". These **Sustainability Learning Pathways** will assist undergraduate students in navigating the range of sustainability curricula offered by UBC. We acknowledge that co-curricular activities can be a key component of learning, but they are not explicitly included in the pathway model as currently there is no mechanism to accredit these activities.

A Sustainability Learning Pathway is any combination of curricular experiences that together equip the undergraduate student with a firm grounding in the four sustainability attributes. **Sustainability Learning Pathways are flexible in structure**. They can take the form of a major, minor or concentration and result in a formal transcript designation, or they can be informal such as a student-built pathway designed with the guidance of a faculty advisor which does not result in a transcript designation.

To ensure successful pathways, we ascribe to a **scholarly approach to teaching and learning**. As an approach, Sustainability Learning Pathways:

1. Demand outstanding teaching and learning experiences through a vertically and horizontally integrated program of study that evolves from scholarly approaches to teaching.
2. Enable students to construct their knowledge such that they achieve the program's broadly articulated learning goals.
3. Motivate and empower students to self-direct, reflect upon, critically evaluate, and communicate their learning, both individually and socially, within active learning experiences that acknowledge the spectrum of knowledge domains.

Within UBC it is the responsibility of individual faculties, departments and programs to determine how best to design a pathway so students can attain the four attributes. While the USI Teaching and Learning Office has no mandate or capacity to approve or certify curriculum, the office is able to offer guidance and other support in pathway development.

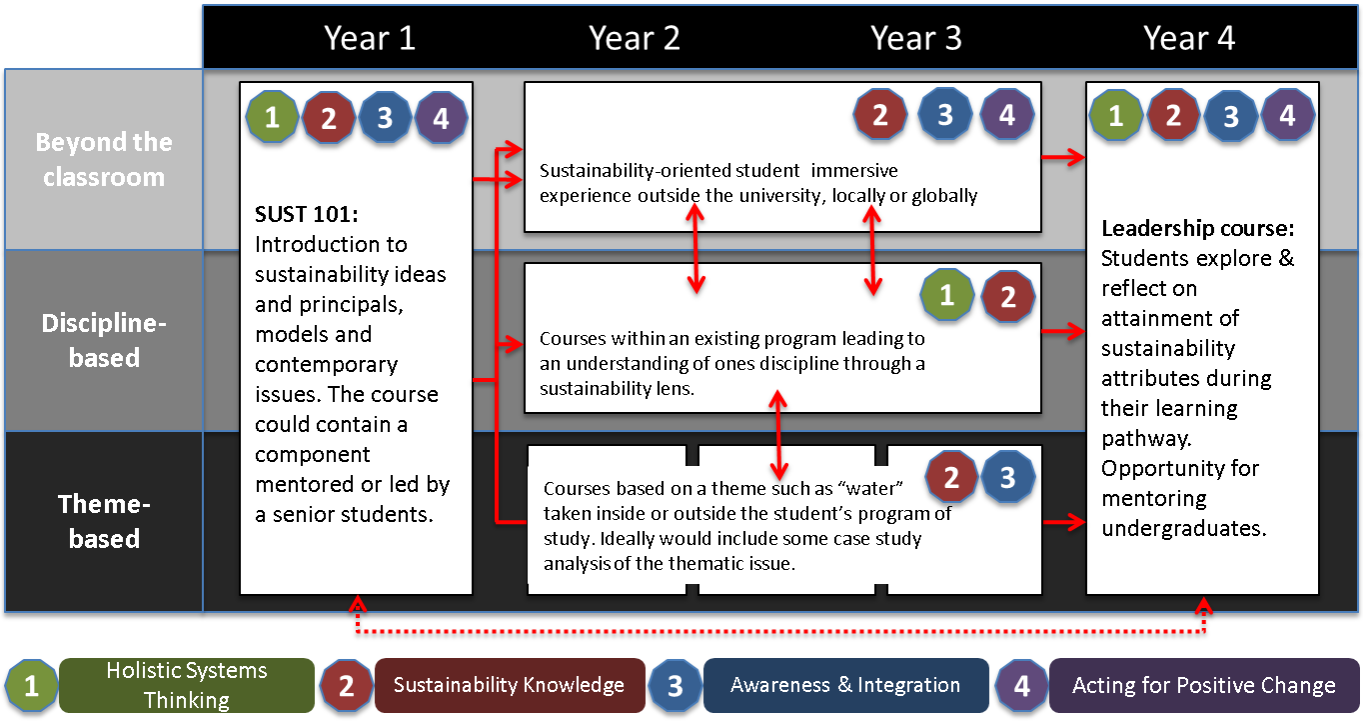
Sustainability Learning Pathways are intentionally extremely flexible in their design and implementation to allow students with different levels of expertise and experiences with sustainability to choose pathway which is meaningful to them. However there are a few characteristics which should be common to all pathways. An undergraduate **Sustainability Learning Pathway** should:

- Present a meaningful progression of learning over the duration of the university experience via well -connected courses and activities.
- Allow students to gain experiences outside of the traditional classroom. This can be achieved at UBC through the UBC SEEDS Program or innovative course work, or outside the university through the UBC Community Learning Initiative (Community Service Learning), Go Global International Service Learning (ISL) or any other approved program. Ideally students would collaborate with communities to work on projects that address real world sustainability challenges.

The focus of this document is on undergraduate sustainability education. However, a graduate level Sustainability Learning Pathway should also foster the development of student sustainability attributes. We acknowledge that the relative weighting of the four attributes would likely be considerably different for graduate students than undergraduate students, and other attributes not outlined here may be critical for a graduate education in sustainability.

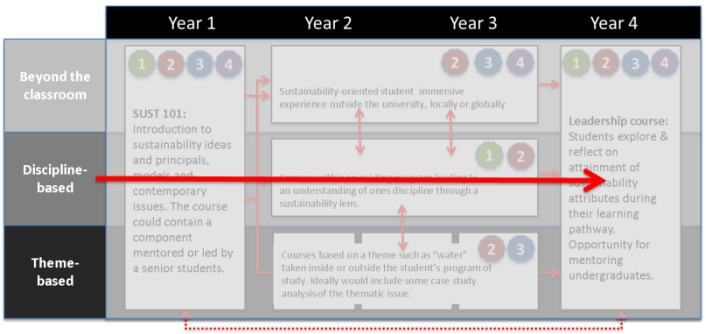
In order to demonstrate how an undergraduate **Sustainability Learning Pathway** might be assembled, we present three hypothetical pathways based on 1) a disciplinary pathway in biology, 2) a cross-cutting thematic pathway oriented around water, and 3) a "beyond the classroom" pathway with an immersive sustainability experience outside UBC. For each, we describe the journey of imaginary students as they move through their undergraduate sustainability learning at UBC.

The figure below illustrates how the four student sustainability attributes map on to various components of the hypothetical undergraduate pathways. **Key components of the pathways are a first and forth year experience which act as "bookends" and frame the pathway providing cohesiveness to the learning experience.**



Example Pathways

1. Discipline Based Pathway:

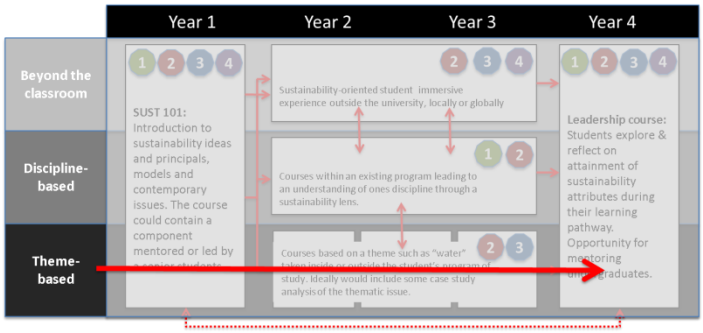


One model of a **Sustainability Learning Pathway** could occur within an existing discipline, such as biology. Such a learning pathway may lead through the traditional sub-disciplines within Biology (e.g. Cell Biology & Genetics, Animal Biology, Plant Biology, etc.), or may explore a wider range of sustainability themes that emanate from the core program in biology (e.g. bioethics, biofuels, biodiversity, etc.). The intent would be for students to "see biology through a sustainability lens." To develop such a pathway, existing courses which align with the student sustainability attributes could be identified and examined to establish if gaps in learning exist. If gaps exist, courses from outside the department or faculty, or new courses, may be required. For example, in the case of biology it is likely that new first year learning activities which introduce sustainability concepts and issues and initiate the pathway may be required as well as new fourth year learning experiences where students learn leadership and practice change agent skills. These gaps may involve the development of one or two new courses, or integration of sustainability components (for example, a new sustainability module embedded into an existing first year experience). Cohort based experiences like the coordinated science program (CSP) present one opportunity for integration of sustainability.

Imaginary student Tara

Tara enrolls at UBC in the Faculty of Science, thinking that she would like to be a veterinarian. In a first year mandatory biology workshop based around environmental sustainability, Tara becomes interested in biodiversity and conservation issues. Tara speaks to the Biology advisor about her options to learn more about these topics within biology. She chooses various courses in 2nd and 3rd year that touch on ecology, biodiversity, ecosystems and conservation, and in her 3rd year volunteers with Let's Talk Science speaking to elementary school students about local biodiversity issues. In her final year, Tara conducts a directed studies research project focused on finding more sustainable options to herbicides used on campus (SEEDS project), and participates in the 4th year sustainability leadership course to reflect on her sustainability learning and to connect with students from other disciplines. Tara plans to apply to graduate school to study how biodiversity impacts ecosystem function.

2. Theme Based Pathway:

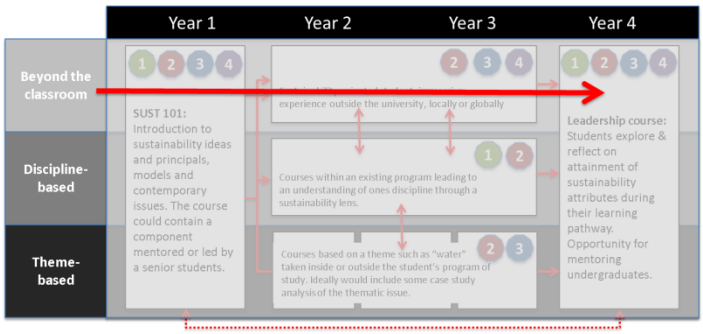


A second approach to a **Sustainability Learning Pathway** could be around cross-cutting themes, such as water or energy. **A theme based pathway,** like a discipline-based approach, requires a first and final year course which frames the pathway. In the 2nd and 3rd years a suite of courses should be assembled around a theme (such as water) from either inside or outside the student's program of study. By the time students enter their final year they will have achieved a depth of knowledge and understanding around one or more aspects of the theme (e.g. water policy, water infrastructure). In the fourth year capstone course, students have the opportunity to integrate and connect their unique body of knowledge with others and work on themed projects or case studies with students from different disciplinary backgrounds. These students could also participate in a sustainable leadership course where they develop change agent skills through mentoring students in the earlier years of a sustainability pathway.

Imaginary student Alice

Alice comes to UBC to pursue a civil engineering degree. During her 2nd year she learns about the implications of sustainability for the civil engineering profession and participates in a CSL project working with a community partner during which she starts to seriously consider sustainability issues for the first time. Her interest in water infrastructure leads her to take water-related technical electives (e.g. GEOG 412 Water Management: Theory, Policy and Practice; CIVL 409 Design of Water Supply and Waste Conveyance Systems etc.) which she identifies with advice from the USI Teaching & Learning Office and her civil engineering advisors. She also volunteers with Engineering without Borders where she organizes a multi-disciplinary student conference on Water Infrastructure and Health within Aboriginal Communities. In her last term of her degree, she takes the new applied science course entitled "Global Engineering Leadership" during which she works with students from a variety of engineering disciplines to design a water infrastructure system for city staff working in a town in Northern Canada. After graduation, she wants to work with an organization like Drop In The Bucket, which provides water and sanitation to children in Africa.

3. "Beyond the Classroom" Pathway:



A third approach could be yet more flexible and integrate a range of curricular experiences within and beyond UBC. Entry to this pathway could be through an introductory sustainable course, or through co-curricular experiences which have equipped the students with a strong background in sustainability issues and concepts. Unique to this pathway could be an immersive off campus sustainability experience where students study, learn and work within a cohort of peers. For example, students could spend a term in a rural community working with local residents on finding solutions to pressing sustainability challenges. Alternatively UBC students could spend a term working in a cohort comprised of students from other institutions investigating and finding solutions to urban sustainability issues. As described in the other pathways a fourth year course would allow students to synthesize this knowledge and further their leadership skills.

Imaginary student Trevor

Trevor is passionate about sports and enrolls at UBC in the Bachelor of Human Kinetics (Physical and Health Education) program with the goal of having a career teaching physical education. Once at UBC, Trevor discovers the link to the UBC Centre for Sustainability and Sport on the department's homepage. He reads about the centre, and curious about the connections between sustainability and sport, sends an email to the Director of the centre. He is advised that most courses within human kinetics that relate sustainability are in the upper years, but learns about the introductory sustainability course which is open to all students in any faculty. Trevor takes the introductory course in his second year, and is inspired by module on social sustainability and health. Trevor participates in an immersive experience in his 3rd year spending a term working on urban sustainability issues with the city, and applies his passion for active transportation by working on the Vancouver's Greenest City goal of making walking, cycling, and public transit the preferred transportation options. In his final year at UBC, Trevor participates in the sustainability leadership course to reflect on his learning.