

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

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## 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 philosophies**.

Sustainability learning involves investigating specific **concepts**, contexts, and issues which are particular to contemporary sustainability concerns within and across bodies of knowledge. Such relationships necessarily vary according to issues, disciplines, and contexts. 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 social practices and cultural stories of indigenous and aboriginal people, the science of climate change, the artistic expressions of literary, visual or performance artists, the science of oceans, forests or food webs, or they may relate to social or economic resource inventories and/or resource allocation techniques.

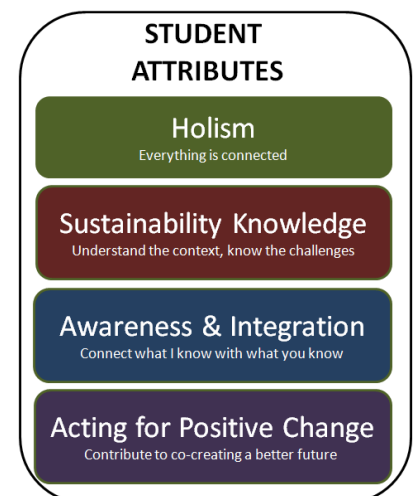
Understanding sustainability **processes**, or procedural knowledge related to sustainability, can similarly be context specific, such as studying applied skills and technologies to conduct a spatial analysis to benchmark changes in biota across time, asset-based community development for cities, value-chain mapping within business, or life-cycle assessments applied to infrastructure. Sustainability knowledge and learning can also include studying the political and social dynamics to be an effective change agent, a competency that cuts across issues and disciplines. Learners will engage in experiential practices that include an ability to learn the fundamental mechanics or steps in the process or procedure, and refine their expertise by creatively applying the knowledge within a variety of unique contexts and challenging situations.

At its heart, sustainability learning necessitates the examination of personal philosophies and values related to a holistic and systemic mindset regarding people and place. This requires examination of personal attitudes and beliefs relating to equity, justice, technology, and nature. Students engaged in sustainability education thus need to participate in course-based, community, and service-learning activities 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. These attributes have been initially developed and described by members of the USI teaching and learning fellows. A document describing the initial attribute development is available here:

[http://www.sustain.ubc.ca/sites/sustain.ubc.ca/files/uploads/images/teaching\\_learning/transforming-sustainability-education-at-ubc-desired-student-attributes-and-pathways-for-implementation.pdf](http://www.sustain.ubc.ca/sites/sustain.ubc.ca/files/uploads/images/teaching_learning/transforming-sustainability-education-at-ubc-desired-student-attributes-and-pathways-for-implementation.pdf)



This document provides additional information about each attribute with additional learning objectives, examples from UBC and beyond, as well as some potential assessment tools which could be used to help develop, and then assess students understanding of these key sustainability concepts.

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. These multiple perspectives of sustainability should provide a holistic view to challenge students to remember, reflect and critique sustainability content, as well as to analyze, synthesize, evaluate and apply solutions to solve existing problems.

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. And example learning outcomes derived from the attribute.

# Holism

Everything is connected

## **PREAMBLE**

Holism considers the interdependent, inter-relational, and contextual aspects of phenomena and applies an integrated, inclusive mindset to problem solving. Holistic approaches are concerned with the assumptions, knowledge, methods, and implications of various disciplines and treats them as an integrated whole, or system. Systems can be ecological, social, institutional, or a combination of all three, and relationships, within and between systems are recognized as complex with cyclical interdependencies, or feedbacks. Higher-order, or emergent, properties become evident when systems are considered in this integrated fashion.

With a sustainability focus, holistic approaches require methods that articulate and qualitatively and/or quantitatively measure how human, and the biological communities that sustain them, work and interact within complex ecological systems. A holistic systems world-view is grounded in people taking responsibility for their own actions and being receptive to transformational change. Fundamental to this philosophy are personal beliefs that sustainability is a conscious choice by people to aspire to a purposeful and equitable integration of a systems view of life. Some may recognize holism by other names: ecological systems thinking, synergistic approaches or a 'joined-up' mindset.

## **LEARNING OUTCOMES**

Students will have opportunities to conduct inquire into, and represent their learning about, holistic systems. Learning objectives might include:

- 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

- Understand how tipping points, interdependencies, feedback loops, and emergent properties impact a variety of social, economic and ecological systems
- Demonstrate the ability to integrate knowledge of social and ecological systems to predict or forecast, assess, analyze and integrate the effects of human activities
- Articulate, qualitatively assess and quantitatively measure how different systems work and interact
- Examine personal philosophies regarding the purposeful and equitable integration of systems on our planet
- Engage in dynamic conversation about different types of systems and processes (for example the food web, globalization)
- Conduct inquiry and synthesis as a means to posing problems and solutions to complex ideas and issues of sustainability.
- Demonstrate capacity for synthesis to propose solutions to complex problems and negotiated a more sustainable world

## TEACHING AND LEARNING EXAMPLES

*EXAMPLE 1:* One way to integrate holism into course content or programs of study is to consider a range of degrees of interdependence. For example, (i) using a disciplinary approach, examples of sustainable systems can be used as a resource for examination of other complex human and natural systems. A more integrated approach could be to (ii) enlarge understanding of complex systems by identifying their relationships, boundaries and goals, incorporating a sustainability theme and lastly a fully integrated approach (iii) where entire systems are examined using a sustainability lens.

In case 1, indigenous stories could be used as a resource to illustrate ideas of holistic systems, with many cultures interpreting the ideas of earth, ecology, and environment through artifacts and practices in different ways. Students could examine and discuss a range of cultural beliefs such as ancient Egyptian culture who believe that the world's vegetation sprouted from the Earth father's back; Algonquin people regarded the Earth as their mother and similarly, creation myths of the Hopi tell of Tiowa or Spider Grandmother who in the beginning gave structure and form to the Earth.

In the second approach, holism can be examined in relation to disciplinary knowledge. In forestry, for example, dominion vs holistic systems can be examined. Historically, a dominion (human superiority) mindset was prevalent in the unquestioned clear-cutting of old-growth forests with trees solely for human endeavors and economic growth even at the cost of endangered flora and fauna. Current forestry policies around maintaining old growth forests are being influenced by a stewardship mindset that facilitates care of the entire forest ecosystem.

Lastly, entire systems could be examined through holistic system approaches. For example agricultural science could be examined entirely through a sustainability lens and examples offered at UBC farm which can provide students experiential learning experiences in the care of a working, economically and ecologically productive landscape. These experiences offer relevant, practical solutions that are linked to some of society's most pressing global challenges. Another example could be a focus on eco-criticism, which encourages interdisciplinary discussion from fields as diverse as literature, ecology and religion on topics such as an examination of place, and definitions of nature.

*EXAMPLE 2:* An exploration of the university through a “UBC as a living lab” experiential learning application that informs students about systems and their interaction. In 2012, with funding from the AMS Sustainability Project Fund, UBC students developed a smart phone application that leads students on a system circuit around UBC. With site visits, questions and additional resources, the exploration is aimed to give students an experience of how water, energy, food and waste systems work at UBC. As a follow up to this activity students shared what they learned about each system and synthesized the information gathered by considering the system components, the inputs and outputs, the processes involved, the flow, and the people who facilitate the function of the individual system.

# Sustainability Knowledge

Understand the context, know the challenges

## **PREAMBLE:**

A student's area of academic inquiry informs their interests and values as it relates to sustainability. A working knowledge of sustainability depends on fundamental, overarching concepts central to its themes. Students should become proficient in the history and underlying ideas and principles of sustainability, the incorporation of ideas related to natural capital and resources, social justice, resilience, adaptability, and complexity. The student should become aware and be able to analyze and evaluate competing sustainability models and paradigms. A student would be expected to use this knowledge to assist in developing a personal inventory for sustainability. This work sets the stage for a process of engagement, enactment and enablement to generate a transformative sustainability learning experience.

It is recommended that any curriculum on sustainability knowledge incorporate a foundational learning opportunity that reaches beyond specific disciplines. Discipline specific materials that build and strengthen this foundational experience should then be explored over the student's path of study. To the extent that it is warranted by discipline, implementation of sustainability knowledge concepts in projects performed outside the academic arena is strongly encouraged.

## **Learning Outcomes**

Students should be able to synthesize, and evaluate different models of sustainability and the relevance to their specific domain of study. Learning objectives might include:

- Compare and contrast three and four component sustainability models, and their utility when examining issues such as climate change, fresh water management or biodiversity loss
- Establish connections between their own domain of study and sustainable development dimensions such as triple bottom line approaches
- Demonstrate knowledge of how economic theory and resource equity contribute to sustainability
- Display knowledge of basic ecological principles, such as the components and flows through ecosystem and links to sustainability concepts within ecology
- Demonstrate an understanding of how social equity contributes to global sustainability

*EXAMPLE 1:* Phosphorus is a critical element used for the production of food with roughly 90% of phosphorus used to produce fertilizer to support large scale agriculture. Increasing populations in Asia and India, as well as changing dietary and nutritional habits, is resulting in global demand increasing by 50-100% in 30 years. Yet phosphorus is also a non-renewable resource that cannot be substituted using other elements and is only available in specific regions—Morocco, China and the United States, leading to potentially critical geo-economic conflict. China has begun a strategy to withhold its phosphorus resources to secure a domestic supply, whereas Western Europe and India are reliant on imports. Nations in Africa are simultaneously the largest exporter and yet the continent with the largest food shortage.

A detailed analysis of the economic, social and environmental impacts of phosphoric can provide a context to examine complex interconnected systems. Consider the environmental, economic and social aspects of phosphorus production. What social and economic inequities between nations and regions require balancing when considering this increasing demand ?

*EXAMPLE 2:* Calculate your home energy use, transportation, food, and housing footprint using online tools. Also calculate a number of combined integrated indices such as your carbon and ecological footprints. Critique the assumptions of these calculations. What activities do you undertake that influence these indices the most? How do you compare to your class mates? Suggest an amalgam of these indices to produce a “Vancouver resident calculator” which provides a more realistic estimate of resource use within Western Canada.

# Awareness & Integration

Connect what I know with what you know

## PREAMBLE:

From the advent of the scientific and industrial revolutions in the 16th and 18th/19th centuries respectively, humankind has benefited greatly from the emergence of the modern scientific and social scientific disciplines. This reductionist framework has continued into the current era and characterizes the structure of all contemporary universities. But within the last half century, the environment which has fostered this multidisciplinary has drastically changed with the emergence of humankind's ability to act on a global scale and profoundly influence global-level natural processes. Accompanying this revolutionary change has been the coincident emergence of a class of problems whose solution requires more than the mere agglomeration of reductionist approaches. As outlined in the discussion of Attribute #1 – holism - activities within any one disciplinary boundary have the capacity to influence outcomes in a multitude of other areas, traditionally the domain of single disciplinary research. As a consequence, there is now a pressing need to communicate and work across disciplines in recognition of the current potentially dysfunctional fragmentation of knowledge and the recognition that large problems require holistic solutions. This requires an exchange and mutual understanding of ideas, mind sets, philosophical principles, frames, methodologies and cognitive styles traditionally confined to single disciplines. Several approaches are required to resolve these roadblocks to successful holistic problem recognition: a series of cross-disciplinary concordances, and the emergence of a common language to describe the challenges that cross individual fields of study.

Ultimately what is required is not a traditional multidisciplinary focus, but the application of a broad range of inter-disciplinary, cross-disciplinary and trans-disciplinary research leading to the emergence of new domains of knowledge equal to the task of addressing global sustainability issues in all their dimensions.

## 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

*EXAMPLE 1:* There are several conceptual models which can aid in the understanding of the emergence of these new broad domains of knowledge frequently characterized by shifting amorphous boundaries and a dynamic process of spinning off new disciplinary entities. Each model is outlined briefly below with some recent examples drawn largely, but not exclusively, from the three pillars which underlie the concept of sustainability: ecology, economics and society.

### Description

Adoption of one discipline's methodology by another, sometimes

### Examples

1. Use of portfolio theory from Finance to change fisheries management from single-species to multi-species

leading to the creation of a new subdiscipline

optimization with additional perspectives brought from risk analysis principles from the fields of economics and engineering (Edwards et al., 2004; Sanchirico et al., 2006)

2. Ecological principles associated with systemic risk have been used to aid in the understanding of financial market crises such as the most recent near global meltdown of 2007-2008 (Soramaki et al., 2006; May et al., 2008)
3. The incorporation of certain biological processes and characteristics into architecture, frequently referred to as ecotecture (New York Times, May 20, 2007).
4. A similar process is also manifested under the rubric of biomimcry with the incorporation of biological processes and characteristics into commercial products (Benyus, 1997)

Incorporation of one discipline's philosophical approach into another, sometimes leading to the creation of a new subdiscipline

1. The incorporation of Kahneman and Tversky's research on the human mind into economics. Their work fundamentally challenges the neo-classical economic model of the rational actor with the sole, self-centered goal of maximizing personal wealth or utility. This has led to the creation of a new subdiscipline called Behavioural Economics (Kahneman, 2012).
2. Where industrial processes are redesigned to replicate natural metabolic processes to the maximum degree possible, often referred to industrial ecology and cradle-to-cradle (Graedel and Allenby, 2010; McDonough and Braungard, 2002)

Interaction of two disciplinary perspective to influence analysis within each discipline

1. The emergence of the concept of natural capital. This is based on the ecological principles of limits to growth in a finite environment melded with the financial principle of living off capital, as opposed to consuming it and considering it as income. This latter phenomenon has been a consistent problem with national income accounting (Costanza et al., 1997a).

Development of meta-disciplinary theoretical concepts which find application in multiple disciplines

1. The development of the systems-analytical concept of panarchy by C.S. Holling which contributes to the understanding of evolutionary-like processes in multiple fields such as ecology and business economics (Gunderson and Holling, 2002).

Blending of two or more disciplines to create a new trans- discipline or meta-disciplinary domain

1. The creation of a new blended discipline of ecological economics which draws on the principles of both fields (Costanza et al., 1997b).
2. Among two of the most revolutionary examples of the emergence of dynamic new fields at the boundaries of human knowledge are the meta-domains of biotechnology and brain research. In the latter case, the integration of multiple disciplinary perspectives



from at least seven diverse fields of study have led to the development and application of mental imaging technology (e.g., fmri) to create new disciplines such as neuroeconomics (Glimcher et al., 2009) which helps in understanding the nature and process of human choice, and neuroethics essential to the understand of ethical decision making (Illes, 2003).

# Acting for Positive Change

Contribute to co-creating a better future

## **PREAMBLE:**

To be an effective and successful graduate a student must be able to engage others and implement or contribute to positive change. The integration and application of a holistic approach, 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. Achieving these outcomes requires repeated practice with progressive activities included in introductory, intermediate and advanced courses. 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.

Community based learning makes knowledge for sustainability real and the impacts of concrete projects addressing locally (community-based) problems provide rewards and enriches the meaning of sustainability studies. Community-based action research (CBAR), a process with dual goals of scholarship and social change, has become increasingly appealing to university researchers interested in investigating real-world complex systems characterized by diverse, intergenerational stakeholders, multiple areas of expertise, and the interests and agendas of public, academic, government and not-for-profit organizations. CBAR engages in iterations of learning and change that require community collaboration to define the problem, generate locally-produced knowledge, and devise and implement locally-appropriate actions to create mutually acceptable change

These participatory research methods and Community Base Experiential Learning (CBEL) enable researchers and students together to engage in systemic research (knowledge creation) that can be applied to other contexts (knowledge mobilization) while at the same time, develop supportive networks of collaborative relationships within a community (knowledge co-production and translation). This process increases the potential for replicating the successful outcomes of a project, while ensuring a high probability of continuation of project objectives from within a community.

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.

## **LEARNING OUTCOMES**

- Articulate a testable question or a solvable problem, identifying goals.
- Engage in self-assessment, self-reflection, and analysis and have a strong awareness of one's own values and how they inform one's ways of seeing (i.e. paradigmatic awareness)

- Use relevant theories of societal and institutional change to identify when, and where to direct energy and actions towards a targeted outcome.
- Summarize complex ideas using simple concepts.
- Communicate effectively orally, in writing, and in dialogue.
- Adjust to changing needs of both individuals and society as a whole
- Appreciate the importance of community-engaged scholarship and experiential knowledge and be able to participate in community-based action research collaborative initiatives

***In Teams:***

- Work collaborative with others to creatively solve a community focused problem
- Demonstrate competency in active listening, conflict resolution and mediation during group activities with diverse participants.
- Identify experiences and learning moments that demonstrate the value of diversity (cognitive styles, values and backgrounds) as an enhancer of working efficiency and a condition to resolve (or constructively manage) conflict.
- Advocate for positive changes through collaboration, mediation and consensus building strategies
- Involve and inspire others during group activities
- Appreciate that collaboration and engagement with communities leads to enriched creative problem solving, and contributes to the ongoing development of leadership skills.

*EXAMPLE 1:* An effective agent of positive change demonstrates the ability to transfer technical knowledge from experts to stakeholders, the general public and decision makers. An example learning exercise could be the writing of a newspaper op-ed (opposite-editorial) piece where the student conveys his/her opinion on a matter, marshaling evidence in support. The key components here are (1) seizing and holding the attention of your audience, and (2) conveying complex concepts effectively, and in simple terms.

*EXAMPLE 2:* Students could develop and implement a project with relevant partners to intervene in an area (a neighborhood; a site; an institution like a school or a campus) to collaborate with the community associated the problem in its implementation (i.e. restore a water stream; work in a watershed; plan and plant a garden; planting trees in a biodiversity restoration project; restore salmon habitat; garden; assess diet in cafeterias and improve them through designing and organizing farm to school collaborations, etc.

**Assessment Considerations:**

We also acknowledge that a variety of **assessment tools** exist by which to assess the learning of students around each attribute. We draw of the Integration Guide for Instructors, 2010, Ministry of Advanced Education, Employment and Immigration, Saskatchewan ([http://www.aeei.gov.sk.ca/evergreen/communications/part5/index.shtml#assessment\\_tasks](http://www.aeei.gov.sk.ca/evergreen/communications/part5/index.shtml#assessment_tasks)) as a basis for describing a number of these different assessment tools below.

**Self-evaluation**

Self-evaluation involves students undertaking their own assessment of the quality of their work which is undertaken using explicit, evidence criteria with the aim of ensuring students self improve in the future. Making students assess their own quality, against known standards, has been shown to be highly effective and a potentially powerful technique because of its impact on student performance through enhanced self-efficacy and increased intrinsic motivation. They also enjoy it ! (Rolheiser & Ross, 1999). While faculty may initially be concerned that students will grade themselves higher than the instructor, evidence suggests that these concerns are generally not true (Boud and Falchikov 1995).

**Summative Assessment**

Summative assessment typically occurs at the end of a theme, unit or course and is used to determine the acquired skill and knowledge, as well as the effectiveness of the course. The learner's knowledge and understanding of generic skills and learning outcomes, and the culminating assessment of the teaching/learning process throughout the course, are summarized to arrive at a final grade (O'Farrell 2013).

**Service-based & Experiential Assessment**

The intent of service-based & experiential assessment is to assess the students work as a whole and to undertake assessment similar to conditions found outside the formal learning environment. For example adults often work in teams in the workplace, so evaluation of, and by, other student peers, or in teams, could be considered. This type of assessment encourages the development of analytical skills, integration of materials, as well as critical and creative thinking, collaboration, and well as enhancing written and oral expression.

## 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.

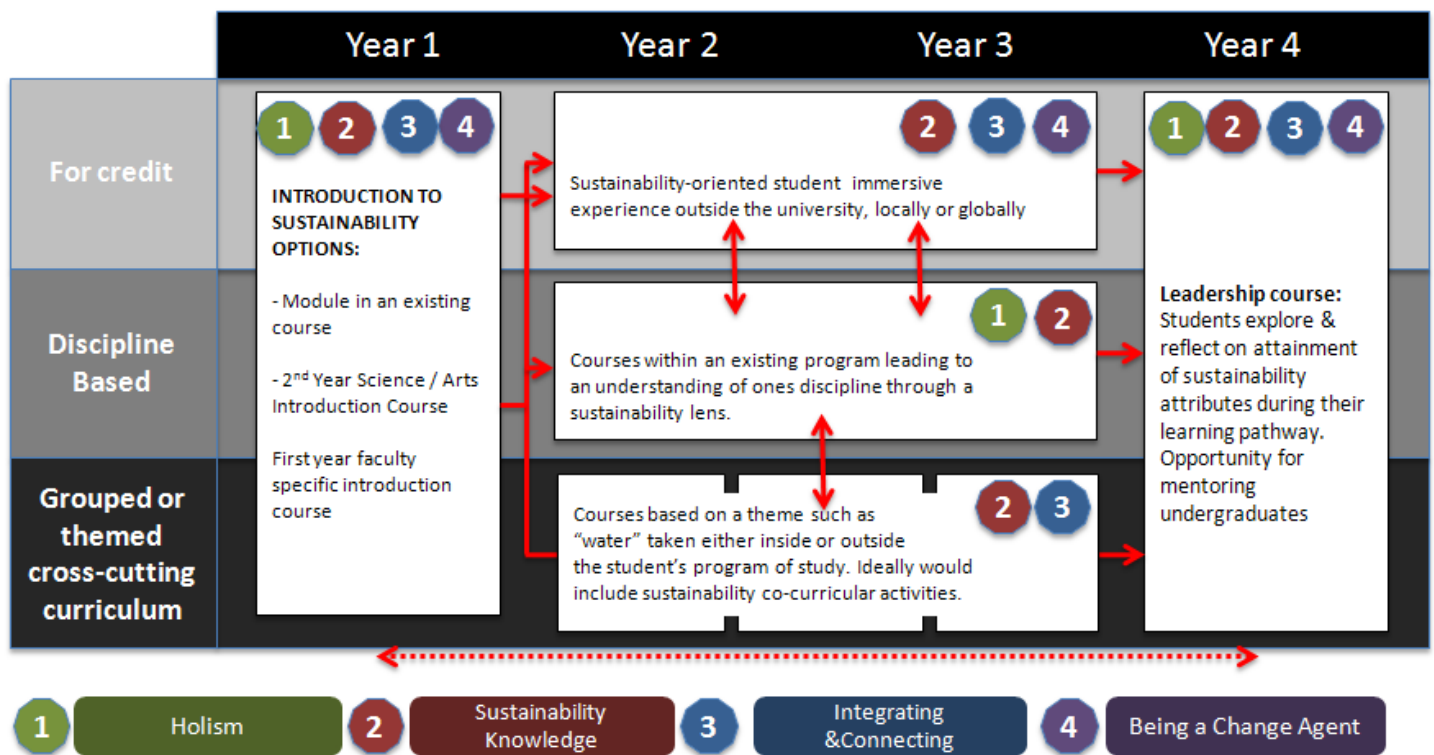
Sustainability Learning Pathways are intentionally extremely flexible in their design and implementation to allow students with different levels of expertise and experiences with sustainability to choose pathway which is meaningful to them. However there are a few characteristics which should be common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

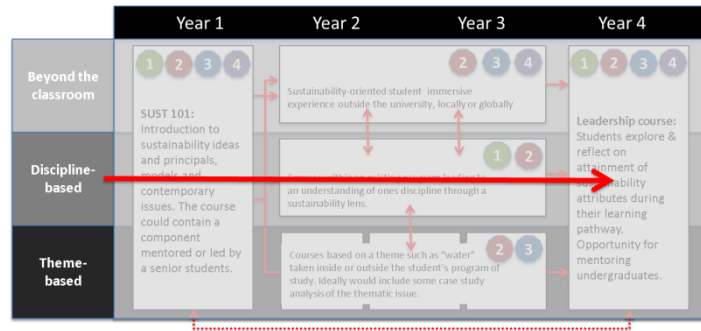
The figure below illustrates how the four student sustainability attributes map on to various components of the hypothetical undergraduate pathways. **Key components of the pathways are a first and fourth year experience which act as “bookends” and frame the pathway providing cohesiveness to the learning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



## Example Pathways

### 1. Discipline Based Pathway:

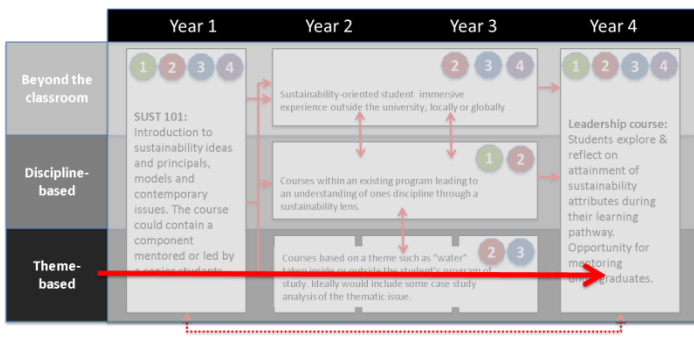
One model of a **Sustainability Learning Pathway** could occur within an existing discipline, such as biology. Such a learning pathway may lead through the traditional sub-disciplines within Biology (e.g. Cell Biology & Genetics, Animal Biology, Plant Biology, etc.), or may explore a wider range of sustainability 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 2<sup>nd</sup> and 3<sup>rd</sup> year that touch on ecology, biodiversity, ecosystems and conservation, and in her 3<sup>rd</sup> 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 4<sup>th</sup> 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 2<sup>nd</sup> and 3<sup>rd</sup> 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.

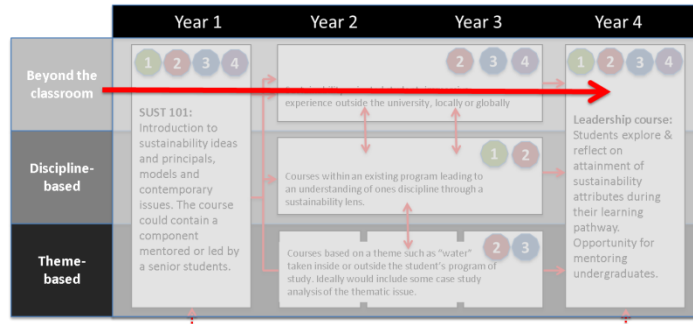
### *Imaginary student Alice*

Alice comes to UBC to pursue a civil engineering degree. During her 2<sup>nd</sup> 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 3<sup>rd</sup> 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.

**Further Reading:**

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