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### Sustainability Education at the University of Montana

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# Sustainability Education at The University of Montana

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## Abstract

Sustainability education has become increasingly important to prepare the next generation of professionals to address immense challenges such as climate change. Institutions of higher education play a critical role in developing student understanding and perceptions of sustainability through their curricula, specifically in the three pillars of sustainability: ecology, economy, and society. This research paper explores sustainability education at the University of Montana to answer the following questions: (1) To what extent do sustainability-focused and sustainability-inclusive courses at the University of Montana include themes or concepts from all three pillars of sustainability; (2) Do courses at UM impact student understanding, beliefs, attitudes, and intentions about sustainability; and (3) From among the small group of sustainability courses sampled, are students' understanding, beliefs, attitudes, or intentions impacted by course content? I collected data in three phases. First, I examined UM's 2021 Sustainability Tracking and Assessment Report (STARS) of inventoried sustainability courses to analyze the distribution of the three pillars of sustainability. Second, I assessed syllabi from three sustainability courses taught in the fall of 2021. Lastly, I administered a survey to students in those three courses at the beginning and end of the fall 2021 semester to measure student understanding, beliefs, attitudes, and intentions. The results showed that only 18% of the inventoried sustainability courses incorporated all three dimensions of sustainability, and the economic dimension was the least represented across courses. Syllabi varied in topics and activities and was more difficult to compare given that there is no common framework for curricula development. The survey results revealed that most students held sustainability beliefs prior to the course which stayed consistent over time. Student understanding and attitudes were more variable and had the biggest changes from beginning to end of the semester, while intentions somewhat changed. Currently, there is no standardized assessment tool for examining sustainability curricula internationally or at UM, which made the research process nuanced and difficult. This research suggests that UM needs a collaborative and interdisciplinary approach to develop an updated and common framework to guide curricula development, as well as a standard assessment tool, so that aspects of sustainability teaching are consistent across campus.

## Introduction

Climate change threatens our natural and man-made systems and is considered by many to be the greatest risk to the social, natural resource, and economic systems on which humans have come to rely. Attempts to address these challenges include efforts to define and describe what a more "sustainable" world can look like. Sustainability has many definitions, but a common one describes it as behavior that "meets the needs of the present without compromising the ability of future generation to meet their own needs," (Brundtland 1987, p. 8). If the goal is to work collectively towards a more "sustainable" future, one defined in part by mitigating the effects of climate change, education for a sustainable future is imperative. Sustainability in Higher Education Institutions (HEIs) has become an ever-growing field of interest in the past few decades, both in the U.S. and internationally (Menon & Suresh 2020). As a quickly growing field, there is not an agreed upon standardized format or set of learning objectives to which all HEIs adhere. This has led to many different emerging strategies as well as increasing literature in the field.

At the University of Montana, there have been efforts to develop sustainability education. A program called Green Thread was established to workshop sustainability curricula but was discontinued in 2013, and in 2021 The Office of Sustainability used a tracking and assessment tool to create an inventory of sustainability courses. However, there has not been an effort to assess the content of these courses or

explore the relationship between sustainability curricula and student outcomes. Additionally, there has been no programming offered since Green Thread to help faculty develop sustainability curricula in a way that is consistent across campus or in keeping with best practice. I was drawn to research sustainability at UM for my senior capstone project because I am majoring in Sustainability Science and Practice and sustainability topics have been central in my learning. Sustainability is such a nuanced and broad term, which made me curious how other students perceived the topic, especially those in which sustainability is not a central component of their degree. I became interested to learn what messaging other students receive about sustainability and if that in turn impacts their views and behaviors.

The objective of this paper is to understand and assess the sustainability course offerings at the University of Montana and get a sense of the impact these courses have on student outcomes. The research questions are as follows: (1) To what extent do sustainability-focused and sustainability-inclusive courses at the University of Montana include themes or concepts from all three pillars of sustainability; (2) Do courses at the UM impact student understanding, beliefs, attitudes, and intentions about sustainability; and (3) From among the small group of sustainability courses sampled, are students' understanding, beliefs, attitudes, or intentions impacted by course content?

## Background

This section first details a brief history of sustainability education and its basic components. This is followed by a more detailed description of sustainability curricula themes found from the literature, specifically interdisciplinary teaching and values-based learning. Next, terms used in the research questions are defined. These terms are student understanding, beliefs, attitudes, and intentions. Finally, *Sustainability Competencies*, a sustainability teaching framework, is explained, as it is later used in the research methods.

### Sustainability in Higher Education Institutions

At the United Nations Conference on the Human Environment in 1972, education was internationally recognized for its crucial role in fostering sustainable development (Casarejos et al., 2017; Mintz & Tal, 2018; Wu & Shen, 2016). Thirty years later, The United Nations Educational, Scientific and Cultural Organization (UNESCO) declared 2005 to 2014 as the decade of education for sustainable development (Casarejos et al. 2017, Mintz & Tal, 2018, and Wu & Shen 2016). This declaration established goals of integrating values, principles, and practices of sustainable development within education to promote the larger goal of sustainable living (Menon & Suresh 2020 and Wu & Shen 2016). Since then, sustainability education has increased internationally. Broadly speaking, research and initiatives between 2005 and 2009 tended to focus on the relationship between the environment and sustainability while initiatives from 2010 to 2014 worked to promote concepts of interdisciplinary integration (Wu & Shen 2016).

The basic premise of sustainability is that human and natural systems are interdependent and must be considered together to resolve critical issues (Dale & Newman, 2005). The goal of sustainable action is to create spaces that are environmentally, economically, and socially just to meet the needs of the present and future generations (Agyeman et al. 2016, Casarejos et al. 2016, Menon & Suresh 2020, Mintz & Tal

2018, and Wu & Shen 2016). The three aspects of environment, society, and economy are sometimes referred to as the three pillars of sustainability, or the triple bottom line (Menon & Suresh 2020). Despite the importance of sustainability education, studies have shown that “universities tend to focus on management and operations rather than on pedagogical or curricular reforms” (Christie et al. 2013). This gap led to a renewed urgency in research to understand and promote best practices for curricular development. Some common recommendations in the literature include using a systems approach that recognizes cause-effect chains among the three pillars, practicing collaboration among disciplines, integrating personal and social sustainability, using evaluative measures, and providing space for teacher reflection and pedagogical transformation (Fenner et al. 2005 and Moore 2005). Additionally, courses should promote “active, experiential, interdisciplinary, collaborative, and student-centered learning” (Mintz & Tal 2018).

Interdisciplinary learning is a key component of sustainability but is often lacking. Of the literature reviewed that assessed sustainability curricula, it was found that many courses within HEIs lack the interdisciplinary component of sustainability (Coleman & Gould, 2019; Gaard et al., 2017; Menon & Suresh, 2020). Rather than integrating all three pillars and discussing the interactions, many courses strictly taught sustainability as it directly related to their topic. For example, courses within social and behavioral studies were more likely to discuss social and environmental justice, while scientific departments focused on ecological impacts, and business schools focused on the role of economics in sustainable development (Coleman & Gould, 2019). Single-disciplinary curriculum does not holistically capture how sustainability is applied to real world problems (Lidgren et al., 2006). Environmental, social, and economic issues intersect and compound on one another, often exacerbating existing issues that cannot be solved by addressing only one factor. The lack of social and environmental justice may reinforce the idea that sustainability is mostly an ecological concept not relevant to underrepresented students. “Such a trend would be problematic because it suggests that only a narrow group of students will see sustainability as a relevant frame to address issues about which they are concerned,” (Coleman & Gould, 2019).

In addition to interdisciplinary curricula within sustainability education, another theme is the need for increased social, cultural, and values-based interaction (Casarejos et al. 2017, Mintz and Tal 2018, Menon & Suresh 2020, and Ribeiro et al. 2016). Mintz and Tal (2018) found that knowledge and critical thinking skills are essential but are not sufficient to fully developing students’ views of educational sustainable development (ESD): “Learning outcomes in the field of ESD should include both cognitive and affective components such as values and attitudes.” Menon and Suresh (2020) also identified the need for teaching to shift from reformative to transformative models with “opportunities for students to reflect on their values, beliefs, and behaviors.” These opportunities allow students to develop more informed views about social norms and behaviors that impact sustainability (Mintz & Tal 2018).

### Understanding, Beliefs, Attitudes, and Intentions

For this study, student impacts were measured via a survey and categorized under specific terminology. The literature suggests sustainability education needs to integrate transformative models to increase

student engagement with sustainability values, beliefs, attitudes, and behaviors. But what do these terms mean and look like in practice? Further research resulted in the following terms: student understanding, beliefs, attitudes, and intentions. Understanding, also described as Sustainability Literacy, is “the knowledge, skills and mindsets that allow individuals to become deeply committed to building a sustainable future and assisting in making informed and effective decisions to this end” (Göransson, 2018). Belief “governs the regime of a person’s value, state of mind, and conviction which can be shaped by knowledge, culture, and upbringing,” (Tang, 2018). Attitudes are “the expression of a person’s belief demonstrated via actions and thoughts,” while intentions are “the state of mind that steers a person’s future action,” (Tang, 2018). These terms can be put together in a linear fashion. Understanding is the foundation of beliefs which drive the forming of attitudes which then influences an individual’s intentions to act. For example, if a person has a belief of responsibility and care for others, they might become concerned about climate change, choose activities like biking or recycling to reduce their carbon footprint, and pursue an environmental degree to prepare them for a future career in climate action.

### Sustainability Competencies as a Curricular Framework

A recent development in sustainability curricula is the concept of *sustainability competencies*, which are “complexes of knowledge, skills, and attitudes that enable successful task performance and problem solving with respect to real-world sustainability problems, challenges, and opportunities” (Wiek et al., 2015). These competencies showcase what transformational models can look like in practice and integrate student outcomes like beliefs and attitudes. Wiek and colleagues (2015) laid out five key competencies to serve as reference points for the development of courses: systems thinking, futures thinking, values thinking, strategic thinking, and collaboration. *Systems thinking* is the ability of students to analyze sustainability issues that impact different domains and scales and relates to the need for interdisciplinary education. *Futures thinking* is the ability to anticipate how sustainability problems might evolve over time and create future visions based on development pathways. This aligns with student intentions. *Values thinking* is the ability to apply sustainability values, principles, goals, and targets informed by concepts such as justice, fairness, and responsibility, which aligns with student beliefs. *Strategic thinking*, or the action-oriented competence, is the ability to develop and test strategies toward sustainability while accounting for consequences and cascading impacts. This relates to student attitudes and intentions. The last competency is collaboration, which is the ability to engage with different types of collaboration such as teamwork and stakeholder engagement with skills such as in communication, negotiation, and leadership.

## Methods

The purpose of this study is to understand and assess sustainability courses and student outcomes at the University of Montana by answering the following research questions: (1) To what extent do sustainability-focused and sustainability-inclusive courses at the University of Montana include themes or concepts from all three pillars of sustainability; (2) Do courses at UM impact student understanding, beliefs, attitudes, and intentions about sustainability; and (3) From among the small group of sustainability courses sampled, are students’ understanding, beliefs, attitudes, or intentions impacted by

course content? My research methods below are organized in three sections. The first includes an assessment of 175 sustainability-related courses at UM to identify the distribution of sustainability pillars among courses. The second is an assessment of sustainability course syllabi from three courses taught in fall of 2021 for the presence of sustainability competencies. The last portion is a survey of students from the same three courses to assess student understanding, beliefs, attitudes, and intentions pre- and post-course completion.

### Sustainability Courses at UM

The research began with data from section AC-1 of UM's 2021 Sustainability Tracking, Assessment, and Rating Systems (STARS) Report to assess the sustainability courses offered at UM. The Office of Sustainability worked with the Office of the Provost to compile a list of all courses taught in 2021 and then used surveys, word of mouth, and course description keyword searches to build an inventory. This inventory includes both undergraduate and graduate level courses, which are categorized into two groups: sustainability-focused and sustainability-inclusive. Sustainability-focused courses "must indicate a primary and explicit focus on sustainability," including the application of sustainability within a specific field, as an interdisciplinary topic, or as a major sustainability challenge (See Appendix, Attachment 1). Sustainability-inclusive courses are those that are not explicitly focused on sustainability but still clearly incorporate it within its content, such as a unit or module that integrates sustainability activities, challenges, issues, and concepts.

As of fall 2021, UM had 65 sustainability-focused courses and 110 sustainability-inclusive courses for a total of 175 courses (See Attachment 2). Each course in the STARS report has a short description of its content to provide rationale for its inclusion in the inventory. For my research, I went through each course description to highlight and tally aspects that pertain to the triple bottom line of social, environmental, and economic dimensions. Common words for social aspects included social issues, equity and equality, political systems, ethics, culture, society, social justice, and humanities. Common words for the environmental pillar included ecology, natural systems, climate change, nature, natural resources, and ecosystem services. Economic terms included economic development, businesses practices, markets, consumption, economic viability, and growth. As discussed above, many studies in the literature found that sustainability courses offered at various universities tended to lack interdisciplinary aspects (Coleman & Gourd 2019, Gaard et al. 2017, and Menon & Suresh 2020). Tallying the three dimensions from the STARS descriptions was a metric to assess how interdisciplinary sustainability courses are. That is, a course with all three pillars present would be considered interdisciplinary.

### Curricula Assessment

Of the 175 sustainability courses offered at the University of Montana, I chose five classes in the fall semester of 2021 to more thoroughly explore *how* sustainability appears in course content and if that has any impact on student outcomes. However, due to low survey response rates, I only analyzed three courses which are included in the results section of this paper. These classes are *Water and Sustainability* taught in the Geography Department, *Sustainable Business Practices* offered in the College of Business' Marketing and Management Department, and *Ethics and Sustainability* offered within

Natural Resource Science and Management in the College of Forestry. *Water and Sustainability* and *Ethics and Sustainability* are both 300-level courses, while *Sustainable Business Practices* is a 400-level course. The STARS report lists *Sustainable Business Practices* as a sustainability-focused course in the STARS report, while *Water and Sustainability* is sustainability-related. *Ethics and Sustainability* was not listed on the STARS report, but based on the criteria, would likely fall under sustainability-focused.

I selected classes with an effort to represent diverse disciplines and topics rather than sampling from typically interdisciplinary fields like Environmental Studies or Climate Change Studies. This decision was based on the assumption that students within fields like Environmental or Climate Change Studies may self-select for sustainability courses and would likely already hold pro-sustainability values. Rather than survey this demography of students, I sought to survey students who may be relatively new to sustainability topics. Instructors of the selected courses provided current syllabi, which I then used to identify instances of sustainability education components proposed by Gaard et al. (2017). These included (1) a clear definition of sustainability; (2) a statement of sustainability learning outcomes; (3) sustainability-infused class activities; (4) course-relevant sustainability resources; and (5) sustainability assessment tools. This assessment was relatively simple, determined by a yes or no for evidence of each of the criteria. I then reviewed the same syllabi for the five *sustainability competencies* that Wiek et al. (2015) believe to be fundamental to comprehensive sustainability education: systems thinking, futures thinking, values thinking, strategic thinking, and collaboration. This assessment required going through each syllabus to identify each competency as well as determine how the competencies were incorporated into course activities.

### Student Surveys

In addition to analyzing three syllabi, I developed and administered a survey to students from the original five courses at the beginning and end of the fall 2021 semester. I only analyzed the results from the three classes with an adequate response rate, which was *Sustainable Business Practices*, *Water and Sustainability*, and *Ethics and Sustainability*. The survey was designed to gather data on student understanding, beliefs, attitudes, and intentions to answer the second research question: Do courses at UM impact student understanding, beliefs, attitudes, and intentions about sustainability? I assumed that any response change between the two surveys could be attributed to the course content. Additionally, I intended to use the survey results to capture any patterns of responses by course to answer the third research question: From among the small group of sustainability courses sampled, are students' understanding, beliefs, attitudes, or intentions impacted by course content? If there were any clear response patterns between courses, the curricula assessment would be used to explain why. For example, if one course had a large amount of change in student behavior, was there a topic or module used in the course that allowed for student reflection and encouraged sustainable behavior? Attributing student impacts to specific learning tools required significant interpretation but the goal was to possibly explain any notable shifts in student responses.

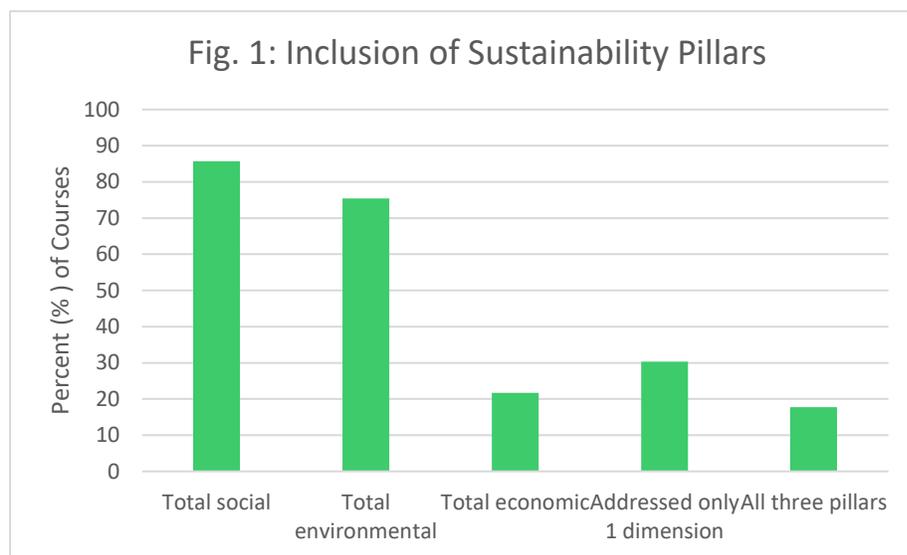
I developed the survey using several scholarly resources including sustainability surveys used at other universities (McKinley et al. 2020 and Tang 2018), a past UM sustainability survey (See Attachment 3), and feedback from my mentors. The survey received IRB approval in August and the survey was sent out during the first week of class. I matched pre- and post-course responses with the last four digits of the

students' identification numbers so that all responses were anonymous. The pre- and post-surveys included the same questions, with the addition of a qualitative question on the second survey asking students to share their "biggest takeaway" from the course (See Attachment 4). Many questions used a 5-point Likert Scale to assess student agreement level with statements (strongly agree to strongly disagree), level of confidence of a subject (very confident to not confident at all), or their frequency in participating in a variety of behaviors (very often to never).

## Results

### Sustainability Course Inventory

Of the 175 inventoried sustainability courses in UM's 2021 STARS report, 18% (31 courses) include all three pillars of sustainability (Fig. 1). There is a small discrepancy between those courses that are categorized as sustainability-focused (22%) and those that are sustainability-inclusive (16%) (See Appendix-Table 1 and Table 2). The social pillar is represented most frequently across all courses, appearing in 86% of all classes (Fig. 1). This is followed closely by environmental concerns, which are included in 76% of all inventoried courses. Economic dimensions of sustainability are far less



*Figure 1: Inclusion of sustainability pillars among the 175 inventoried courses. Social dimensions appeared in 86% of courses, environmental topics in 76%, and economic topics in 22% of courses. 30% of courses only addressed a single pillar, while 18% incorporated all three.*

represented, appearing in only 22% of inventoried classes. The representation of the three pillars are similar in the -focused and -inclusive categories, with the largest discrepancy being that environmental issues are covered in 66% of the sustainability-focused classes compared to 81% of sustainability-inclusive courses (Table 1 and Table 2). Over half of all courses incorporate at least two pillars (Table 3).

Courses most commonly pair social and environmental topics together, appearing in 34% of sustainability-focused courses and 52% of sustainability-inclusive courses. Thirty percent (30%) of all inventoried courses address only one pillar (Fig. 1 and Table 3).

A second research goal was to discern which academic disciplines have embedded sustainability concepts into their curricula and identify any trends related to the frequency of sustainability -inclusion or -focused material. In 2021, The University of Montana offered 2,330 (1,668 undergraduate and 662 graduate level) courses across 126 majors and minors. Thirty-nine (39) distinct majors and minors, which is 31% of all offered majors and minors, offered sustainability courses. There were 21 majors

represented in sustainability-focused courses and 31 majors included in sustainability-inclusive courses. Environmental Studies offered the most courses across both -focused and -inclusive courses, accounting for 39 of the 175 classes (See Appendix-Table 4). This was followed by Natural Resource Science & Management, with 16 courses and Geography with 15 courses. Twelve, or 31%, of all represented majors had a clear environmental focus across both -focused and -inclusive courses. These majors include Fish, Wildlife, and Science Management, Environmental Science, and Geology. These environmental majors and minors offered 106 courses, or 61% of all sustainability courses inventoried in the STARS report (See Table 5). Eleven, or 28% of all majors were related to social sciences, such as Philosophy, Political Science, and Communications. Across these programs there were 33 courses, accounting for 19% of all inventoried sustainability courses (See Table 5). There were only four clearly focused economic majors which offered 10 courses, or 6% of all classes, such as Business-General and Economics. There were an additional 12 majors that were harder to categorize and included crossover such as Biology, Construction Trades, and Public Administration.

## Course Breakdowns: Syllabi and Survey Results

### *Sustainable Business Practices*

The *Sustainable Business Practices* syllabus included four of the five criteria outlined by Gaard et al. (2017). The syllabus defined clear sustainability learning outcomes, had sustainability integrated within its class activities, offered sustainability resources in the form of readings and guest speakers, and had assessment tools in the form of quizzes, a presentation, and report (See Attachment 5 & 6). A clear definition of sustainability was not present in the syllabus; however, aspects of the triple bottom line were mentioned in the learning objectives and the definition of sustainability was discussed the first day of class. The first two weeks were spent understanding the foundations of sustainability, such as the triple bottom line, causes of unsustainability, tragedy of the commons, carrying capacity, externalities and market failures, and climate change (Systems Thinking). Next, the class explored business related sustainability such as the importance of sustainability strategies to avoid risk (Futures Thinking). The class also engaged in strategies to discuss sustainability to communities with conservative tendencies and other worldviews (Values Thinking). After looking at governance and local business sustainability efforts, the students worked in groups to create and present a Sustainability Management Plan (Collaboration and Strategic Thinking). Based on this assessment, *Business and Sustainability* touched on each of the five competencies. Values Thinking seemed to be the only competency lacking in comparison to the others. There was one class dedicated to discussing other world views and a discussion on Tragedy of the Commons that could have touched on concepts of justice, fairness, and responsibility. However, there weren't other opportunities (at least clearly articulated on the syllabus) that aimed to develop values thinking such as activities that allow students to "explore their own values, preferences and norms" (Wiek et al. 2015).

There was a total of eight survey responses from students who took both the pre- and post-course survey. Between the two surveys, 87% of students knew the correct definition of sustainable development at the beginning of the semester while, surprisingly, 75% chose the correct definition the second round. Familiarity with the triple bottom line increased from 50% to 100% of students by the end of the semester. At the beginning of the semester, 38% of students cited the media for being the most

influential in shaping their views on sustainability, which was the most popular answer. By the end of the semester, 75% of students responded that UM courses/professors had the biggest impact on shaping their views on sustainability. Other significant changes included the percentage of students who “strongly agree” that social inequality and environmental degradation are connected, increasing from 50% to 88%. Prior to course completion, 38% of respondents “strongly agreed” courses at UM have influenced their perception of sustainability, while 88% indicated this to be true in the post-survey. Students who answered “definitely yes” to their intention to change their lifestyle to live more sustainably increased from 38% to 88%.

One student who strongly agreed with the statement “I have a responsibility to act sustainability” wrote, “Everyone has a responsibility to make an effort in acting sustainably. I want to be able to enjoy the outdoors and care about the environment in the future not only for my family but for society as well.” After taking the second survey, one student responded that their biggest takeaway of the course was, “businesses can still be successful while being sustainable, which is contrary to what is shared in the public,” and another noted, “there is still time to reduce the harm already done to the environment but it’s important not only for individuals but for businesses to step up and make a stand on sustainability.”

#### *Water and Sustainability*

The *Water and Sustainability* syllabus clearly fulfilled four of the five criteria from Gaard et al. (2017). It outlined clear sustainability learning objectives, had sustainability class activities in the form of a paper and presentation, resources present as books and readings, and its assessment tool was a rubric for the paper and presentation (See Attachment 7 & 8). There was no clear definition of sustainability, but there was a reference to the three pillars in learning objectives. The course covered topics such as hydrology, hydro-social cycle (Systems Thinking), water rights, watershed planning and governance, and had intermittent quizzes and a reflective essay (Values Thinking). A significant portion of the course was dedicated to students writing a paper and presenting on a water issue in Montana that aimed to develop student thinking about water resources, hydro-social systems, and sustainability. Within this project, students developed a framework to analyze processes that contribute to their issue (Systems and Strategic Thinking) and assessed solutions or actions to increase sustainable management (Futures Thinking). In their data collection, students were required to interview a specialist working on their issue (Collaboration). Students spent the last class discussing water ethics and policies for sustainable watersheds, including a synthesis and reflection (Values Thinking). The syllabi hit on each of the five competencies, many of which seemed to be concentrated within the main project of writing a research paper and presenting on the topic. Collaboration seemed to be the attribute most lacking, as students worked on their papers independently and the only sign of collaboration from the syllabus came from interviewing an expert. In terms of the three pillars, economic topics were the least represented with possible discussion occurring over topics of development and infrastructure. Ecological and social pillars were clearly present.

In terms of student survey responses, only three students took both the pre- and post-surveys. All students knew the correct definition to sustainable development and familiarity with the triple bottom line increased from 33% to 67% among the three respondents. Student confidence in their

understanding of sustainability increased from 100% students answering, “somewhat confident” to 67% responding “very confident.” All three students “strongly agree” that courses at UM have influenced their perception of sustainability on the post-survey.

In response to why students felt a responsibility to act sustainably, one student who “somewhat agreed” stated, “I think it's important to be part of the solution rather than the problem. Future generations deserve to have a good quality of life based on our actions today. However, I think it is also the responsibility of big polluters, mostly corporations, to adopt sustainable practices in order to make a real change.” Another response of a student who “strongly agreed” stated, “Because I have the means, I have the responsibility.” In response to what were their “biggest takeaways” from the course, one student answered, “our world views and values strongly influence what actions are taken towards sustainability.”

### *Ethics and Sustainability*

The *Ethics and Sustainability* syllabus had four of the five Gaard et al. (2017) criteria accounted for. It had clear sustainability learning outcomes, activities included weekly discussion forums and an essay, plenty of sustainability resources in the form of books, articles, and videos, and assessment tools in the form of a graded essay and exams (See Attachment 9). There wasn't a clear definition of sustainability, but the social pillar was clearly present in learning objectives and ecological and economic aspects were included in weekly topics. The first portion of the course covered political philosophy, sustainability, and Earth Stewardship, including topics of population growth (Futures Thinking), various ethical dimensions such as Utilitarianism and Tragedy of the Commons (Values Thinking), and planetary boundaries (Systems Thinking). The second portion of the class explored technology, conservation, and sustainability. These topics included conservation science and the ethics of synthetic biology, and students wrote an essay exploring the ethics of a particular conservation issue (Values and Strategic Thinking). There wasn't much evidence of collaboration in terms of students working in teams. However, weekly discussions foster listening, communication, and interpersonal skills which are listed components of collaboration.

There were nine students who completed both pre- and post- surveys for *Ethics and Sustainability*. One hundred percent (100%) of students knew the correct definition of sustainable development in the pre-survey and familiarity with the triple bottom line increased from 11% to 44% from beginning to end of the semester. Confidence in understanding of sustainability increased from 11% to 33% of students feeling “very confident” (while the rest felt “somewhat confident”). Students who “strongly agreed” that environmental degradation and social inequality are related increased from 56% to 77%. Students who cited UM courses/professors as having the most influence on their views of sustainability increased from 0% to 38%. Eighty-eight percent (88%) of students “strongly agreed” (38%) or “somewhat agreed” (50%) that UM courses have impacted their perception of sustainability on the post-semester survey.

A student who “strongly agreed” to feeling a responsible to act sustainability stated, “I have the resources and education to make sustainable choices. I also recognize the serious existential threats posed by climate change.” Another student who “somewhat agreed” stated, “while I try to have

sustainable habits and products, there are certain barriers (such as cost, accessibility, no other alternatives) that keep me from being as sustainable as I want to be. In addition, corporations produce much more pollution and use more resources than I can comprehend. While I think individuals should do their part, corporations need to be the primary target.” Four of the nine responses mentioned future generations in their rationale for feeling a responsibility to act sustainability. One student cited their biggest takeaway from the course as “there are many different facets of sustainability and ethics are inseparable from it.”

## Survey Results

To answer the third research question regarding the relationship between student outcomes and course content, I was hoping to compare survey results from each of the three courses. However, with only 20 respondents between the first and second survey, I was unable to do so. Instead, I combined the survey results from the three courses to draw conclusions about student understanding, beliefs, attitudes, and intentions regardless of course content.

### Student Understanding

*Student understanding* was assessed via four survey questions: (1) Which of the following is the most commonly used definition of sustainable development? (2) Are you familiar with the three pillars of sustainability? (Also referred to as the Triple Bottom Line?) (3) How confident are you in your understanding of the following: sustainability, climate change, social justice issues, and sustainable business practices? (Fig. 2) (4) Please rate your level of agreement with the following: Environmental degradation and social inequality are related. Ninety-five percent (95%) of respondents across the three courses knew the correct definition of sustainable development post-survey. Across all three courses, student familiarity of the triple bottom line increased from 30% to 70%.

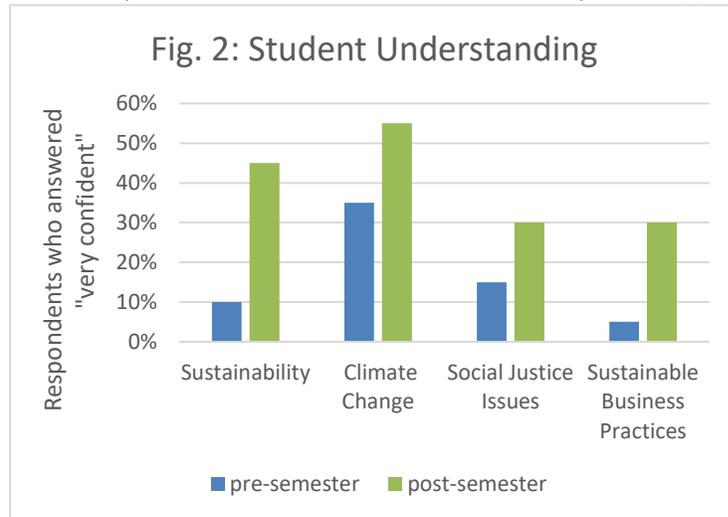


Figure 2: Survey results related to student understanding. Students who responded they felt “very confident” about sustainability increased from 10% to 45%, 35% to 55% for climate change, 15% to 30% for social justice issues, and 5% to 30% for sustainable business practices.

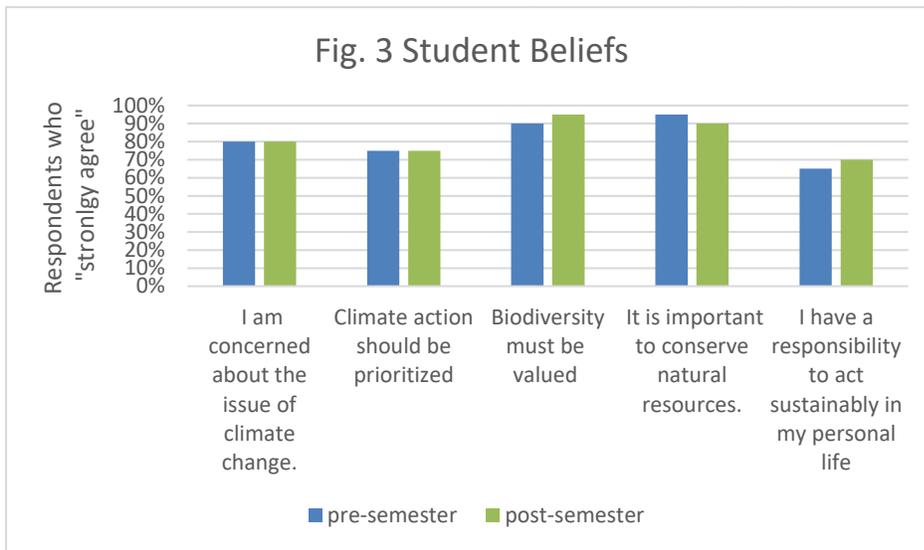
Students who answered “very confident” in their understanding of sustainability increased from 10% to 45%, 15% to 30% for social justice issues, 5% to 30% for sustainable business practices, and 35% to 55% for climate change (Fig. 2). The question which had the largest change was those who strongly agreed environmental degradation and social inequality are related, which increased from 60% to 85%. All 30% of students who felt “very confident” about sustainable business practices were from the *Sustainable Business Practices* course.

Students who answered “very confident” in their understanding of sustainability

increased from 10% to 45%, 15% to 30% for social justice issues, 5% to 30% for sustainable business practices, and 35% to 55% for climate change (Fig. 2). The question which had the largest change was those who strongly agreed environmental degradation and social inequality are related, which increased from 60% to 85%. All 30% of students who felt “very confident” about sustainable business practices were from the *Sustainable Business Practices* course.

### Student Beliefs

Six survey questions targeted beliefs around sustainability. Responses to these questions did not change significantly from the beginning to end of the semester. In fact, many did not change at all. Sixty-five percent (65%) of students believe the three pillars are “equally important” to pursue, 80% of students



“strongly agree” they are concerned about climate change, and 75% of students “strongly agree” climate action should be prioritized by individuals and within our broader western culture (Fig. 3). Slight changes include those who “strongly agree” biodiversity must be valued and protected (90% to 95%), those who “strongly agree” they have a responsibility to act sustainably in their

*Figure 3: Survey results related to student beliefs on sustainability topics. 80% of students “strongly agree” they are concerned about climate change, 75% of students “strongly agree” climate action should be prioritized, 90% to 95% of students “strongly agree” biodiversity must be valued and protected, 65% to 70% “strongly agree” they have a responsibility to act sustainably in their personal life, and 95% to 90% “strongly agree” it is important to conserve natural resources.*

personal life (65% to 70%), and those who “strongly agree” it is important to conserve natural resources (95% to 90%). Student beliefs were generally high coming into the course and stayed consistent over the course of the semester.

### Student Attitudes

There were 15 questions that sought to measure attitudes. These questions had far more variability in responses and saw larger shifts from beginning to the end of semester. Some larger shifts included 75% to 90% of students who “strongly agreed” it is important for UM to teach and incorporate sustainability across its curriculum and campus and 40% to 65% of students who “strongly agreed” courses at UM have influenced their perception of sustainability (Fig. 4). Students who answered that they “always” or “mostly” vote for candidates who prioritize environmental action and social equity increased from 40% to 55%, students who answered they are “mostly” or “always” mindful of the activities and choices that

impact their carbon footprint increased from 55% to 70%, and those who “always” or “mostly” support locally owned businesses that support sustainability increased from 50% to 75% (Fig. 4).

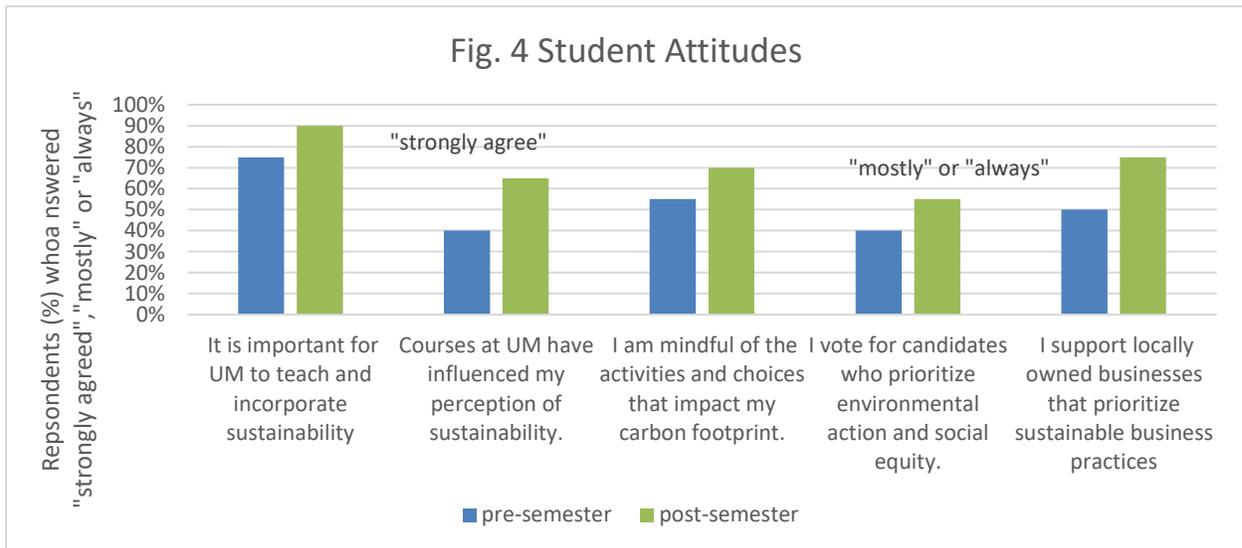


Figure 4: Survey results related to student attitudes around sustainability. 75% to 90% of students “strongly agree” it is important for UM to teach and incorporate sustainability and 40% to 65% “strongly agree” courses at UM have influenced their perception of sustainability. Students that answered “always” or “mostly” increased from 40% to 55% for voting for candidates that prioritize environmental action and social equity, increased from 55% to 70% for being mindful of activities that impact their carbon footprint, and increased from 50% to 75% for supporting locally owned businesses that support sustainability.

### Student Intentions

Three survey questions measured intentions. Students who “strongly agree” that they prefer to work for

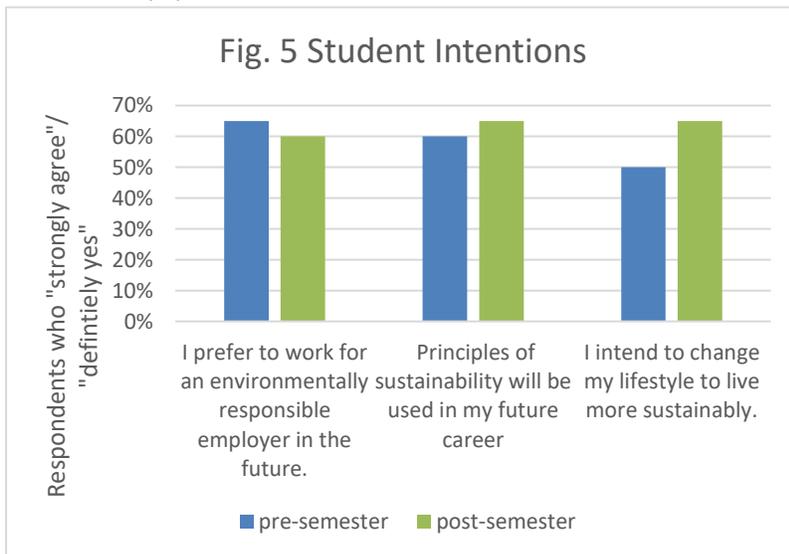


Figure 4: Survey results related to student intentions on sustainability. Students who answered, “definitely yes” to their preference to work for an environmentally responsible employer in the future decreased from 65% to 60%, and increased from 60% to 65% to the statement “principles of sustainability will be used in my future career.” In response to “I intend to change my lifestyle to live more sustainably,” responses increased from 40% to 55% for those who answered “definitely yes” or that they already live sustainably.

an environmentally responsible employer in the future slightly decreased from 65% to 60%, while there was a slight increase from 60% to 65% of students who “strongly agree” principles of sustainability will be used in their future career. In response to the statement “I intend to change my lifestyle to live more sustainably,” 40% of respondents answered “definitely yes” compared to 55% by the end of the semester (10% answered that they already live sustainably).

## Discussion

Sustainability education within Higher Education Institutions is a complex and evolving field that has no rigid framework, allowing universities the flexibility to develop their own unique program. The University of Montana has begun efforts to quantify and expand sustainability teachings, of which was explored in this paper. This section first outlines the main findings of my research within each category: STARS course inventory, syllabi, and survey results categorized by student understanding, beliefs, attitudes, and intentions. Then, I discuss my limitations. Lastly, I use my research findings to give recommendations for how I believe UM should move forward in improving and expanding sustainability curricula.

### Findings

#### *STARS Course Inventory*

There are 175 inventoried courses in UM's 2021 STARS report which integrate sustainability education, spanning across 39 majors and minors. Of these 175 course descriptions, social dimensions appeared in 86% of inventoried courses, environmental dimensions were included in 76% of courses, and economic dimensions appeared in 22% of course descriptions. While social and environmental dimensions are comparable, economic dimensions are far less represented across all course offerings. Economic dimensions were offered in 38 inventoried courses, spanning across 10 different disciplines. Ten of those courses are offered within the College of Business and the Economics major. This points to two conclusions. The first is that programs with a focus on business, economics, and finance offer few opportunities for their students to learn about sustainability. The other conclusion is that there are only 28 courses offered from disciplines not from the College of Business or Economics. Students in other disciplines have few opportunities to become acquainted with economic dimensions of sustainability.

Of the 175 inventoried course descriptions, 18% explicitly integrate all three pillars of sustainability within the course content. This statistic points to the need for cross-discipline collaboration to integrate more holistic teachings of sustainability to increase the percentage of courses that incorporate all three pillars. Additionally, 39 majors and minors were represented across all inventoried courses, which is only 31% of all academic majors and minors offered at UM. Sixty-one percent (61%) of all inventoried courses were offered by majors and minors with a clear environmental focus, such as Environmental Studies and Natural Resource Science and Management. As discussed above, there needs to be more programs from other disciplines integrating sustainability into their majors and minors.

#### *Syllabi Assessment*

To take a deep dive into actual course content, I reviewed the syllabi and student survey responses of three courses offered in the fall of 2021: *Sustainable Business Practices*, *Water and Sustainability*, and *Ethics and Sustainability*. Coincidentally, these three courses represented each of the three pillars (economic, ecological, and social respectively), but each course did a good job of incorporating aspects of all dimensions. Sustainability was clearly present in the learning objectives, course activities, resources, and assessment tools of all three syllabi. There was not a definition of sustainability present in any of the syllabi, but there was mention of the three pillars and how topics of sustainability would be explored throughout the class. It is possible that a definition of sustainability is not a good metric for

how well a syllabus addresses sustainability, but it is interesting to note that none of the syllabi contained one. The five competencies (Systems Thinking, Futures Thinking, Values Thinking, Strategic Thinking, and Collaboration) were present in every class. Systems and Futures Thinking were the most addressed across the three courses. *Sustainable Business Practices* seemed to lack Values Thinking, while *Water and Sustainability* and *Ethics and Sustainability* seemed to lack Collaboration.

While every competency was mentioned in some form, certain competencies were more fulfilled than others. “Mastery” of sustainability competencies occurs on three levels: novice, intermediate, and advanced. The undergraduate level corresponds to the “intermediate” level in Wiek et al.’s framework and has a list of objectives to achieve “mastery” for each competency (2015). In this study, it was difficult to assess if “mastery” was achieved based on just a syllabus. Some specific class activities aligned with a few of the “mastery” objectives, but none of the classes fulfilled every criterion. Additionally, some of the competencies were only addressed a single time or with objectives that were listed under the “novice” level. For example, in *Ethics and Sustainability*, Collaboration seemed to be lacking. Students had weekly discussion forums which exemplified “general concepts critical to interpersonal interactions, including listening, communication...” as listed under the “novice” level (Wiek et al. 2015). However, there was no evidence of fulfilling any of the “intermediate” criteria such as participating in work with stakeholder engagement, peer mentoring, resolving internal team conflicts, and incorporating stakeholder input into problem solving activities. Because the criteria are difficult to assess given a simple syllabus, it’s possible these topics were addressed in readings, exams, or other class activities. However, I was not able to find evidence of any of these “intermediate” level objectives of Collaboration present on the *Ethics and Sustainability* syllabus. This could lead to the conclusion that while aspects of Collaboration were present, Collaboration as a competency for the “intermediate” level was not fully achieved.

This phenomenon was true for every competency in every course, which showcases the complexity of the *Sustainability Competencies* framework. Rather than being used as an assessment tool, these competencies could be better utilized as objectives when designing curricula. A common framework, such as Sustainability Competencies, would be helpful for professors at UM when developing curricula and could also be used as an assessment tool. Professors were not expected to design curricula based around the five competencies, so it is not a fair assessment tool in this scenario. Rather, referring to the presence of the competencies in these courses gives us an idea of how courses cover a diverse range of sustainability issues and how instructors ask the students to grapple with these issues.

### *Survey Results*

Across all three courses surveyed, student understanding and attitudes changed the most, intentions somewhat changed, and beliefs tended to stay the same from beginning to end of the semester. Student understanding of sustainability topics positively increased from beginning to end of the semester. The highest percentage of students feeling “very confident” was for the topic of climate change, while the largest increase from beginning to end of the semester was for the topic of sustainability. Attitudes also positively increased over time, with more students agreeing with the importance of UM integrating sustainability within its teachings and the willingness to engage in sustainable behaviors and activities. Student intentions were more variable. The largest percentage increase was for students who “strongly

agree” they have intentions to change their lifestyle to live more sustainably, while questions regarding future career paths saw less change over the semester. Perhaps students are more convinced of the individual and shorter-term behaviors they can change, while the longer-term thought processes of integrating sustainability into their careers is less apparent. Student values did not tend to change over the course of the semester, but these percentages were high to begin with. It is more difficult to change beliefs over the course of a semester compared to understanding or attitudes. However, it’s also possible that these findings showcase a self-selection bias in that students with high sustainability beliefs could be more likely to take a course that integrates sustainability or be more willing to complete a survey about sustainability. From these results, we can conclude that student attitudes correlate with understanding, while values may be either a necessary requirement to build attitudes on, or they are more difficult to influence over the course of a semester.

### Limitations

My methods for gathering data from the STARS Report had two main shortcomings. The first is the information I used to determine the presence of the three dimensions among courses were based on very short descriptions provided within the STARS data. When submitting their data, professors were not asked to clarify which of the three pillars they covered, only to provide a brief synopsis of the course content. Additionally, some descriptions were much longer and in depth than others, making it unequal to assess across the board. The second shortcoming was that my categorization required assumptions on my end. I tried to minimize these by using the same key words to quantify dimensions, as described in the methods. Because of the nature of these words, social and environmental dimensions encompassed far more words than economic aspects and could be a reasoning for why more classes addressed these two dimensions than economics. Additionally, it was easier to argue that most classes incorporate social aspects as humans are involved in nearly every topic. Many words cover multiple dimensions such as climate change, resource management, and environmental justice, which made it easier to justify many classes having crossover. Despite these imperfections, this data is still useful in that it is clear sustainability courses at UM address social and environmental dimensions of sustainability more often than economic aspects.

There were also limitations for the assessment of syllabi and surveys. I originally wanted to have a large enough sample from five classes to directly compare survey responses across courses to infer patterns of student responses across disciplines. However, with a low number of responses I could only look at three courses and the response rate within those classes were different so I could not make direct comparisons. This meant I could not fairly answer the third research question of, “From among the small group of sustainability courses sampled, are students’ understanding, beliefs, attitudes, or intentions impacted by course content?” Another limitation was assessing the syllabi based on *sustainability competencies*. Without taking the course it was difficult to assess which competencies were addressed with only a short description of class activities. I was able to find evidence of each competency, but it is highly likely they were addressed more times. On the other hand, it is also possible I made assumptions about how in depth each activity or assignment addressed a competency. As discussed previously, evidence of one aspect, concept, or objective of a competency is not enough to justify that “mastery” was achieved at the intermediate, or undergraduate, level. Similar to categorizing courses within the

three pillars, there was no expectation that professors had to identify which of the three pillars they incorporate in their syllabi or design their courses to fulfill sustainability competencies.

### Recommendations

Based on these findings, I believe UM can take action in the following areas: increase the presence of economic dimensions within sustainability teachings, improve interdisciplinary incorporation among courses, develop a campus wide framework to guide curricula development, create a standardized method for quantifying and measuring sustainability courses, and utilize current sustainability leaders on campus to guide these improvements.

Only 22% of course descriptions from the STARS report displayed a clear incorporation of economic dimensions. One solution is for more disciplines with a focus on economics, accounting, or business to improve on incorporating sustainability topics within their curricula. There are only three programs within the College of Business with sustainability offerings, of which account for seven total classes (Business General, Business Management, and Marketing). Economics was the only other related program, which offers three courses. There are no offerings in programs such as Finance, Accounting, and Business Management Systems. The other necessary solution is for other disciplines to improve on incorporating economic dimensions. Of the 175 courses inventoried, only 28 classes that incorporated economic dimensions were offered from other programs not within the economics or business majors.

Increasing the presence of economic dimensions among sustainability courses can be guided by collaborative efforts between disciplines to improve interdisciplinary teachings of sustainability. This aligns with initiatives already happening on campus. For example, the Office of the President recently outlined five priorities of action within their strategic initiatives. Priority number two is to “drive excellence and innovation in teaching, learning, and research.” Within this priority, UM seeks to ensure that curriculum continues to evolve and that “Communities of Excellence come to life as interdisciplinary learning and research communities,” (University of Montana, 2022). Additionally, sustainability was outlined as one of the University’s Core Values in the 2020 Strategic Plan (University of Montana—Missoula, 2012). Other evidence for the need for sustainability curricula development programs comes from a professor of one of the courses analyzed in this study. They expressed:

“I think support around sustainability pedagogy is needed. Sustainability is so multi-faceted theoretically, methodologically, and pedagogically. How to approach this topic/theme in the context of specific courses is going to be different than how it is approached in business, the humanities or education. So, I think some very tailored training and professional development for different fields or discipline-specific would be terrific.”

My research suggests that the University of Montana needs a collaborative and interdisciplinary approach to develop an updated and common framework to guide and assess curricula development so that aspects of sustainability teaching are consistent across campus. Recommendations for how to design and implement a robust sustainability curricula program at UM is outside the scope of my research but is the next step UM should make. Lessons from my research include the need for increased interdisciplinary teachings (only 18% of sustainability courses integrated all three pillars), the need for

an agreed upon sustainability definition (no syllabi I analyzed included a definition), and perhaps increased opportunities for students to build and develop sustainability beliefs (these percentages had the least amount of change between pre- and post-surveys). Utilizing interdisciplinary teaching can increase the number of courses that integrate multiple pillars as well as aid in incorporating values systems. Additionally, adopting a broad definition of sustainability can be helpful so diverse stakeholders can “tailor the generic definition to achieve concrete goals in their unique situation,” (Dale & Newman, 2005). There are many existing frameworks, such as *Sustainability Competencies*, and Higher Education Institutions who have designed workshops and sustainability programs of which UM can model after. UM could reinstate Green Thread, a workshop that encouraged interdisciplinary collaboration for sustainability teaching, but with improved measures such as defined outcome expectations, common frameworks to use, an agreed upon definition, collaboration opportunities between professors, and other tools for integrating opportunities for students to build and reflect on their sustainability beliefs.

Another recommendation is to create a standardized way for measuring and assessing sustainability curricula at UM. While the STARS tool is helpful, we cannot measure what we do not know. The UM Office of Sustainability inventoried 175 courses, but it’s very likely there are more courses offered on campus. In fact, *Ethics and Sustainability*, a course surveyed in this study, had clear sustainability components but was not included in the inventory. Because there is no standardized process for collecting sustainability course information, the Office of Sustainability had to use surveys, word of mouth, and course description keyword searches to build the inventory themselves. This process could be streamlined by requiring professors to input data about sustainability when submitting their course information to the Registrar’s Office, which could be as simple as checking a box if their course integrates sustainability or not. Additionally, the inventoried courses were self-reported by professors, and there were no criteria of what to include. It would be helpful to have specific criteria for which professors can report on, such as the three pillars. Ideally, a framework that is developed during sustainability workshops by multiple departments would be used to create a metric so that the curricula frameworks or guiding principles align with how we measure and assess sustainability curricula across campus.

The last recommendation is to utilize sustainability leaders and initiatives already happening on campus for collaboration. The Office of Sustainability is a centralized body optimal for providing direction with common frameworks and hosting workshops. However, there are other groups on campus who could also provide leadership. In the last few years, the University of Montana created two new majors with a specific focus on sustainability: a B.S. in Sustainable Science and Practice offered by Environmental Studies (EVST) in the College of Humanities and Sciences and a B.S. in Environmental Science and Sustainability offered in the W.A. Franke College of Forestry & Conservation. Additionally, the College of Business offers a certificate in Sustainable Business Strategy. The Environmental Studies degree offers credit in six NRSM courses (a degree in the College of Forestry) and one course from the College of Businesses. The College of Forestry degree offers credit for three EVST courses across all six of its concentrations, and no courses from the College of Business. The business certificate offers credit in two EVST courses and two NRSM courses. Although sustainability is broad in nature and allows for different focuses, it appears there could be more collaboration between the three programs. The creation of

these programs shows promise for sustainability education but also showcases how UM's efforts are being developed in somewhat of isolation from each other. As experts on campus, it would be great to see these programs work together to lead sustainability workshops or initiatives to enhance sustainability curricula in all disciplines.

## Conclusion

With the urgency of sustainability challenges across the world becoming exacerbated by climate change, it is imperative students at UM are prepared to address these complex issues in their personal and professional lives. It is an exciting time to be involved in sustainability curricula at UM because it is a relatively new and rapidly evolving discipline. Within the last couple years, UM has created new education programs regarding sustainability and identified sustainability as a Core Value of the University. The direction is clearly going towards increased sustainability academia, but the current state is largely discipline-specific, and efforts seem fragmented. UM has an opportunity to unify sustainability teachings across campus and create a robust educational program that reaches across all corners of campus teachings. To create this, I recommend the university initiate a collaborative and interdisciplinary effort, such as workshops, to design and implement sustainability frameworks, teaching tools, and a common metric to measure the content of these courses. This will ensure students across campus have equal opportunities to become acquainted with sustainability teachings and that the university will have adequate means to measure and track sustainability education progress in the future.

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## Appendix

<b>Table 1</b>	Total	percentage
<b>Sustainability-focused courses</b>	65	
Total social	58	89.2%
Total environmental	43	66.1%
Total economic	16	24.6%
Social only	19	29.2%
Environment only	6	9.2%
Economic only	0	0%
Addressed only 1 dimension	25	38.5%
Social and environmental	22	33.9%
Social and economic	2	3.1%
Environment and economic	0	0%
All three pillars	14	21.5%

<b>Table 2</b>	Total	percentage
<b>Sustainability-inclusive Courses</b>	110	
Total social	92	83.6%
Total environment	89	80.9%
Total economic	22	20%
Social only	13	11.8%
Environment only	13	11.8%
Economic only	2	1.8%
Addressed only 1 dimension	28	25.5%
Social and environmental	57	51.8%
Social and economic	3	2.7%
Environment and economic	1	0.9%
All three pillars	17	15.5%

<b>Table 3</b>	-inclusive	-focused	Sum	Percentage
Total social	92	58	150	85.7%
Total environmental	89	43	132	75.4%
Total economic	22	16	38	21.7%
Social only	13	19	32	18.3%
Environment only	13	6	19	10.9%
Economic only	2	0	2	1.1%
Addressed only 1 dimension	28	25	53	30.3%
Social and environmental	57	22	79	45.1%
Social and economic	3	2	5	2.9%
Environment and economic	1	0	1	0.6%
All three pillars	17	14	31	17.7%

<b>Table 5: Pillar-specific disciplines</b>				
<b>Pillar</b>	<b>majors/minors</b>	<b>% of programs</b>	<b>total classes</b>	<b>% of classes</b>
Environmental	12	30.76923	106	60.57143
Social	9	23.07692	33	18.85714
economic	4	10.25641	10	5.714286

<b>Table 4: Programs offering sustainability courses</b>			
<b>Discipline</b>	<b>Name</b>	<b>Total course offerings</b>	<b>% of all courses</b>
ENST	Environmental studies	39	22.30%
NRSM	Natural Resource Science and Management	16	9.10%
GPHY	Geography	15	8.60%
WILD	Fish, Wildlife, and Science Management	11	6.30%
CSTN	Construction trades	7	4.00%
ENSC	Environmental science	6	3.43%
PHL	Philosophy	6	3.43%
FORS	Forestry	5	2.86%
CCS	Climate change studies	4	2.29%
COMX	Communication	4	2.29%
PSCI	Political science	4	2.29%
PTRM	Parks, Tourism, and Recreation Management	4	2.29%
SOCI	Sociology	4	2.29%
ANTY	Anthropology	3	1.71%
BGEN	Business general	3	1.71%
BIOB	Biology-general	3	1.71%
ECNS	Economics	3	1.71%
GLBD	Global leadership	3	1.71%
LIT	English-literature	3	1.71%
NASX	Native American studies	3	1.71%
BGMT	Business management	2	1.14%
BIO	Biology	2	1.14%
BIOS	Biology- Systems Ecology	2	1.14%
BMKT	Business: marketing	2	1.14%
CHMY	Chemistry	2	1.14%
CSD	Communicative science and disorders	2	1.14%
GEO	Geology	2	1.14%
HNRS	Honors	2	1.14%
NRGY	Sustainable energy	2	1.14%
PSYX	Psychology	2	1.14%
BIOE	Biology- Ecological	1	0.57%
BIOM	Biology-microbiology	1	0.57%
CRWR	Creative writing	1	0.57%
ERTH	Earth Sciences	1	0.57%
LING	Linguistics	1	0.57%
NUTR	Nutrition	1	0.57%
PHAR	Pharmacy	1	0.57%
PUAD	Public administration	1	0.57%
PUBH	Public health	1	0.57%

[Attachment 1: AC 01 Academic Courses- STARS rationale for sustainability-inclusive and sustainability-focused courses](#)

[Attachment 2: List of Sustainability-inclusive and -focused courses at UM \(2021\)](#)

[Attachment 3: Survey on sustainability at UM developed by grad students in 2018](#)

[Attachment 4: Copy of the Sustainability Survey used in this study](#)

[Attachment 5: Sustainable Business Practices Schedule](#)

[Attachment 6: Sustainable Business Practices Syllabus](#)

[Attachment 7: Water and Sustainability Syllabus](#)

[Attachment 8: Water and Sustainability Schedule](#)

[Attachment 9: Ethics and Sustainability Syllabus](#)