



SUSTAINABLE STUDIES

Mapping Sustainability in WPI Curricula

("Hire WPI," n.d.)

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Sponsored by The WPI Office of Sustainability

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This report represents work of WPI undergraduate students submitted to the faculty as evidence of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review. For more information about the projects program at WPI, see <http://www.wpi.edu/Academics/Projects>.

Executive Summary

While humanity at large has made great strides in various fields such as medicine, education and life expectancy, this progress is not without great cost to our world (“Sustainable Development Commission. History of SD.,” n.d.). We need to take care of the world for future generations, and as such it's vital that we educate young people on topics relating to sustainability because, as a WPI professor explains, “[they] are going to be the ones to deal with it.”

WPI first years are expected to make a 4-year plan that maps their schedules to a set of graduation requirements. Unfortunately, while designing these plans, learning about sustainability is not a factor in their selections. The Climate Crisis, increased poverty and inequalities emphasize how essential it is to learn about sustainability. The Association for the Advancement of Sustainability in Higher Education explains that “the classroom (is) the true battleground for change,” but WPI students have no means of determining which courses cover sustainability topics, and some WPI faculty lack the resources to integrate sustainability into their curricula (“Ten Ways to Integrate Sustainability into the Curriculum,” 2013).

The goal of our project is to promote sustainability in education for WPI faculty and students through an online platform that serves both students and faculty. The platform allows for students to filter through sustainability themed courses by department or sustainability topic. The faculty section of the platform provides access to resources that can assist instructors in integrating sustainability into curricula and the student interest in sustainability topics and delivery methods.

Our platform incorporates results from both faculty interviews and student surveys. We interviewed faculty who teach sustainability themed curriculum to determine what sustainability topics they currently cover and what resources they used to gather sustainability content. Sustainability topics covered in the courses were categorized by the relevant Sustainable Development Goals (SDGs). The SDGs covered in each course are available on the ‘Sustainability Themed Courses’ page of our platform. This allows for a student to find specific courses relating to their sustainability topic interests. Sustainability resources the faculty provided were included in the faculty resource library on the platform.

Executive Summary

We surveyed students currently enrolled in sustainability themed courses to find out what SDGs they are interested in learning about and their preferred delivery methods. Through these surveys we discovered students were most interested in learning about Climate Action, Affordable and Clean Energy, and Good Health and Well-Being, but had a large interest in learning about every SDG. We found students preferred professors using hands-on projects to cover sustainability topics. Methods such as handouts and practice problems were of lower interest of the students. These survey results are provided on the 'Faculty Resources' page of our platform for any faculty looking to tailor their sustainability course content towards the student's interests.

A D20 snapshot of our platform is available at: <https://ryc1x.github.io/sustainable-studies/>. In order to view the most updated copy of our platform, contact WPI's Office of Sustainability.

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The Problems

WPI has made great strides in sustainability since founding the Office of Sustainability in 2014, striving to reduce carbon emissions on campus and providing funding for sustainability themed projects. While the Office of Sustainability has primarily focused on making campus operations more sustainable, more could be done to incorporate sustainability in the classroom. Unfortunately, this integration has been delayed in part due to communications challenges between the WPI Office of Sustainability and the WPI community.

1

There are several courses that currently cover sustainability content, but no system currently exists to provide students information regarding which courses cover sustainability, and what sustainability topics are in those courses.

2

Many WPI faculty do not know they can integrate sustainability topics in their curricula. These faculty members might be more inclined to include sustainability related content if they had resources to aid with course integration.

3

Some WPI faculty want to integrate sustainability into their curricula, but it is difficult for them to accomplish if they do not know how to gather quality sustainability related content. Currently, WPI faculty must find all sustainability course materials on their own.

4

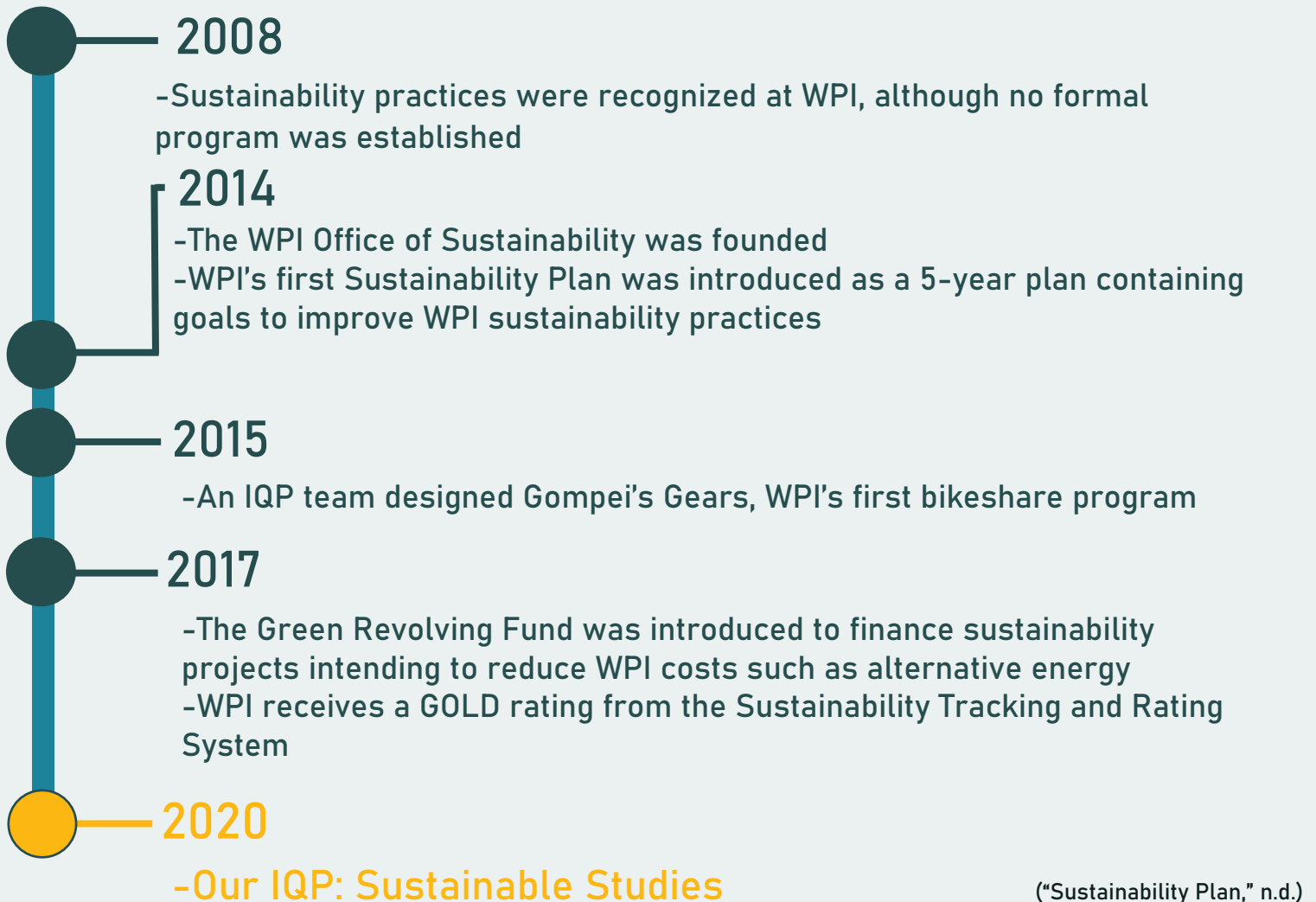
Some WPI faculty currently integrate sustainability topics into their course curricula, but their courses are not recognized as sustainability themed by the WPI Office of Sustainability.



Tech for Teaching Profiles

History of Sustainability at WPI

According to one of our sponsors, sustainability practices such as recycling and efforts to reduce energy use and water consumption began at WPI in 2008. Although WPI began recognizing sustainable habits that year, the formal WPI Office of Sustainability was not founded until 6 years later in 2014. Since then, WPI has continued to improve its sustainability practices, but little emphasis was placed on sustainability education until 2020 with our IQP.



Most of WPI's sustainability focus has been on environmental issues. For example, Gompei's Gears focused on reducing carbon emissions by riding bikes over driving cars and the Green Revolving Fund promoted saving energy or reducing water usage (“Sustainability Plan,” n.d.). In order to combat global issues such as the Climate Crisis, WPI's sustainability focus must extend beyond campus operations to sustainability in curricula as educating students to be sustainably literate members of society may be the only way to save their futures.

The Purpose

To help improve communications regarding WPI's existing sustainability curricula and promote sustainability themed course offerings, we developed and implemented an online sustainability resource platform for the WPI Office of Sustainability that serves both students and faculty.

The Sponsors

We worked with Professor Paul Mathisen, the Director of Sustainability at WPI, and Liz Tomaszewski, the Assistant Director of Sustainability at WPI, to design the platform and ensure the platform can be maintained.



("Meet the Team," n.d.)

The Stakeholders

The WPI Office of Sustainability, WPI students, and faculty are the primary stakeholders for this project. The WPI Office of Sustainability will be the recipients of the platform and responsible for platform maintenance once our iteration of the project is over. WPI's students and faculty are the intended users for the platform. WPI's entire community will benefit from this project as an increase in sustainability knowledge will allow for WPI's sustainable practices to increase and allow us to have a greener campus, both minimizing WPI's footprint while saving WPI money.

This project can be beneficial to other universities as increasing sustainability in curricula can be extended to all universities, whether they are currently sustainably focused or not. Other universities can take inspiration from the course categorizations on our platform, and their professors can use the resources on our site to begin integrating sustainability into their curricula.

Overall, this project has the potential to help the world. Educating the youth in sustainability topics will provide them with another tool to combat global issues.

Sustainability Tracking, Assessment and Rating System

The Sustainability Tracking, Assessment and Rating System, STARS, is a sustainability benchmarking tool used by many North American universities. The tool quantifies a university's sustainability practices and provides a sustainability ranking on a score from bronze to platinum. WPI currently has a gold star, which puts the university in the top 40% of currently rated schools. STARS focuses on five different categories of criteria to determine university scores. ("About STARS," n.d.)

1. The first category assessed in STARS is **ACADEMICS**. Academics focuses on both the curriculum and research within a university.

2. The second category is **ENGAGEMENT**, which is comprised of both campus-wide and public engagement.

3. University **OPERATIONS** form the third category, including air/climate, buildings, energy, dining, grounds, waste, water, and transportation.

4. **PLANNING AND ADMINISTRATION** encompass the four category, focusing on coordination, planning, diversity, affordability, investment, finance, and wellbeing.

5. The final category for assessment is **INNOVATION AND LEADERSHIP**.

("About STARS," n.d.)

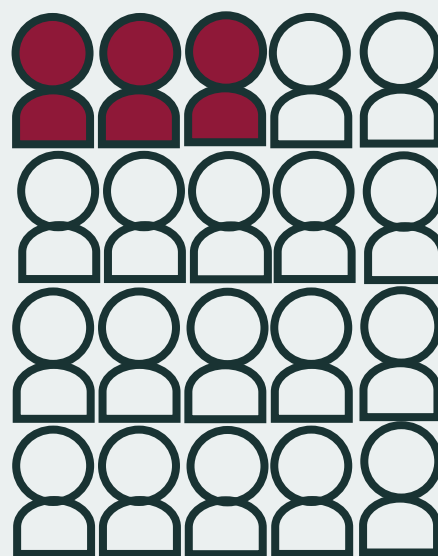
In order to map sustainability in curricula, our project focused on the first category: Academics. As part of the Academics assessment, WPI must submit a list of sustainability themed courses categorized that are either sustainability related or sustainability focused ("About STARS," n.d.).

Sustainability Themed Courses

STARS awards points for courses classified as either sustainability related or sustainability focused. STARS recommends starting with a keyword search to begin categorizing courses, followed by a manual review ("Academic Courses," n.d.). At WPI, this process is completed by one of the Office of Sustainability's student interns. The intern categorizes the courses manually by reading each course description in the course catalog and uses their perception of sustainability to categorize the courses. After the preliminary list is complete, the Director of Sustainability at WPI approves the list for validity. The courses are categorized according to the following STARS definitions:

-Sustainability Related courses' descriptions appear to cover sustainability topics without sustainability being the focus of the course. WPI's 2019/2020 course catalog has **117 Sustainability Related Courses**.

-Sustainability Focused courses' descriptions display an evident course focus on sustainability topics. WPI's 2019/2020 course catalog has **18 Sustainability Focused Courses**.



3 out of 20

Since our project treated both sustainability related and focused courses equally, we will be referring to both sets of courses together as 'sustainability themed' courses. **Professors knew their course was recognized by WPI as a sustainability themed course**

One of the challenges with the current process of categorizing a course as sustainability themed is that the faculty member teaching the course is not integrated in the process. We focused on 20 of the sustainability themed courses offered in the D20 term. When queried, only 3 out of 20 professors teaching these courses knew their course was identified as 'sustainability themed'.

Communicating sustainability course offerings with faculty and students is difficult due to the vagueness of term 'sustainability themed'. We wanted to provide a more defined breakdown of the sustainability topics covered in these courses, as sustainability has many different aspects.

Sustainable Development Goals

We chose to categorize the sustainability themed courses according to the United Nations' Sustainable Development Goals (SDGs). The SDGs are 17 goals that were announced as part of the 2030 Agenda for Sustainable Development ("Sustainable Development Commission. History of SD" n.d.). We chose to use these goals as categories for mapping sustainability because these goals encompass a wide array of topics across the three branches of sustainability: social, economic, and environmental. We believe that each sustainability themed course should relate in some way to one or more SDG. The Office of Sustainability has also expressed interest in promoting the SDGs in curricula.

SOCIAL ISSUES



ECONOMIC ISSUES



ENVIRONMENTAL ISSUES.



(United Nations, 2018)

The Sustainable Development Goals are an integral part of our platform design for both students who are searching for sustainability themed courses to take, as well as faculty working to integrate sustainability into course curricula.

Designing the Platform

For the Students

We wanted to provide students with a platform that allows them to search for sustainability themed courses that fit both their degree requirements and personal interests. Many students at WPI want to take sustainability related curriculum, but those in majors removed from sustainability may not realize the number of sustainability themed courses that accommodate their graduation requirements. The 'Sustainability Themed Courses' page of the platform provides students a list of all classes that relate to the global Sustainable Development Goals. This list of courses was provided to us from the WPI Office of Sustainability. A screenshot of our student page is seen below.

Sustainability Themed Courses

This page contains a listing of WPI's sustainability themed courses. You can search for a specific course using the search bar on the right, or use the 'Course Filters' column to search for specific sustainability topics or subjects. Please note: by default all filters are selected, so in order to search for a specific topic or subject one should hit deselect all topics and then select the one they are interested in.

2

Course Filters

3

SDGS

DEPARTMENT

SELECT ALL

SELECT NONE

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Course Table

4

Search

Name	Subject	Number
ARCHITECTURAL GRAPHICS AND COMMUNICATION	AREN	3002
ENGINEERING INNOVATION AND ENTREPRENEURSHIP	ETR	1100
HYDRAULICS	CE	3062
INTRODUCTION TO CONTEMPORARY ELECTRIC POWER SYSTEMS	ECE	3500
SCIENCE-TECHNOLOGY POLICY	GOV	2302

The 'Sustainability Themed Courses' page contains 4 main elements:

- 1 List of All Sustainability Themed Courses
- 2 Sustainable Development Goal Filter Bar
- 3 Department Filter Bar
- 4 Search Bar for Keyword Filtering

Designing the Platform

Student User Functionality

A student user has many different interaction options within the 'Sustainability Themed Courses' page. These options are designed to help the student find courses fitting both their interests and their graduation requirements.

Sustainable Development Goal Filter

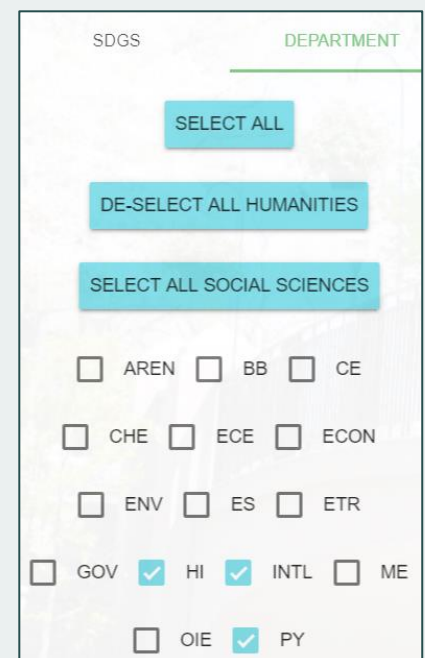
A student user can select the sustainability topic(s) they are interested in by clicking the corresponding image(s). All selected sustainability topics will remain bright and the rest will be shadowed. As the student selects their preferred topics, the course list will update to include courses that match their selection. The filter auto selects all sustainability topics by default in case a student has no strong preference for a specific topic.

The relevant SDGs for the sustainability themed courses offered in D20 were provided by the professors teaching those courses. The SDG designations are shown on the 'course specifics' pop-up. In order to present the Office of Sustainability's full course list, SDG topics were estimated for all other sustainability themed courses. Providing the sustainability topics covered in all courses without estimates would require responses from all professors.



Department Filter

Our platform allows students to filter all the sustainability themed courses by department. This allows the student to find courses that relate to sustainability while also fulfilling their graduation requirements. For example, students could filter the list of courses by humanities as all WPI students need to complete a humanities requirement. Students can also filter more specifically by subjects within the humanities and social sciences departments.



Designing the Platform

Student User Functionality

Course Specifics

Once the student finds a course that suits their interest, they can click on it to view more information. A pop-up including information such as the course description and the sustainability topics covered in the course will appear. A pop-up example is provided below.

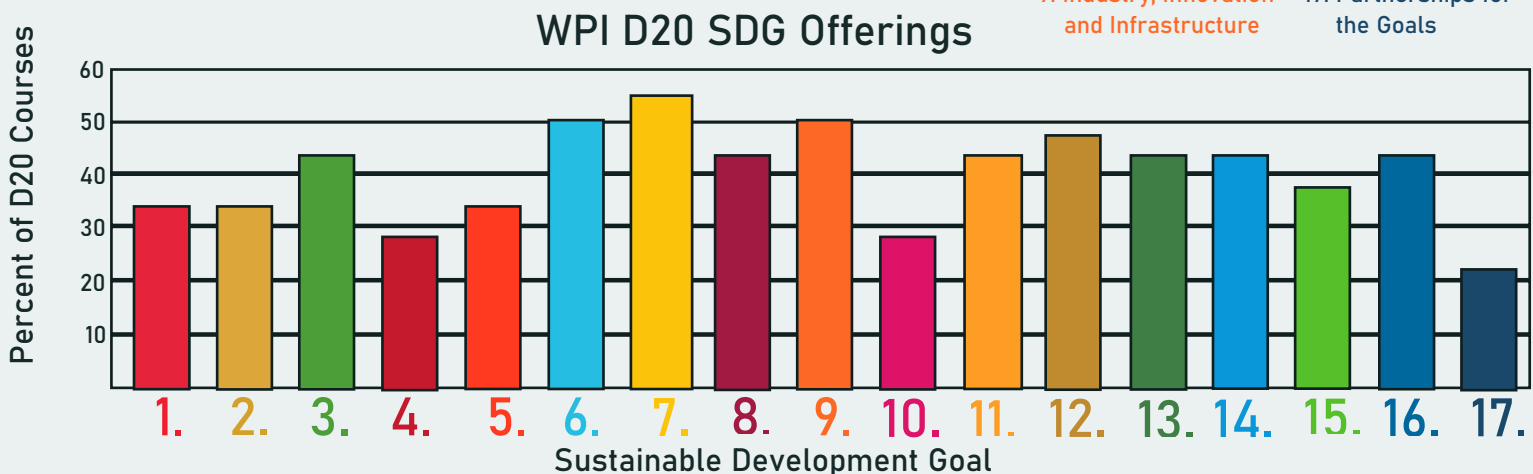


D20 Course Offerings

Through our interviews with faculty, we determined the proportion of each SDG covered in the courses in our D20 sample. SDG 7: Affordable and Clean Energy had the highest offering percentage, whereas SDG 17: Partnerships for the Goals had the lowest. Each of the 17 goals were covered in between 21 and 54 percent of all D20 sustainability themed courses.

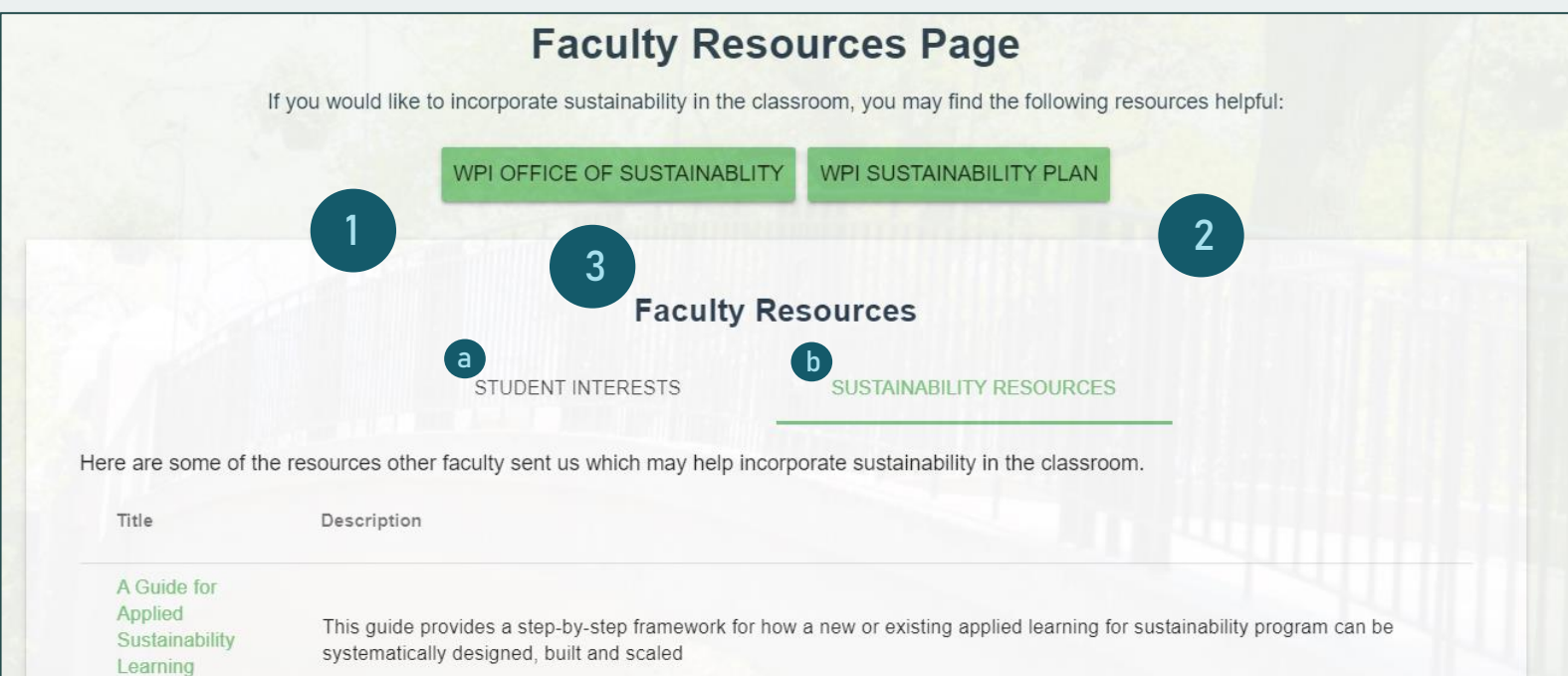
Number Key

- | | |
|--|--|
| 1. No Poverty | 10. Reduced Inequalities |
| 2. Zero Hunger | 11. Sustainable Cities and Communities |
| 3. Good Health and Well Being | 12. Responsible Consumption and Production |
| 4. Quality Education | 13. Climate Action |
| 5. Gender Equality | 14. Life Below Water |
| 6. Clean Water and Sanitation | 15. Life on Land |
| 7. Affordable and Clean Energy | 16. Peace, Justice and Strong Institution |
| 8. Decent Work and Economic Growth | 17. Partnerships for the Goals |
| 9. Industry, Innovation and Infrastructure | |



For the Faculty

Many WPI faculty do not currently cover sustainability topics in their courses. We believe these faculty are in one of two situations: (1) they do not know sustainability can be incorporated into their course or (2) they wish to cover sustainability and do not know how. If faculty do not know how to educate students on sustainability, the students will never be introduced to the content. Therefore, our platform provides faculty with existing WPI resources to assist them in providing quality content that relates to the Sustainable Development Goals. A screenshot of the faculty page is seen below.



The opening page of the Faculty Resources page contains 3 main elements:

- 1** Shortcut Link to the WPI Office of Sustainability's Page
- 2** Shortcut Link to the current WPI Sustainability Plan
- 3** The Faculty Resources
 - a. Student Interests
 - b. Sustainability Resources

We interviewed 9 different WPI faculty members that are currently teaching courses WPI recognizes as sustainability themed. Interviewees were asked about resources they currently use to gather sustainability content for their course. Resources they shared with us, as well as resources provided from the WPI Office of Sustainability, are available on the platform under the 'Sustainability Resources' tab of the 'Faculty Resources.'

Designing the Platform

Within the Faculty Resources

Faculty Resources

STUDENT INTERESTS

SUSTAINABILITY RESOURCES

Here are some of the resources other faculty sent us which may help incorporate sustainability in the classroom.

Title	Description
A Guide for Applied Sustainability Learning Projects	This guide provides a step-by-step framework for how a new or existing applied learning for sustainability program can be systematically designed, built and scaled
A focus on sustainability as a core value	An article that describe links between IE approaches to problem-solving and facility layout
Engineering Unleashed	Engineering Unleashed is a network of thousands of engineering faculty just like you, working to unleash undergraduate engineers so that they can create personal, economic, and societal value through the entrepreneurial mindset.
Development Economics: Theory, Empirical Research, and Policy Analysis	Theory Empirical Research and Policy Analysis by Julie Schaffner offers a means to think about development and policy in a way that is disciplined by economic theory and informed by empirical research. The main goal of this text is to get readers to think rigorously using tools of economic analysis. This text will help to define development objectives, understand the development process, identify potential barriers to development, design candidate development interventions, and analyze the multidimensional impact of theory, empirical research and policy analysis within the study of economic development.

Sustainability Resources

Our platform allows faculty to view the shared resources we gathered throughout our project. These resources include “A Guide for Applied Sustainability Learning Projects,” which provides insight into designing a sustainability program, “Engineering Unleashed,” a faculty network sharing resources to integrate sustainability topics into curricula, and more. We found that most of the resources professors gathered for their courses were specifically tailored for their class size and subject matter. For our platform, we chose to publish resources that were more general starting points for integrating sustainability in curricula.

Student Interests

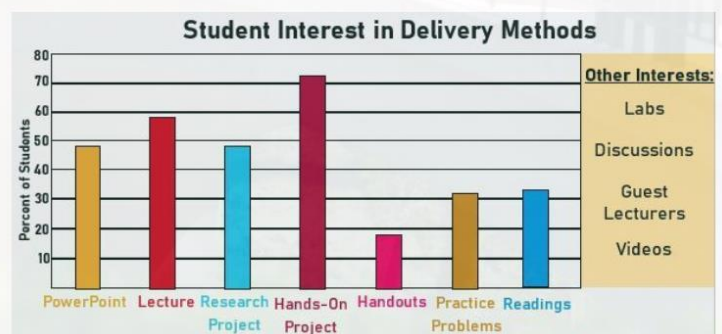
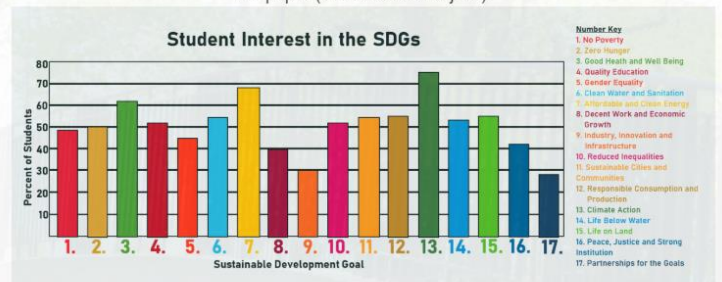
Our platform displays the results we found after surveying 101 students who were distributed among 11 different sustainability themed courses in D20. We provide faculty with information regarding student interest in learning about specific Sustainable Development Goals and their desired delivery methods. Further analysis on our discoveries are found on the following pages.

Faculty Resources

STUDENT INTERESTS

SUSTAINABILITY RESOURCES

We surveyed 101 students across 11 sustainability themed courses to learn about their interests in specific Sustainable Development Goals and their desired delivery methods. We received the following results. To read more about our findings and methodology, see our paper (in 'About the Project').

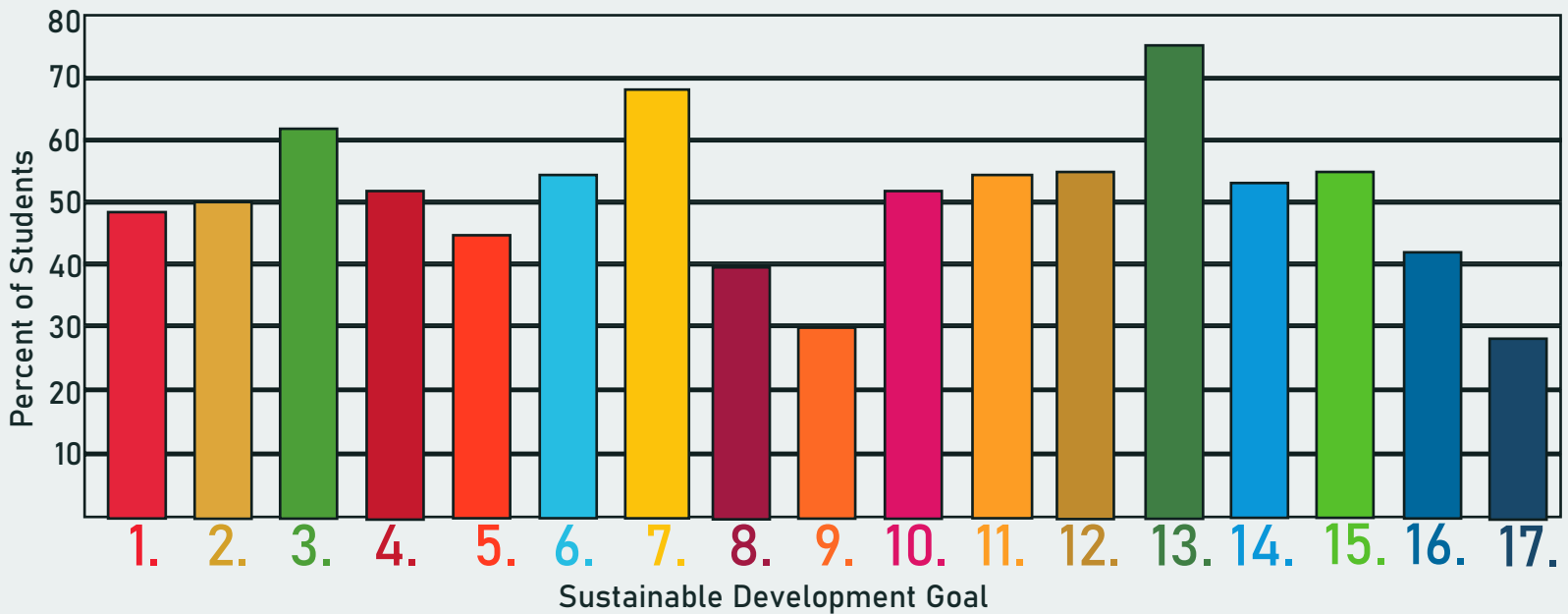


Designing the Platform

Student Interest

We wanted to provide faculty with the student interest in specific sustainability topics as faculty designing new sustainability themed content might want to know what topics students are interested in.

Student Interest in the SDGs



Number Key

1. No Poverty
2. Zero Hunger
3. Good Health and Well-Being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice and Strong Institution
17. Partnerships for the Goals

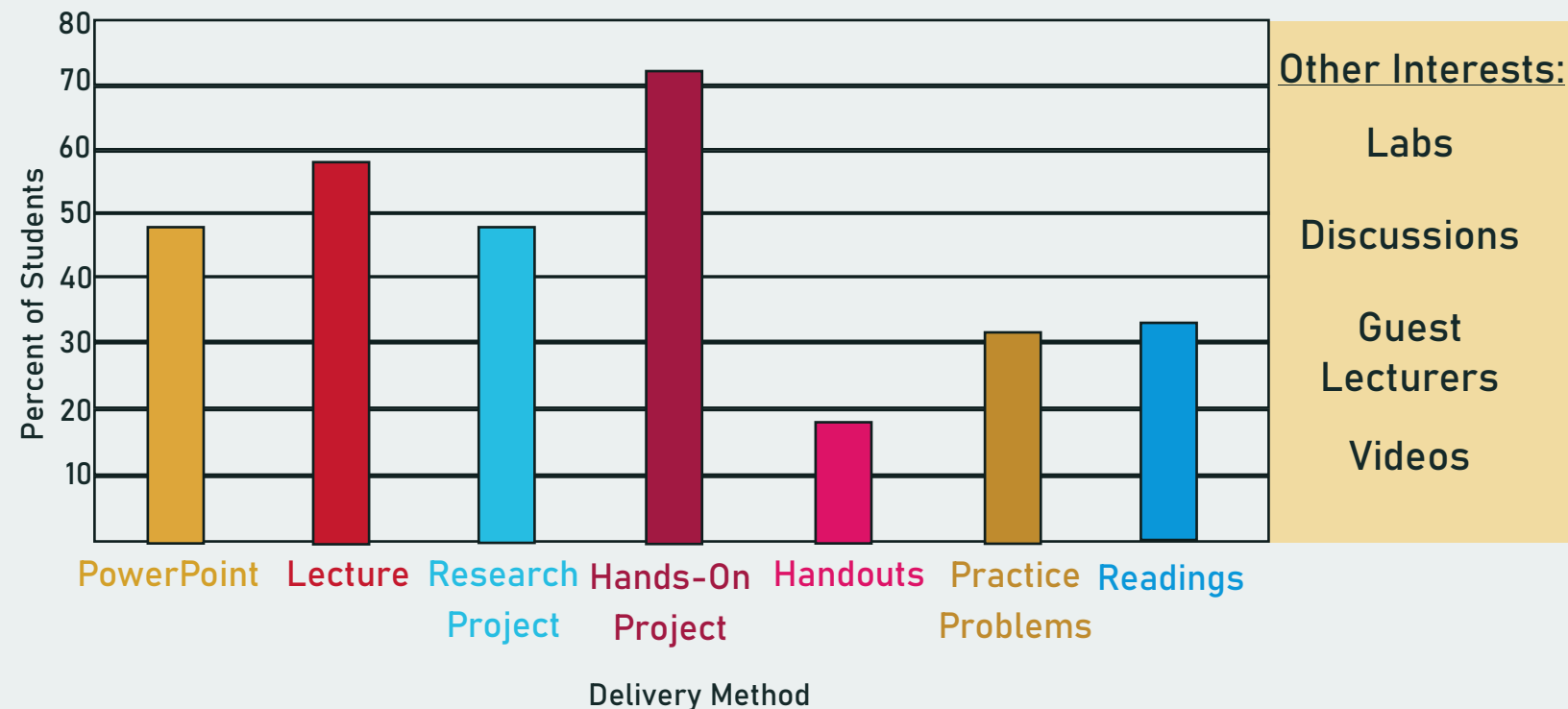
The data collected depicts a large overall interest in learning about sustainability topics. The top three SDGs of interest were (13) Climate Action, (7) Affordable and Clean Energy, and (3) Good Health and Well-Being. Although these students came from courses in 6 different WPI departments, they all seemed to have an interest in learning about sustainability topics. One potential bias in these counts could be our student sample, as we only surveyed students already taking a sustainability themed course. Although we only surveyed students taking sustainability themed courses, we anticipate that an interest in sustainability topics can be extrapolated to the entire WPI student body as several of these courses were not publicly advertised as covering sustainability.

Designing the Platform

Student Interest

We wanted to provide faculty with the students' preferred delivery methods for SDG content, as faculty designing new sustainability themed content might want to know how the students prefer to learn about sustainability.

Student Interest in Delivery Methods



Students appeared to be most interested in using hands-on projects to learn about sustainability. This fits well into the theme of WPI and its project-based curriculum. Handouts and practice problems seem to be the least popular delivery methods. Although this method is less attractive than projects, these methods would be ideal for courses where it is more difficult to integrate project-based work. In future survey deployments, this question should be asked with a ranking system, as in our survey a student could select multiple options but could not state preference.

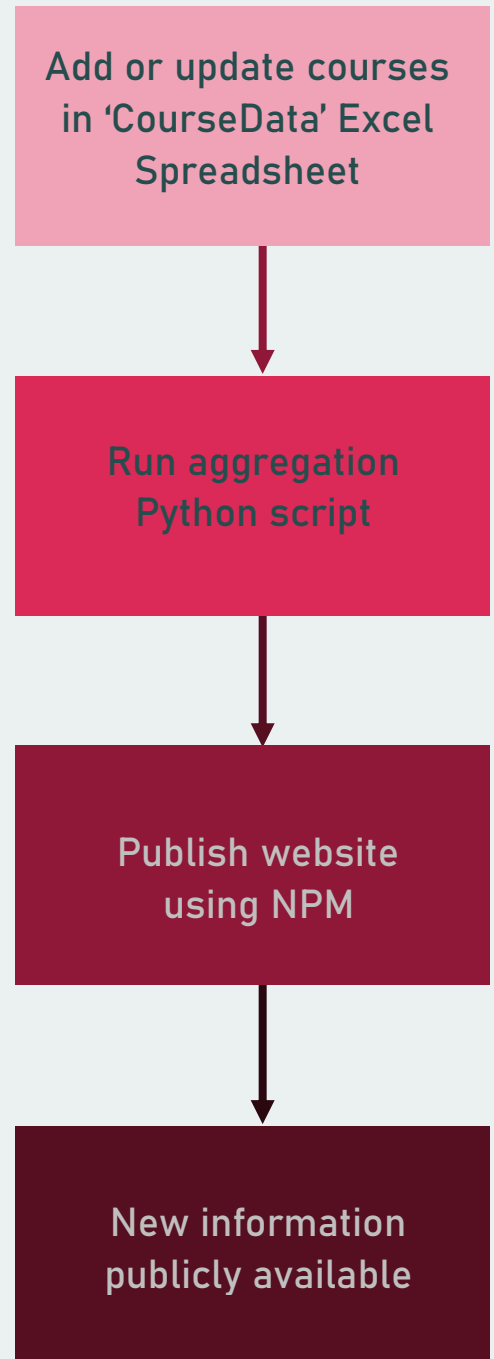
Sustaining the Platform

One of our primary goals with this IQP was to make a platform that was not only relevant for this current term, but one that could be updated to reflect changes in course information.

To ensure the information remained up to date and easy to update, we created a defined set of steps for the Office of Sustainability to follow. The course information will be compiled into an Excel sheet mirroring the information the Office already collects for STARS. Once the sheet is updated, the Office can run a Python script which will convert the Excel sheet into a format the website can read, then the website can be republished to incorporate new course data.

Since we chose to focus on the D20 professors teaching the sustainability themed courses, we were unable to get official SDG topics for every course that WPI classifies as sustainability themed. Instead, we chose to include an estimate for SDG topics covered in all other course at the recommendation of our sponsors. These estimates are displayed on the 'Sustainability Themed Courses' page of our platform. Courses with estimated SDG topics include a disclaimer in their individual "Course Specifics" pop-up.

Updating the Platform



Through our work, we have created a set of recommendations for three WPI groups to complete:

WPI Office of Sustainability

Future IQP Teams

WPI Community

For the WPI Office of Sustainability

1

Interviews revealed that most faculty members were not aware of WPI's categorization of sustainability themed courses. Additionally, some faculty members taught courses they believed to be sustainability themed but were not officially categorized as such.

We recommend that the Office of Sustainability publicize the list of sustainability themed courses to WPI faculty members annually.

2

Currently, there is no clear protocol or procedure for faculty or administrators who wish to add a course to the current list of sustainability themed courses or who wish to remove a course from the current list of sustainability themed courses.

We recommend creating, implementing, and marketing a clear protocol and procedure for faculty or administrators to follow if they would like to add a course, or delete a course, from the current sustainability themed course list.

3

Professors are not required to include sustainability in their courses, therefore not enough professors are creating or teaching sustainability themed courses or including sustainability modules within a course.

We recommend providing an incentive to faculty who offer sustainability themed courses or modules within a course and celebrate the faculty who currently offer sustainability themed courses and modules.

4

An updated list of sustainability themed courses and the specific sustainability topics that are taught does not currently exist. Topics that have been reported through our research can vary if the professor of a course changes.

We recommend creating a policy, procedure and/or management system for the purpose of regularly updating the specific content covered in classes listed on the sustainability themed course list.

Final Recommendations

For a Future IQP Team

1

A reality at every university is that professors have differing teaching styles, reputations and use varying teaching modalities and techniques. Students are aware of these realities which can, in turn, serve as a factor during course registration.

We recommend that a future IQP project create a listing of faculty members and their particular style of teaching to be added to the sustainability themed courses table on the platform. It would be prudent to devise a process and procedure for regularly updating this aspect of the sustainability themed courses list.

2

WPI students face restrictions in deciding when to take particular courses dependent on what term(s) courses are offered. The sustainability themed courses platform does not currently distinguish between offered terms of courses.

We recommend that a future IQP project create an additional filter that allows students to view the courses taught in particular terms. This information will also require a process and procedure for annually updating this aspect of the sustainability themed courses list.

3

While the current sustainability themed courses platform provides information on which sustainability topics are referred to in a particular course it does not provide specific information on the depth or breadth of the information taught in the course.

We recommend that a future IQP project evaluate the depth and breadth, as well as the effectiveness, of the sustainability topics being taught in each class (See appendix 5)

For the WPI Community

1

Students are not aware of the sustainability themed courses available.

We recommend a set of strategies to include, (1) Residential Advisors (RA) and Community Advisors (CA) introduce the sustainability course platform at New Student Orientation, (2) market the sustainability platform throughout the University in the University newspaper, and (3) that the Admissions Office market the availability sustainability themed classes to prospective students.

Overall, with the Sustainable Studies Platform, WPI will have improved communications between the Office of Sustainability and the community, spreading sustainability knowledge throughout campus.

Our Remote IQP Experience



Photo taken Pre-Remote Learning

Emily Baker

Through my work on this IQP, I feel like I proved to myself how adaptable I can be in various situations. Having to cancel my plans to go to Worcester, UK and completely shifting project ideas was never something I anticipated, but I surprised myself with how our team regrouped and shifted focus to a remote project that will hopefully help WPI in the future. I am proud to know that I can handle my own when faced with confusing, unfamiliar situations. The biggest goal I had for IQP was to complete a project that would be helpful to someone, and I feel we succeeded in helping not only the WPI Office of Sustainability, but also the entire WPI community.

Rui Huang

Before this term started, I thought it would be impossible to complete a great project through only virtual meetings. However, we overcame the difficulties and still worked well. I am proud of how well we cooperated to make a good project during this time. And I am also glad that our platform could help the WPI community to know more about sustainability.

Akash Shaji

Although our original IQP got canceled, this new project allowed me to work on an issue closer to home while simultaneously practicing and learning new software engineering principles. Doing IQP remotely has taught me the intricacies of working in our increasingly digital world, and I hope to apply this knowledge in my post graduate years. Overall, this project was an unexpected but rewarding experience.

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Appendix 1: WPI List of Sustainability Themed D20 Courses

Below is a chart containing the D20 Courses on the WPI Office of Sustainability's Sustainability Themed Courses List. This List contains all of the D20 courses on the list, as well as the SDG topics covered on our platform, if the professor knew their course was sustainability themed (ST), if we interviewed them, and if we surveyed the current students in the course.

Course Title	SDG Topics Covered in Course																	Knew Course was ST?	Interviewed	Surveyed Students
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
ARCHITECURAL GRAPHICS AND COMMUNICATION																				
CHEMICAL PLANT DESIGN PROJECT																				
DESIGN AND OPTIMIZATION OF THERMAL SYSTEMS																				
DEVELOPMENT ECONOMICS																				
ECOLOGY, ENVIRONMENT, AND ANIMAL BEHAVIOR																				
ENGINEERING INNOVATION AND ENTREPRENEURSHIP																				
ENVIRONMENTAL ENGINEERING LABORATORY																				
GLOBAL ENVIRONMENTAL POLITICS																				
HAZARDOUS AND INDUSTRIAL WASTE MANAGEMENT																				
HUMANITARIAN ENGINEERING: PAST AND PRESENT																				
HYDRAULICS																				
INTRODUCTION TO CONTEMPORARY ELECTRIC POWER SYSTEMS																				

Color Key:

SDG Topic(s) Reported by Professor

SDG Topic(s) Estimated by Team

Answered Yes

Answered No

Answer Unknown

Course Title	SDG Topics Covered in Course																	Knew Course was ST?	Interviewed	Surveyed Students
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
PHILOSOPHY AND THE ENVIRONMENT																				
PLANT DIVERSITY																				
SCIENCE-TECHNOLOGY POLICY																				
SENIOR SEMINAR IN ENVIRONMENTAL STUDIES																				
SOCIAL ENTREPRENEURSHIP																				
THE GREEN ECONOMY AND MODELS FOR ALTERNATIVE FORMS OF DEVELOPMENT.																				
TOPICS IN ASIAN HISTORY																				
TOPICS IN ENVIRONMENTAL HISTORY																				
TOPICS IN GLOBAL STUDIES																				
TOPICS IN PHILOSOPHY																				
TRANSPORT & TRANSFORMATIONS IN THE ENVIRONMENT																				
WORK SYSTEMS AND FACILITIES PLANNING																				

Color Key:

SDG Topic(s) Reported by Professor

SDG Topic(s) Estimated by Team

Answered Yes

Answered No

Answer Unknown

Appendix 2: Student Survey

Questions

Below are the survey questions that were distributed to each of the 11 courses surveyed. Each course was given the survey by their professor and did not have any interactions with the IQP team. These surveys were given out during weeks 4 and 5 of the remote term, therefore results on questions 1, 2, and 3 were removed from analysis and publication. These courses are again seen on the recommended survey for evaluating the effectiveness of the sustainability in the curriculum for a future IQP team. A copy of the Qualtrics form can be found here: http://wpi.qualtrics.com/jfe/form/SV_3XfnFo7sdw7tSKx

Question 1:

The United Nations proposed 17 Sustainable Development Goals to preserve peace and prosperity for people and the planet. These goals can be best understood through the graphics below.

Which goal(s) relate to the topics that were covered in this course? Check all that apply.

Answer Options:

- | | |
|---|---|
| GOAL 1: No Poverty | GOAL 10: Reduced Inequality |
| GOAL 2: Zero Hunger | GOAL 11: Sustainable Cities and Communities |
| GOAL 3: Good Health and Well-being | GOAL 12: Responsible Consumption and Production |
| GOAL 4: Quality Education | GOAL 13: Climate Action |
| GOAL 5: Gender Equality | GOAL 14: Life Below Water |
| GOAL 6: Clean Water and Sanitation | GOAL 15: Life on Land |
| GOAL 7: Affordable and Clean Energy | GOAL 16: Peace and Justice Strong Institutions |
| GOAL 8: Decent Work and Economic Growth | GOAL 17: Partnerships to achieve the Goal |
| GOAL 9: Industry, Innovation and Infrastructure | None |

Question 2:

How did the professor cover the sustainability topics? Check all that apply.

Answer Options:

- | | |
|-------------------|---------------------------|
| PowerPoints | Lectures |
| Handouts | Research-Based Projects |
| Practice Problems | Hands-On Projects |
| Readings | Other (fill in the blank) |

Question 3:

How would you best describe this course:

Answer Options (multiple choice):

- Completely Theory-Based
- Mostly Theory Based
- Equal Theory and Practice
- Mostly Practiced-Based
- Completely Practice Based

Question 4: What sustainability topics are you interested in learning about? Check all that apply.

Answer Options:

- | | |
|---|---|
| GOAL 1: No Poverty | GOAL 10: Reduced Inequality |
| GOAL 2: Zero Hunger | GOAL 11: Sustainable Cities and Communities |
| GOAL 3: Good Health and Well-being | GOAL 12: Responsible Consumption and Production |
| GOAL 4: Quality Education | GOAL 13: Climate Action |
| GOAL 5: Gender Equality | GOAL 14: Life Below Water |
| GOAL 6: Clean Water and Sanitation | GOAL 15: Life on Land |
| GOAL 7: Affordable and Clean Energy | GOAL 16: Peace and Justice Strong Institutions |
| GOAL 8: Decent Work and Economic Growth | GOAL 17: Partnerships to achieve the Goal |
| GOAL 9: Industry, Innovation and Infrastructure | None |
| | Other (fill in the blank) |

Question 5:

What delivery methods would you like the professor to use to cover sustainability topics? Check all that apply.

Answer Options:

- | | |
|-------------------|---------------------------|
| PowerPoints | Lectures |
| Handouts | Research-Based Projects |
| Practice Problems | Hands-On Projects |
| Readings | Other (fill in the blank) |

Appendix 2: Student Survey

Results

Course Title	Number of Students Interested in Sustainable Development Goals																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Social Entrepreneurship	8	7	7	7	6	6	7	8	8	7	6	7	10	4	3	4	5
Topics in Philosophy	3	3	4	3	2	3	3	2	2	4	3	3	4	2	2	2	2
Development Economics	3	3	2	2	2	3	2	2	2	2	1	2	2	1	0	2	0
Humanitarian Engineering: Past and Present	1	2	2	2	1	1	1	1	2	1	1	1	2	1	1	1	1
Environmental Engineering Laboratory	0	1	1	2	1	2	2	0	0	0	2	3	2	2	1	0	1
Ecology, Environment, and Animal Behavior	23	22	29	22	18	27	32	17	9	24	25	23	29	24	29	18	10
Plant Diversity	5	6	9	6	7	8	11	4	3	7	7	10	15	10	10	7	5
Senior Seminar in Environmental Studies	6	6	8	7	7	6	9	6	4	7	8	6	9	8	8	7	4
Global Environmental Politics	1	2	2	2	2	2	3	1	1	1	3	2	3	3	3	2	1
Philosophy and the Environment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plant Design Project	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Course Title	Delivery Methods							
	PowerPoint	Lecture	Research-Based Projects	Other	Hands-On Projects	Handouts	Practice Problems	Readings
Social Entrepreneurship	7	6	6	0	8	2	4	3
Topics in Philosophy	1	3	1	1	3	0	0	4
Development Economics	1	1	2	0	3	0	1	1
Humanitarian Engineering: Past and Present	2	1	2	0	2	1	1	1
Environmental Engineering Laboratory	3	3	3	1	3	1	2	1
Ecology, Environment, and Animal Behavior	21	29	26	1	35	8	18	13
Plant Diversity	11	11	5	0	11	4	5	5
Senior Seminar in Environmental Studies	3	5	3	1	6	1	2	6
Global Environmental Politics	2	3	3	0	2	0	0	2
Philosophy and the Environment	0	0	0	0	0	0	0	0
Plant Design Project	0	0	0	0	0	0	0	0

Other Write Ins:

Videos

Guest Lecturers

Labs

Discussions

Appendix 3: Faculty Interview Questions

Below are the semi-structured interview questions that we asked 9 WPI professors that were currently teaching courses on the D20 Sustainability Themed Courses List. These questions were asked over a Zoom meeting, apart from 2 professors that were asked via email.

The United Nations has developed 17 sustainability goals called the Sustainable Development Goals. Which of these goals' topics do you cover in your course? *we provided an infographic of the Sustainable Development Goals for reference*

Are there any additional courses you teach that cover sustainability topics?

What made you decide to include those topics in your course (is it required by department)?

What delivery methods do you use to cover those topics?

What resources do you use to gather content for the course (library, online, etc.)?

What resources do you wish were more readily available for teaching sustainability?

Appendix 4: Platform Guide

Below is the READ ME guide from our GitHub for updating the platform. This is available at this link: <https://github.com/Ryc1x/sustainable-info>

About the Project

This project is developed with `vue` 2.6 and managed with `NPM`.

- Setup
- Updating the Curricula Listing
- Deployment

Setup

Install Dependencies

To run the project, you first need to install necessary dependencies via `npm`:

```
npm install
```

Compiles and hot-reloads for development

Then you can serve the project locally:

```
npm run serve
```

(The default URL used is: <http://localhost:8080/>)

Compiles and minifies for production

You can then generate production code, containing necessary files for deploying the website.

```
npm run build
```

(This command will generate a `dist` file under the root directory)

Updating the Curricula Listing

In order to update the curricula listing, all one has to do is modify `CourseData.xlsx` and run the following command. This requires having Python 3 installed.

```
python3 updateCourses.py
```

Deployment

To host the website for public access, you need to host the production files under `dist` directory. We are using GitHub Pages to host this lightweight front-end webpage ([Link](#)). You may choose to use any website hosting service though.

Deployment using GitHub Pages

Please refer to this [tutorial](#) for a full deployment guide.

To deploy the project, navigate to `deploy.sh`, change the file (line 20/23 specifically) accordingly and run the following command:

```
bash deploy.sh
```

Then navigate to your GitHub Pages site, the website should be deployed successfully.

Additional Information

Helpful Links

<https://vuejs.org/>

<https://cli.vuejs.org/>

<https://vuematerial.io/>

Appendix 5: Student Sustainability Evaluation Survey

Below are the survey questions we recommend using as part of an evaluation of sustainability in curricula.

Question 1:

The United Nations proposed 17 Sustainable Development Goals to preserve peace and prosperity for people and the planet. These goals can be best understood through the graphics below.

Did you learn anything new relating to the SDGs in this course? *(provided SDG graphics)*

Answer Options:

Yes

No

IF YES:

Question 1.1:

Which of the Sustainable Development Goals did you learn about?

Answer Options:

GOAL 1: No Poverty

GOAL 2: Zero Hunger

GOAL 3: Good Health and Well-being

GOAL 4: Quality Education

GOAL 5: Gender Equality

GOAL 6: Clean Water and Sanitation

GOAL 7: Affordable and Clean Energy

GOAL 8: Decent Work and Economic Growth

GOAL 9: Industry, Innovation and Infrastructure

GOAL 10: Reduced Inequality

GOAL 11: Sustainable Cities and Communities

GOAL 12: Responsible Consumption and Production

GOAL 13: Climate Action

GOAL 14: Life Below Water

GOAL 15: Life on Land

GOAL 16: Peace and Justice Strong Institutions

GOAL 17: Partnerships to achieve the Goal

Question 2:

In this course, what are [three | five] aspects relating to the Sustainable Development Goals you've learned that you didn't know before.

Question 3:

Based on what you've learned in this class, are you thinking about changing your behavior relating to the Sustainable Development Goals?

Question 4:

Based on what you've learned in this class, have you changed your behavior relating to the Sustainable Development Goals?