



Integrating Sustainability Engineering into Second-Year Composition

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Abstract

Community colleges are currently facing several challenges, namely 1) increasing the number of students successfully completing STEM degrees, 2) increasing the number of transfers between community colleges and four-year institutions in STEM majors, and 3) increasing the overall technical ability of the current workforce. As more community colleges offer engineering and engineering technology, they must also look for ways to increase student participation and retention within STEM and STEM-related fields that are feasible given cost and personnel limitations. One way our community college is attempting to address these issues is by integrating sustainability engineering into a required second-year composition course.

The course emphasizes strategies and techniques for developing research-based expository and persuasive texts. Within this course, students are exposed to primary and secondary research methods, documentation of sources, critical reading and analysis of sources, and critical thinking about evidence and conclusions. In the past, this course has examined literature texts (short stories and poetry) as the basis for student research. However, the combination of course objectives and range of topics, research, and viewpoints within sustainability engineering provides an opportunity to engage students in STEM topics while still delivering required skills.

Naturally, changing this well-established course presented obstacles and trials, from student registration to curriculum development. This course is open to any student who is a STEM major, has an interest in any STEM field, or has a specific interest in sustainability. However, this meant that even our advisors needed some clarification as to the definitions of STEM and sustainability in order to register students that would benefit from this course. The course was taught using a team-based approach, with one faculty member from English and one from Engineering, combining both areas of expertise in the classroom. Additionally, there was a shift from using MLA style to APA style citations. Furthermore, students were allowed to choose their own topic, such as Green Building or Bottled Water versus Tap Water, so that they could take ownership of their work and peak their interest in STEM topics, courses, and majors. The effectiveness of this course is based on both its ability to meet its learning objectives and its ability to engage students in sustainability topics, projects, and career choices. Both classroom discussions and major assignments served as the basis for course assessment and revision of this course.

1.0 Introduction

The focus of this paper is to assess the use of Sustainability Engineering within a Composition II course to increase the ability of students to take ownership of their work, to increase students'

ability to develop research-based expository and analysis essays, and to increase their exposure to STEM-related issues and careers. This endeavor was prompted by a desire to better meet the educational needs of our diverse student population within our current constraints. Our student body typically consists of 2,400 students each semester. Those students are normally earning their associate's degree or a certificate under one of more than 60 degree plans or are earning credits prior to transferring to a four-year institution to complete their bachelor's degree. Our college is also facing the same challenges that other community colleges are currently facing, namely 1) increasing the number of students successfully completing STEM degrees, 2) increasing the number of transfers between community colleges and four-year institutions in STEM majors, and 3) increasing the overall technical ability of the current workforce. In response to these challenges, we offered a pilot course for Composition II that has integrated Sustainability Engineering. This pilot course would combine the required course objectives of Composition II and the range of topics, research, and viewpoints within Sustainability Engineering to engage students in STEM topics. The integration of Sustainability Engineering within a required Composition II course would allow non-STEM students to be exposed to STEM issues, allow STEM students to consider and question their own professional options, and allow students to engage in current issues instead of traditional literary texts for the basis of their research. This paper will discuss the course development of this pilot course, enrollment challenges, use of existing resources, and outcomes of this pilot course.

2.0 Course Development

This course is one of the required courses in the state's core curriculum for either an associate's or a bachelor's degree. For this reason, there are several sections of this course offered every semester. To maintain a standard of educational excellence, the English faculty have created an outline of the course requirements and deliverables that meets state learning objectives so that each student receives a quality experience. Within the outline of all Composition II courses, students are expected to explore techniques for developing research-based expository and analysis essays. They are exposed to primary and secondary research methods, required to learn documentation of sources, required to perform critical reading of sources, and to think critically of evidence and conclusions. The pilot course and any subsequent offerings of the course must also work within these constraints.

Typically students within the current Composition II courses perform their assignments using Modern Language Association (MLA) style for citing their sources. They also develop their analysis essays based on literature and poetry. However, there are several issues that encouraged the development of this course at this time, namely, 1) pending changes to the course from the state, 2) the need for our nursing, psychology, and criminal justice students to learn American Psychological Association (APA) style, and 3) the need to help students connect their research to their everyday lives. In light of these considerations, the course required a subject matter that

was relevant to students and that was broad enough to offer ample choices that would allow students to take ownership of their research. It was also noticed by some of our English faculty that it would be an ideal way to expose students to areas in STEM and STEM-related fields, to encourage students to consider their academic and career options in relation to STEM issues, and to encourage life-long learning. For these reasons, the English faculty decided to use the topic of Sustainability and Sustainability Engineering within this course. In order to have sufficient background in this area, the English faculty invited the engineering faculty to team teach this course. In short, as the curriculum was developed, there were three major alterations to this pilot course, as depicted in Figure 1, namely including 1) the use of Sustainability and Sustainability Engineering topics instead of more traditional literature and poetry, 2) the use of American Psychological Association (APA) style, and 3) a team teaching approach to deliver the course.

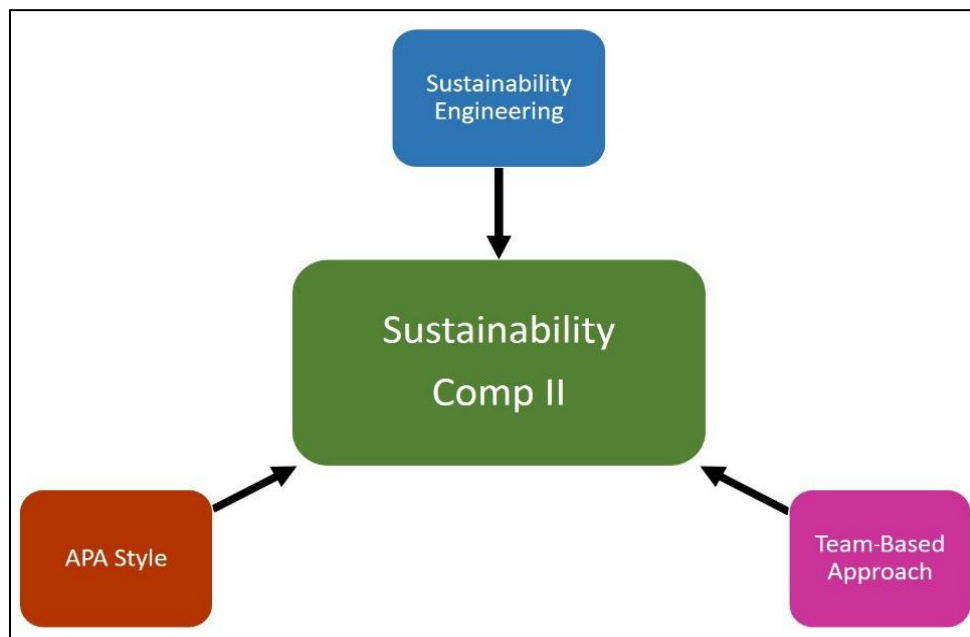


Figure 1. The three major components for the Sustainability-focused Composition II pilot course.

2.1 Modern Language Association versus American Psychological Association

The English faculty successfully teach students how to cite sources each semester. Like most disciplines, they follow the citation style that is appropriate for their subject matter. Their ability to teach the material is not in question. The question our English faculty are facing is how to meet the educational needs of a diverse student body that will seek degrees in social sciences, science, technology, engineering, mathematics, and healthcare. Students entering these fields of study will in most cases need to learn an alternate citation style. Currently, there is a larger number of students within our student body pursuing healthcare and the social sciences. Our student body typically consists of large numbers of nursing students since many of our nursing students plan on transferring to the University of Texas Medical Branch. For this reason, APA

style of citation, which is required for students within nursing, was selected for this pilot course. It should be noted that students entering this course would have already taken Composition I using MLA style. It should also be noted that the focus of the course is still on developing research-based expository and analytical essays, exposure to primary and secondary research methods, documentation of sources, critical reading and analysis of sources, and critical thinking about evidence and conclusions.

2.2 Sustainability and Sustainability Engineering

There are four reasons that the Sustainability and Sustainability Engineering was selected to be incorporated into this pilot course. Firstly, the topic itself is broad enough to allow students enough choice to take ownership of their topic. By allowing students the ability to choose their own topic of interest, the faculty sought to increase student motivation to complete their research and increase their quality of work.¹

Secondly, the topic is of particular interest and relevant to an island community where the health of area beaches, bay, and state parks is critical to our tourism and shipping sectors that constitute the majority of island employment. It would also be relevant to students due to the number of chemical refineries within the county and their subsequent impact on their own quality of life. This is imperative if students, our nation's future workforce, are to become more aware and more involved in the political, economic, and social challenges that surround them.²

Thirdly, using the topics within Sustainability Engineering should engage student interest in completing their research assignments and participation in classroom discussions.³ Furthermore, many issues facing Sustainability Engineering are still being researched, which would provide opportunities for students to see recent research and to cultivate their critical thinking skills.

Lastly, our college is trying to engage more students in activities that will allow them to see the opportunities in STEM and STEM-related careers. By introducing students to Sustainability, students are exposed to a STEM area that has grown tremendously over the last few years as evident by the growth of Sustainability programs across US universities since 2008.⁴ In fact the use of Sustainability across curriculums has been used by other institutions such as Tufts University and Emory University since the 1990's.⁵ A large component of integrating Sustainability across the curriculum depends on the ability of faculty to gain a basic understanding of Sustainability and how it relates to their specific field.⁵

2.3 Team Taught Approach

The rationale for using a team taught approach depends mainly on the need to leverage the existing expertise within the current faculty but also to leverage the use of two viewpoints for classroom and faculty discussion. The English faculty member for this course has offered this course a number of times and is well versed in the requirements set forth by the English Department for this course. As the instructor for this course, she had already developed the basic template for a Composition II course within our learning management system, and most importantly her writing and grammar skills are essential to this course. On the other hand, the Engineering faculty brought a background in Sustainability Engineering, having already offered Introduction to Sustainability courses in the past. She brought information on how STEM careers and STEM-related topics intersect the current career choices held by students and how they could take advantage of STEM opportunities on campus. She also brought an alternate viewpoint to classroom discussions. Typically, the English faculty would assume the role of a layperson to act as the role model to students that even non-STEM people can understand STEM concepts. This emphasized to students that as they enter the workforce they should continue learning and that they will be more valuable to the workforce if they are able to understand and even solve STEM-related problems. Similarly, the Engineering faculty would assume the role of expert and served to demand a high level of work and to play devil's advocate during classroom discussions. Additionally, the two faculty members had the opportunity to evaluate and discuss the results of each class, which was invaluable to this pilot course for assessment of specific assignments and tasks.

2.4 Using Existing Resources

Like the other Composition II courses, the Sustainability Composition II class was able to leverage the services provided by the campus library to learn about the research resources and the services available at our college. In fact, the library staff members set up an entire session within a computer classroom to facilitate this session. Additionally, library staff also participated as guest reviewers during student presentations.

In addition to the sessions with the library staff, students also benefitted from class sessions with the Technology Trainer and meeting the STEM Advisor. During sessions with the Technology Trainer, students learned about PowerPoint presentations, Prezi presentations, website creation, image usage, and copyright law. Indeed the increasing issues of intellectual property on social media is an area that should be taken into consideration by faculty across all disciplines.⁶ These skills were necessary for the completion of their deliverables. Moreover, students now know the STEM advisor is a point of contact should they consider their STEM options within their degree

plans. The Technology Trainer and STEM advisor also participated as guest reviewers during student presentations.

In addition to the participation of the Technology Trainer with the students, the Technology Trainer was also able to provide training to the faculty on the specific classroom equipment, including a tablet that could be passed around the classroom. The equipment was useful in engaging students in citation practice. Students were able to post a sentence with a citation. The rest of the class was then challenged to make corrections using the tablet.

3.0 Course Piloting

This course was piloted during the fall 2013 semester and started with eight students due the previously mentioned enrollment challenges. The distribution of student majors is given in Figure 2. Students were informed of the differences between this pilot course and the other Composition II courses, with all deciding to remain. There are two main areas that formed the course, namely class discussion and student deliverables.

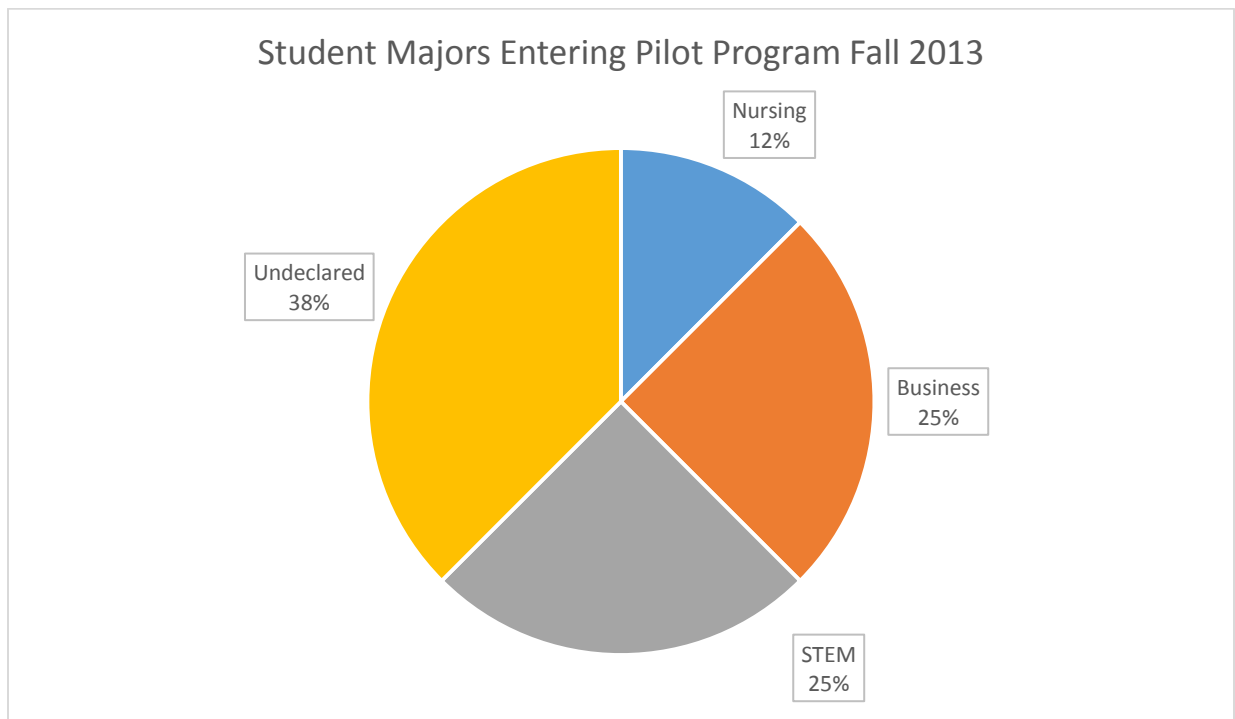


Figure 2. Distribution of students by major at the start of the semester.

3.1 Enrollment Challenges

Some of the unexpected challenges with this course came during the enrollment period. The first challenge was how to list the course using our existing catalog system where students could differentiate between a regular Composition II course and the Sustainability Composition II course. To avoid transfer issues, the name of the course could not be altered in the system. The course was then listed as “by instructor permission only”, where students would be required to obtain instructor signatures to enroll in the course. Our advisors would direct students who had an interest in STEM and STEM-related to enter the course. This posed two more issues. The first issue was the general understanding of the scope of STEM and sustainability issues by our advising staff, who are still learning about the new and updated STEM degree plans, including Engineering, Electrical and Electronic Technology, Welding, and Industrial Systems. This issue became a learning opportunity for our advisors to gain a deeper understanding of STEM and will continue to benefit the students every enrollment period. Secondly, students tended to prefer the path of least labor and often chose a section that did not require obtaining a signature. For the second offering of this course, the section will be listed without the signature requirement, it will be advertised to students in the first composition course, and will continue to have support from our advisors.

3.2 Classroom Discussions

3.2.1 Components of Classroom Discussions

A major portion of the course centered on classroom discussion to explore areas of research, to discuss issues surrounding the different research topics, and critical thinking about the sources, the evidence those sources presented and the conclusions reached by the authors. The components for our classroom discussions are shown in Figure 3. Students were exposed to several topics by the faculty at the start of the semester, and they were encouraged to select a topic that was relevant to themselves, their families, or just of great interest. Some of the proposed topics centered on maintaining the ecosystem and tourism of our island, meeting the needs of a population facing drought conditions, and maintaining a balance between refinery plants and the communities that surround them. Unlike the traditional composition course, students also discussed sustainability ethics in order to better understand some of the arguments they would come across in the articles they were gathering. Additionally, the size of the class allowed time to show videos that pertained to the students’ specific research topic. Like the traditional composition course, students participated in in class readings, and exercises to practice their critical thinking of sources, evidence, and conclusions.

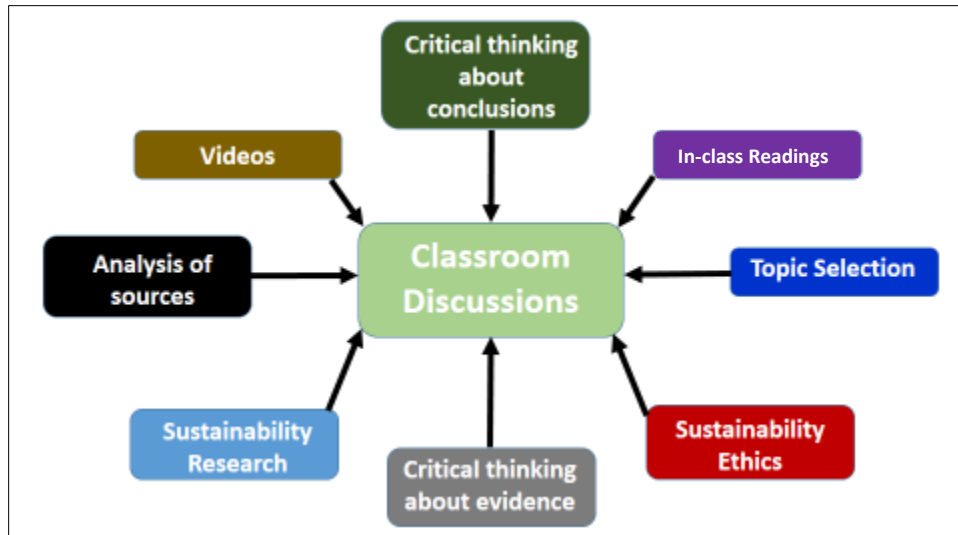


Figure 3. Course components to provide students with sufficient background to create their own websites.

3.2.2 Results of Classroom Discussions

Throughout the semester, students were exposed to topics such as genetic modification, green building, tap water versus bottled water, fracking, aquaponics, beach erosion, and natural gas. At the start of the semester, students either had little information about the topics or a preconceived opinion about a topic based on second hand information. They also viewed Sustainability and Suitability Engineering as “something that happens somewhere else” and as far removed from their own career paths.

As the course progressed, students began to have a better grasp of the issues within these topics, the use of Sustainability Engineering to address some of these issues, the impact these issues have on their community, and how their career paths could be influenced by Sustainability issues. There are three particular instances that demonstrated that change from passively accepting someone else’s opinion to critically thinking about the evidence.

One student decided to research natural gas versus other alternative energies. At the start of the semester, he had a hypothesis based mostly on the opinion of a parent that happens to work within the natural gas industry. As the student continued to research the topic, he came to a point mid-semester where he was no longer sure of the supremacy of natural gas, and ended the semester relying on his research to make his final choice.

Another student who happens to work in a family construction business decided to research green building. He started the semester thinking building green was just using solar panels and too expensive. With additional research, he discovered more and more green building options and began to actively search for affordable ways to include green options in the family business.

Lastly, one student who happened to be new to the island decided to research bottled water versus tap water because everyone told her not to drink the water. In fact, as she shared her initial research interest, the rest of the class agreed that she should not drink the water. After researching the amount of testing done on water, water pricing, and learning of where companies obtain water within the US, and sharing with the class, she truly persuaded the class with her research. By the end of the semester, the entire class had started using bottles of tap water instead.

In fact the final class discussion highlighted these and other changes that students had undergone during the semester. This final discussion also highlighted the students' perceptions of their skill sets and changes or alterations to their educational and professional choices.

3.3 Student Deliverables

Throughout the semester, students were required to complete weekly assignments and journals. The weekly assignments were aimed at improving their ability to correctly cite sources using APA style or to build their resources for their research paper. These assignments are similar to the assignments in the other sections of Composition II. They also had three major deliverables: their research paper, their research presentation for use in the class website, and their website analysis.

The research paper included the research conducted on a weekly basis, included responses to questions asked during class of that student's topic, a draft paper, and the final draft. The papers were graded by both faculty members. Most of the errors contained in the papers still stemmed from grammar and usage mistakes. There were some technical mistakes as well. There were only a few citation mistakes found within the papers. However, when the research papers of this pilot course are compared to the other Composition II classes taught by the same English faculty, the pilot course produced papers of a higher caliber.

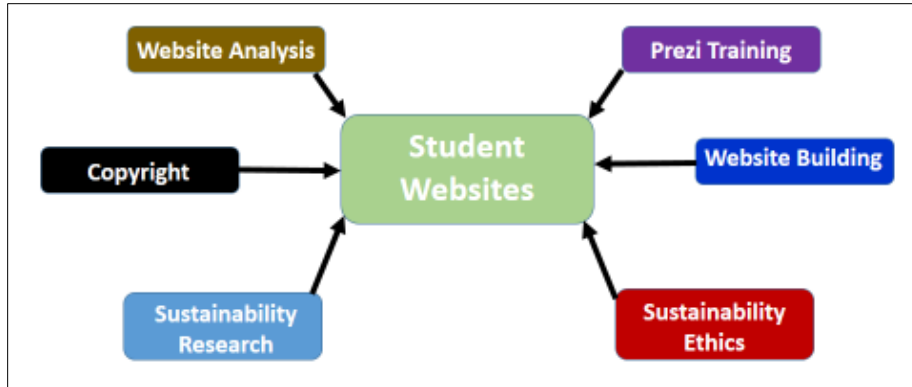


Figure 4. Course components to provide students with sufficient background to create their own websites.

The course also provided students with training, depicted in Figure 4, in order for them to create their research presentations and their websites with the aid of both faculty members and the Technology Trainer. For their presentations, students were able to take their research and produce either a Prezi or PowerPoint to support their hypothesis. Student presentations were expected to present their arguments, their supporting research, and their conclusions. Additionally, students were expected to adhere to APA style as well as copyright law, when citing their sources.



Figure 5. Images of the webpages of students' website analysis.

Students also had to create their own website that analyzed the city's website for rhetorical effectiveness. Again, the components depicted in Figure 4 were essential to student success. Within a classroom discussion, students were asked to note specific items they liked and disliked on the city's website. Students also compared the city's website to those of other cities of similar size from around the country. They searched the websites for ease of use by residents and visitors. By performing the analysis, students were able to discuss the credibility and appearance given by the website, challenging their critical thinking skills. These activities also helped them develop an understanding of how they would design their own websites. This assignment proved to be somewhat technically challenging due to learning how to create a website. The real difficulty of this assignment laid in the number of options in formatting their page, the images used on their page, and the general layout of the page. A collage of their webpages is given in Figure 5. Again the overall quality of the pages was generally high. The course also developed its own website, depicted in Figure 6, which provides links to the students' presentations, links to their websites, and some background information concerning the students themselves.

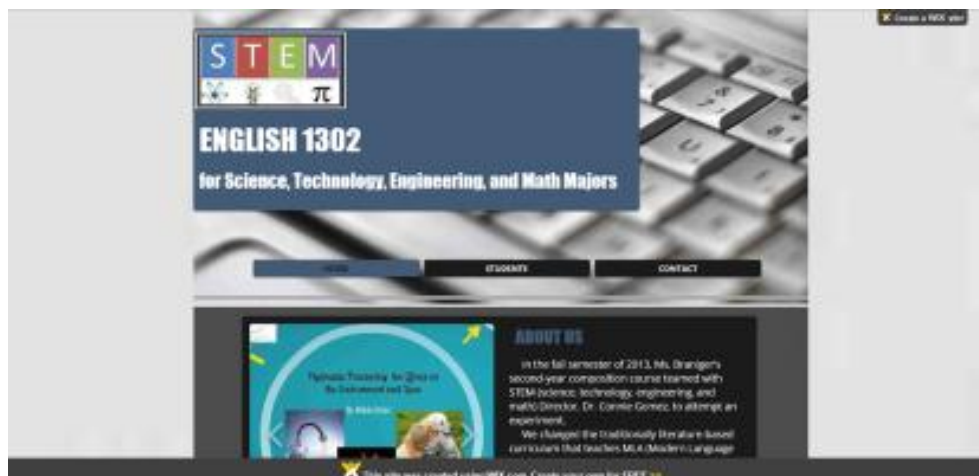


Figure 6. Images of the class website.

4.0 Student Retention and Student Reaction

As the course progressed, there were of course students who experienced setbacks and had to withdraw from the course. The retention for this pilot course is depicted in Figure 7. Two of the students had to withdraw due to family reasons that were beyond their control, which caused them to miss major assignments. Before the end of the fall semester, one student had expressed the desire to complete this course in the spring. Two other students had to withdraw from the course as they struggled to balance work, family, and school. The rest of the class successfully completed the course.

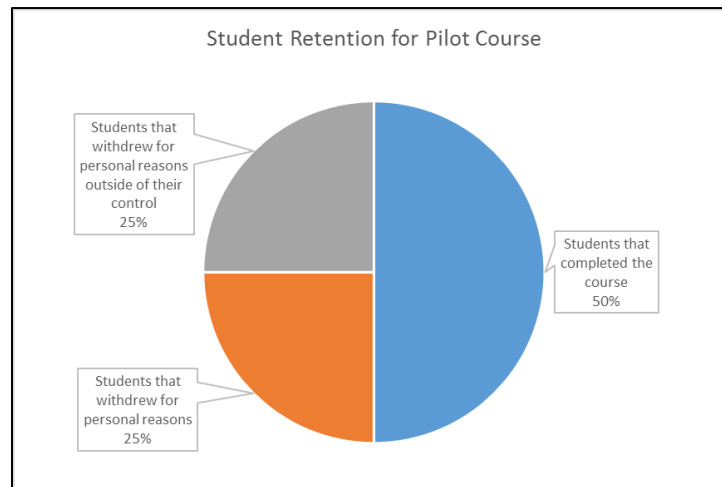


Figure 7. The student retention for the pilot course, showing a 50% completion rate.

Overall, the students that completed the course expressed positive feedback. Most students felt that they had learned a lot and truly earned their grade. They expressed that they favored the team taught approach presented in the class. Additionally, one student said, “Now it sounds like I know something!” when she described her ability and confidence to talk to someone about Sustainability. Students were more confident that they could learn more from STEM. In fact, two of the students have started considering STEM courses for some of their electives. They enjoyed having the skills to create a Prezi and to create a website. Indeed, one student has decided to create a business website using the skills learned in this course.

5.0 Conclusions and Future Work

Even though the class was very small, the positive response and the level of work produced by the students is an encouraging indication that there is lots of merit to this type of course within our community. The response from this small group of students has prompted a second offering of this course, with an enrollment of 23 students. After this course is offered several times, the results could support the integration of Sustainability within more sections of Composition II. Even with the small class, there were a number of key lessons learned from this pilot course, beginning with and most importantly dealing with the enrollment issues discovered. For this reason, the course will no longer be listed as “by instructor permission only.” Instead, students will be informed that this is a Composition II course that integrates Sustainability Engineering by the advisors prior to enrolling, by campus advertising, and at the start of the course. The input from the Library Staff and the Technology Trainer proved to be invaluable to the students as they completed their assignments. It would be advisable to invite the Technology Trainer for an additional visit to help revise student material prior to presentations. Further in the future, the

course could serve as a model to integrate biology and medicine using the expertise within our Nursing, Radiology, Computed Tomography, and Magnetic Imaging programs.

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