

Proposal:

Sustainability in Engineering Minor

- *“I’m not trying to imitate nature, I’m trying to find the principles she’s using.” – R. Buckminster Fuller, 1972*

Presentation by Dr. Helen Muga, Associate Professor, Engineering Program

Dr. Franklin Lebo, Assistant Professor and Co-Director, Sustainability Program

Baldwin Wallace University (FA20)

Presentation Agenda



● Introduction to the Proposed SUS-EGR Minor

● Part I: Joint Program Minor - Background

● Part II: ABET Learning Outcomes

● Part III: Student Value Added

● Part IV: Joint Program Minor Reqs.

Part I: SUS-EGR – Joint Program Minor Background

- Dr. Helen Muga holds a graduate certificate in Sustainability in Engineering.
- Dr. Muga wove sustainability into the Engineering curriculum both to satisfy ABET's Skills Learning Objectives and to differentiate BW's program identity on the marketplace. Worked with Dr. Franklin Lebo to redesign **SUS363/MGT340: Biomimicry – Nature Inspired Innovation** as this is a differentiator for BW's EGR Program.
- **Examples of Relevance of Sustainability to Engineers**
 - (1) Economic Input-Output Life Cycle Analysis (EIO-LCA),
 - (2) Design for Disassembly, and Monte Carlo analysis which is a risk assessment tool in courses such as EGR305: Product Design and Entrepreneurship and EGR306: Global Engineering Experience.
 - (3) Study of emergent direct-energy technologies in renewable energy.

Part II: ABET Learning Outcomes

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Part III: SUS-EGR Program Alliance

Student Value Added

- Other undergraduate engineering programs offer Sustainability in Engineering minors such as Binghamton University in New York (18-21 credit hours) and/or Certificate options with fewer credit hour requirements (i.e., 16-17 credit hours) such as the University of Wisconsin-Madison.
- There are increasing expectations for EGR graduates to have multidisciplinary learning experiences, which is strengthened by additional credentialing.

Part III (Cont.): SUS-EGR Program Alliance

Student Value Added

- EGR students have a hefty 95 credit hour major requirement with a built in math minor. Credit hour constraints make all other minors difficult for EGR majors to complete. This minor levels the playing field by including EGR students in an opportunity already available to students in other areas. Students can strategically take Core requirements in the field of Sustainability across multiple areas not already covered by the EGR major.
 - **EXAMPLES:**
 - **HPE222W:** Community Health – satisfies Wellness Core requirement
 - **MGT329:** Legal Environment of Organizations – satisfies Meaning and Purpose Core requirement.
 - **PHL273I:** Environmental Ethics – satisfies Meaning and Purpose Core requirement
 - **SOC288:** Environmental Sociology – satisfies Social Sciences Core requirement

Part IV: SUS-EGR Joint Program Minor

Minor Requirements (18 Credit Hours)

- SUS150I: Humans and the Earth (3 Cr. Hrs.)*
- SUS363/MGT340: Biomimicry – Nature Inspired Innovation** (3 Cr. Hrs.)
- EGR305: Product Design and Entrepreneurship** (3 Cr. Hrs.)
- EGR306: Global Engineering Experience** (3 Cr. Hrs.)
- One additional liberal arts elective from approved list (3 Cr. Hrs.)
- One additional business elective from approved List (3 Cr. Hrs.)
- One additional elective from approved list (3 Cr. Hrs.)

□ *Required foundational course in Sustainability.

□ **Already required by EGR Program.

Appendix – Joint SUS-EGR Minor Assessment Rubric

Learning Objective	By the end of this course you will be able to:		You will accomplish this objective through:
Knowledge Learning Objective 1.0	1.1	Discuss sustainability and its application to a product, process, or activity	Complete the text reading, viewing presentations by the instructor, and participating in-class activities and out-off class activities selected to reinforce the main concepts. You will also accomplish this through homework assignment and through performing a streamlined EIO-LCA on a semester-long project.
	1.2	<p>Apply engineering knowledge to solving a global challenge.</p> <ul style="list-style-type: none"> a. Describe engineering challenges in an international context b. Apply the principles of engineering design and science to solve open-ended problems and provide holistic engineering solutions that are sustainable and appropriate. c. Use the different aspects and phases of engineering projects (e.g. conceptual phase, design, construction, implementation) on a real-world open-ended project in a developing country. d. Design a system, component, or process to meet desired needs within realistic technical and non-technical constraints such as economic, environmental, social, political, cultural, health and safety, and sustainability. e. Incorporate technical and non-technical aspects in engineering decisions. 	Homework problems, in-class creativity activities, and reflective writing assignments. You will also achieve this through a semester-long team project design challenge.

Skills Learning Objective 2.0	2.1	Sustainability skills	Semester-long project where life cycle assessment tools such as EIO-LCA and sustainability indicators, life cycle cost analysis, design for disassembly, and monte carlo risk analysis are applied to the project.
	2.2	Professional writing and presentation	<p>Writing Assignments and Presentation. Writing Assignments include semester-long team project and other short homework assignments. Oral communication includes presenting in class and to foreign/international partners or a culturally diverse audience</p> <p>All assignments submitted will be evaluated for proper spelling, grammar and organization.</p>
	2.3	Group Interaction and team building/teamwork	<p>Group interaction with a multidisciplinary team comprised of BW student team and international partner in Central America. This will involved communication via email, WhatsApp, or Skype</p> <p>This course also has a team component, a semester-long design project where students will interact with one another and the international collaborator. Students research the design challenge, develop a cost-effective, sustainable solution, build and test the solution, and give at least 1-2 mid-term presentations to the class. Presentations will be broadcast to the international collaborator.</p>

**Skills
Learning Objective
2.0**

2.4 Demonstrate an understanding of the importance of global awareness and multicultural awareness within design solutions

- a. Demonstrate knowledge of the history and literature of world cultures
- b. Respond to diverse perspectives linked to identity in an international context.
- c. Demonstrate familiarity with a non-native language or experience living in a different culture
- d. Function effectively in diverse groups
- e. Demonstrate awareness of one's own place in and effect on the world.

Reading relevant articles, watching videos or documentaries pertaining to the course or project-site, Homework problems, in-class creativity activities, and reflective writing assignments. You will also achieve this through working on a semester-long team project design challenge with a foreign partner/collaborator.