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Implementing NACE Competencies in LEED Lab to Prepare a Career-Ready Workforce

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Implementing NACE competencies in LEED Lab to prepare a career-ready workforce

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Abstract
Due to buildings' significant role in changing the environment, sustainability has become one of the most critical topics in the building industry. The Leadership in Energy and Environmental Design (LEED) program developed by U.S. Green Building Council (USGBC) is one of the most popular sustainability practices that provide guidelines for the design and construction of any type of building. Due to its comprehensive and practical approach, it is very helpful to implement LEED guidelines and standards into the construction education curriculum to provide opportunities for students to become familiar with and learn how to apply these sustainability standards to the projects. In order to facilitate this, the US. Green Building Council (USGBC) has developed the LEED Lab program to provide this opportunity for students to become involved in a real-world project and practice sustainability during their education. Ball State University is one of the few universities that is offering LEED Lab to undergraduate students through which two campus buildings have been certified to date. In this course, students become involved in the process of certifying a campus building under LEED Operation and Maintenance (LEED O+M) for Existing Buildings. The purpose of this course is to provide a chance for students to gain hands-on experience and improve several skills besides learning a valuable experience about sustainability. However, this goal will not be achieved if the necessary skills are not infused into the course syllabus. Therefore, this study aims to indicate how the National Association of Colleges and Employers (NACE) recommended competencies for a Career-Ready Workforce can be infused into the process of teaching LEED Lab to make sure the students are ready to use their pieces of training in their career. In this study, the NACE competencies (teamwork, Leadership, Professionalism, Technology, critical thinking, and communication) and the initial course learning outcomes of the LEED Lab are correlated to investigate the implementation of those competencies in the course. After discovering the lacking competencies in the course learning outcome, the appropriate learning outcomes were added to the course to cover those competencies. Specific assignments were then added to help achieve the new learning outcomes. This study can help building sustainability educators to prepare students for careers in the sustainable construction industry.

Keywords: LEED, NACE, Skill, Competency, Construction Education

Introduction
The construction industry is a major contributor to environmental degradation and buildings are responsible for a significant portion of the world's carbon emissions, waste, and energy

consumption. This highlights the increasing role of sustainability and green building practices in the building industry. Building design and construction companies are increasingly looking for employees with knowledge and experience in sustainable building practices. Therefore, experiential learning in sustainability and green building can give construction students an advantage in the job market (Mah et al., 2013; Trujillo & Spencer, 2015b).
In order to provide opportunities for students to learn and practice green building guidelines and standards, USGBC has developed the LEED Lab program to involve interested students in real-world projects and allow them to practice sustainability during their education. LEED Lab is an interdisciplinary course and experiential learning program that focuses on sustainable design and building practices. It is designed to help students gain hands-on experience with LEED certification. LEED Lab provides students with an opportunity to work on real-world projects and gain practical experience with sustainable design principles, energy efficiency, water conservation, and other important aspects of green building. The course typically involves working on a specific building or project, analyzing its environmental impact, and developing a plan for achieving LEED certification. LEED Lab is often offered as a collaboration between universities and the USGBC, and it is available to students in a wide range of disciplines, including architecture, engineering, environmental science, and business (LEED Lab | U.S. Green Building Council, 2023). The program is designed to help students develop the knowledge and skills essential to become leaders in the green building industry and to promote sustainable design practices in their future careers.

Although LEED Lab is providing opportunities for universities to provide experiential learning for students, it is important to understand whether it prepares them for pursuing a career in the green building industry. In order to understand this, the success of this practice should be investigated to understand if the application of this program meets career readiness competencies recognized as essential for success in the workforce. NACE (the National Association of Colleges and Employers) has developed a set of competencies that are widely known as the measures of success in the workforce. These competencies include career and self-development, critical thinking, communication, intercultural fluency, teamwork, professionalism, leadership, and technology. These competencies are the most widely used generic criteria and research has shown that meeting these competencies increases the chance of employment for students (Newell & Ulrich, 2022).

Although several studies have discussed the success of experiential learning and the improved competencies of students through the LEED Lab program (Fick & Jones, 2018; Jones & Fick, 2017; Trujillo & Spencer, 2015a, 2015b; Woo et al., 2020), the implementation of NACE competencies in LEED Lab program has not been investigated to understand the success of this program in preparing career ready students.

To bridge this gap, this study aims at introducing a process through which the NACE competencies are incorporated into the LEED Lab program in order to help prepare career-ready students to work in the sustainable building design and construction industry. To achieve the goal of the study, the implementation of NACE-recommended competencies for a career-ready

workforce in the course outcomes of the LEED Lab offered by Ball State University was investigated to understand whether all these competencies are covered by this course. The correlation between each competency and the learning outcome was evaluated and the modifications were then made by infusing the lacking competencies into the process of training by adding additional learning outcomes for this course to make sure all competencies are covered by the learning outcomes. The achievement of each competency and the associated learning outcome were then discussed through associated assignments.

Methodology

In the first step, the current course syllabus for LEED Lab offered at Ball State University was reviewed and the initial course outcomes developed for this class were placed in the left column of a two-column table designed for this study. In the right column, the types of assignments students should work on as their attempts to achieve the outcomes in the left column were listed (Table 1).

Table 1. Ball State University LEED Lab course learning outcomes and associated assignments

Course Outcomes	**Course Assignments**
• Understand the LEED O+M-EB® building rating system	• LEED O+M Credit Study and Presentation
• Implement the LEED building certification process	• Campus Building Selection • Identify Achievable Credits • Select Among the Achievable Credits • Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits
• Apply knowledge of green building assessments to Assess the performance of existing campus buildings	• Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits • Work with Facilities Planning and Management team to collect performance data
• Recognize the limitations and possible improvements in the existing campus infrastructure	• Work with Facilities Planning and Management team to collect performance data • Collect and Report the Existing condition of the Selected Site and Building
• Examine campus sustainability efforts	• Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits • Work with Facilities Planning and Management team to collect performance data
• Develop LEED O+M-EB® submittals for GBCI	• Collect and Report the Existing condition of the Selected Site and Building

	• Document the Existing Policies and Procedures to achieve credits
• Comprehend the value of industry and client interaction and expertise	• Work with the Campus Facilities Planning and Management team to collect performance data

Next, a two-column table was created to correlate the course learning outcomes with NACE Competencies. In order to correlate the outcomes and NACE Competencies, this question needed to be answered: "If a student achieves one of the learning outcomes, will they simultaneously make progress on a NACE competency?" If the answer was a yes, the mentioned course outcome was placed in the box on the right of that specific NACE Competency. For example, if a student achieves the course outcomes "Understand the LEED O+M-EB® building rating system" and "Comprehend the value of industry and client interaction and expertise" then it was presumed that they also make progress on the NACE "Career and Self Development" competency. Therefore, these course outcomes were placed in a box on the right side of the associated NACE competency. Correlating the course learning outcomes with NACE Competencies was continued until each of the course outcomes was placed in the boxes on the right side of the associated competencies. If an outcome was found to be associated with more than one NACE competency, it was placed in all the relevant boxes. For example, the course outcome "Complete LEED O+M-EB® submittals for Green Building Certification Institute (GBCI)" was found to have associations with three competencies "Communication", "Professionalism", and "Teamwork". After putting all course outcomes in the boxes next to the associated NACE competencies, this question was asked: if all the NACE competencies will be achieved by the current course outcomes? Table 2 shows the associations between the course learning outcomes and NACE competencies.

Table 2. The association between course learning outcomes and NACE Competencies

NACE Competency	Course Outcomes
Career and Self Development	• Understand the LEED O+M-EB® building rating system • Comprehend the value of industry and client interaction and expertise • Implement the LEED building certification process • Apply knowledge of green building assessments to Assess the performance of existing campus buildings • Develop LEED O+M-EB® submittals for GBCI
Oral/Witten Communication	• Develop LEED O+M-EB® submittals for GBCI
Critical Thinking	• Apply knowledge of green building assessments to Assess the performance of existing campus buildings • Recognize the limitations and possible improvements in the existing campus infrastructure • Examine campus sustainability efforts
Global/Intercultural Fluency	

Leadership	• Implement the LEED building certification process • Develop LEED O+M-EB® submittals for GBCI
Professionalism/Work Ethics	
Teamwork	Implement the LEED building certification process
Technology	• Develop LEED O+M-EB® submittals for GBCI • Implement the LEED building certification process

As shown in Table 2, the majority of outcomes were found to help achieve one or multiple NACE competencies. Moreover, several course outcomes were correlated with each covered competency. This helped the author understand that the particular competency was covered. However, in order to ensure that the covered competencies were appropriately covered by the course outcomes, the table was checked with the Ball State University's Skill Infusion Program representative. After ensuring that the focused competencies were adequately covered, the two competencies (highlighted in yellow) that appeared not to be achieved through the existing course outcomes were highlighted. The two competencies were "Professionalism/Work Ethics" and "Global/Intercultural Fluency". In order to achieve those lacking competencies, it was necessary to add new learning outcomes to the course and accordingly, there was a need to add more assignments to accomplish the newly added course outcomes.
In order to do this, new learning outcomes were developed to achieve the two competencies. The learning outcome "Interpreting national and international green standards for building design and construction" was added to help students achieve Global/Intercultural Fluency and the learning outcome "Apply technical requirements and implement ethical and professional standards" was added to achieve "Professionalism/Work Ethics". The associated course assignments and the assessment plan to evaluate the activities were then developed for each learning outcome based on constructive alignment (Biggs, 1996). To show how each NACE competency would be achieved through this course, a three-column table was developed to show the correlations between NACE competencies, the revised list of course learning outcomes, and all assignments developed to accomplish the course outcomes. Although an assessment plan was also developed for each learning outcome and course activity, it is not included in this table because it is out of the scope of this study. After the three-column table was developed, it was again discussed with the Ball State University's Skill Infusion Program representative to ensure that the added course outcomes and assignments help competencies to be covered. The additional course outcomes were then revised based on the comments and suggestions. Table 3 shows the correlations of NACE Competencies, final course learning outcomes, and the associated assignments.

Table 3 shows the correlations between the NACE Competencies, course objectives, and the associated assignments.

NACE Competency	Course Objective	Assignment
Career and Self Development	• Understand the LEED O+M-EB® building rating system	• LEED O+M Credit Study and Presentation

	• Comprehend the value of industry and client interaction and expertise	• Work with the Campus Facilities Planning and Management team to collect performance data
	• Implement the LEED building certification process	• Campus Building Selection • Identify Achievable Credits • Select Among the Achievable Credits • Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits
	• Apply knowledge of green building assessments to Assess the performance of existing campus buildings	• Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits • Work with Facilities Planning and Management team to collect performance data
	• Develop LEED O+M-EB® submittals for GBCI	• Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits
Oral/Written Communication	• Develop LEED O+M-EB® submittals for GBCI	• LEED O+M Credit Study and Presentation • Collect and Report the Existing condition of the Selected Site and Building • Prepare and present Weekly Progress report
Critical Thinking	• Apply knowledge of green building assessments to Assess the performance of existing campus buildings	• Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits
	• Recognize the limitations and possible improvements in the existing campus infrastructure	• Work with Facilities Planning and Management team to collect performance data
	• Examine campus sustainability efforts	• Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits • Work with Facilities Planning and Management team to collect performance data
Global/Intercultural Fluency	Interpret national and international green standards for building design and construction	• Case Study Project (paper and presentation)
Leadership	• Implement the LEED building certification process	• Campus Building Selection • Identify Achievable Credits • Select Among the Achievable Credits

	• Apply prior skill or knowledge to reveal performance and comprehension in new situations	• Collect and Report the Existing condition of the Selected Site and Building • Document the Existing Policies and Procedures to achieve credits
	• Develop LEED O+M-EB® submittals for GBCI	• LEED O+M Credit Study and Presentation • Collect and Report the Existing condition of the Selected Site and Building • Prepare and present Weekly Progress report
Professionalism/Work Ethics	• Apply technical requirements and implement ethical and professional standards	• Develop and timely submit LEED O+M-EB® submittals for GBCI
Teamwork	• Implement the LEED building certification process	• Campus Building Selection as a group • Identify Achievable Credits as a group
Technology	• Develop LEED O+M-EB® submittals for GBCI	• LEED O+M Credit Study and Presentation • Collect and Report the Existing condition of the Selected Site and Building
	• Implement the LEED building certification process	• Campus Building Selection as a group • Identify Achievable Credits as a group

Discussion and Conclusion

Higher education is attempting to equip students for careers by developing generic competencies necessary for their future careers (Nodine, 2016). NACE Career Readiness Competencies have been adopted by several higher education institutions in the U.S. However, the incorporation of these competencies in the course learning outcomes is very important and it is directly dependent on the course syllabus developed by the instructor. While generic skills are very important, they should be framed within the objectives of a course and be strengthened with occupation-specific skills. Infusing these skills is even more important when it comes to educating sustainability in the built environment. This study proposed that institutions can concurrently establish skill development in sustainability and provide significant real-world experience through experiential learning of sustainability in LEED Lab to cover all the NACE competencies and prepare students to use their sustainability training to become more competitive in finding relevant jobs and become successful in their careers.

In this study, the implementation of NACE competencies in the LEED Lab was performed in a few steps. First, the competencies and the course learning outcomes were correlated and the NACE competencies that were not covered by the initial course outcomes were detected. Although the majority of the competencies were already considered in the course learning outcomes, it was found that “Global/intercultural Fluency” and “Professionalism and Work Ethics” were not covered. Therefore, two learning outcomes “Interpret national and international green standards for building design and construction” and “Apply technical requirements and implement ethical and professional standards” were added to the syllabus to cover the two

mentioned competencies, respectively. Assignments were also added to help achieve the course outcomes. For the outcome "Interpret national and international green standards for building design and construction" a new project was added to the assignment in which students had to find a few LEED O+M certified projects and study the projects. They had to then present their findings in class and develop an essay to discuss the different aspects of each project. Given that many countries in the world are using the LEED system, this assignment helps students become familiar with the different ways LEED criteria are applied in different contexts and how the criteria are related to the location, culture, and climate. Adding this assignment to the course syllabus which had one assignment related to reviewing LEED credits, LEED O+M Credit Study and Presentation, was challenging because there was a chance that students mix the two assignments and get confused with both or do the same thing for both assignments. At the same time, it was not possible to replace the existing assignment with the newly added one. Therefore, it was important to be very clear and specific about the purpose of the new assignment and the process of doing it. In order to provide a clear picture of the new assignment, a three-page instruction was developed for the assignment and the rationale and the potential benefits of this assignment were discussed in detail. The process and the steps of doing this assignment were also discussed in detail and the timing of the assignment was planned to match the schedule of other assignments.

In order to achieve the course outcome "Apply technical requirements and implement ethical and professional standards", the students have to develop and timely submit LEED submittals for a selected building so that the submittals are meeting the standards for Green Building Certification Institute, as the party that grants LEED certification. This assignment helps students learn how formal documents and submittals should be developed and how the standards and formats are to be satisfied. Furthermore, in this assignment, students had to submit progress reports every week and that helps them improve their time management and scheduling skills. Although this assignment was added due to the modifications made to the course, it did not add a lot of extra work for students. The only thing that was added due to this assignment was to report their weekly findings in a format appropriate to submit for the GBCI. Therefore, the amount of work students needed to do in the semester for a 3-credit course was still reasonable.

By adding the two learning outcomes and the associated assignments, the new version of the LEED Lab that was offered at Ball State University is expected to provide students with new skills that help them become more competitive in finding and pursuing a career. Although the success of this practice has not yet been evaluated to see if it is making any changes, it can be measured by comparing the reflection surveys taken after finishing this course in the previous years and after infusing NACE competencies into the course syllabus in the Fall semester of 2023. The future study can use the findings of the reflection survey to discuss the success of this practice. This study introduces a process and challenges through which professors and instructors can evaluate and modify their course outcomes to help prepare students for their careers.

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