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Experiential Learning through Industry Partnership

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Abstract

Experiential learning gives students the abilities they need for actual-global achievement. Students as well as their parents are seeking the education that teaches them skills that can be utilized in real world applications. Despite the fact that colleges and universities are able to replicate or simulate some of real-world problems within the lecture room or laboratory settings, exposing students with actual real-world experiments as well as hands-on practices can bring another dimension to their learning and understanding of the subject. Experiential learning creates a useful possibility to prepare students for profession or research carriers. When college students are given opportunities to examine a real-world situation on campus or in the network like the ones furnished in internships, area placements, and industrial project partnerships, the mastering becomes extensively more effective. By way of engaging in formal, guided, proper, and actual-experience, the students can increase their knowledge, develop skills and enhance their learning.

One of the most effective ways of conducting internship program is to engage and partner with industry and find proper projects for the students. Selection of a project must be done carefully to meet certain requirements such as; degree of difficulty, matched with student's technical background, duration of project, safety, availability and logistics.

This paper provides the challenges regarding the creation or securing of actual projects suitable for experiential learning, evaluation and assessment of three internship projects conducted with the industrial partnership.

Introduction

Experiential learning teaches students the competencies they need for real-world success. Although the universities tend to simulate the real world within the classroom and laboratory, authentic experiential learning creates a priceless chance to prepare students for a profession or career, learn the craft of a fine artist, or discover how the discipline creates proof to contribute to its body of information. Sullivan and Rosin (2008) discuss that the mission of higher education should be to bridge the gap between theory and practice and Bass (2012) suggests, the educational environment needs to intentionally create rich connections between the formal and experiential curriculums. When students are engaged in learning experiences that they see the relevance with real project, they have increased the motivation to learn. Students are also motivated when they are provided opportunities for practice and feedback. Experiential learning criteria are given in (Ambrose, et. al., 2010). Through experiential learning, students are confronted with unfamiliar situations and tasks in a real-world context. To complete these tasks, students need to figure out what they know, what they do not know, and how to learn it. This requires students to: reflect on their prior knowledge and deepen it through reflection and to transfer their previous learning to new contexts resulting in mastering new concepts, principles, and skills (Linn, et al., 2004). Ultimately, these skills create students who become self-directed and life-long learners. Relationships are developed and nurtured through learner to self, learner to others, and learner to the world at large.

Some forms of experiential learning include (Indiana University, 2006; Moore, 2010): Internships, Service Learning, Cooperative Education, Clinical Education, Student Teaching, Workshop, Undergraduate Research Experience, Community-Based Research, Field Work, and Study Abroad. Our focus in this paper is on internship through industry-based experiential learning. In these opportunities, students, mentored by faculty and supported by the college administration, work with an individual, group, organization, network or other entity, often understood as "industry partners" or collaborators. All participants decide upon a collaborative, mutually agreeable relationship that involves teaching, learning and building knowledge. Their interaction may be on a time from requiring basic skills to application of advanced, disciplinary skills, as in a capstone experience. Students may observe, participate, teach, or offer a talent. Some of these opportunities may embody values orientation, such as practical and active learning for engineering and different technical fields. Some students may interact in style, production or installation of a small project or be a part of an oversized project with business partners' current activities, while others might have students support a method of growth, development, and visioning around core issues. No matter what kind of engagement, the outcome may be a product that benefits the business partner which shows that the scholar has applied or used skills.
The expected outcomes in these learning opportunities can be summarized as follow:

1) Gain understanding and experience to improve their professional skills.
2) Establish networking contacts to support the transition from collage to work.
3) Reflect on ethical responsibilities in diverse communities.

In the following section the description of three projects performed by students are given.

Projects

Three experiential learning projects were conducted by students. Two of these projects are focused on manufacturing and one on renewable energy. In the following the outlines and expected outcomes for these projects are given.

Project-I Solar Energy Implementation (4 Students)
This is an actual Solar Power System project for a 2900 ft^2 residential building located in Downers Grove, Illinois with students' involvement from beginning to the end. The objectives of this project were to:

- Design
- Perform cost evaluation
- Perform incentive calculation
- Perform payback calculation

In order to design the proper Solar Power System for this facility, the following steps required to be taken.

Description

1. To determine the loads and their total kW to be supported by the Solar Power Systems.

2. To determine the Irradiation $[W/_{m^2}]$ for City of downers Grove, IL USA.
3. To determine the optimum angle for solar panels.
4. To select the proper solar panels for a $10kW$ solar power system.
5. To select controller, inverter and other necessary hardware.
6. To calculate the federal and SREC incentives.
7. To calculate the payback.

Figure 1 shows the completed electrical room for the solar power system project ,while the participating students and the home owners are shown in figure 2.

Figure-1 Electrical Control Room

Figure 2 Students with homeowner

Project-II Build a control circuit and corresponding control box for a Packaging Machine (5 students)

This is an actual project to build a control circuit and corresponding control box for a Packaging Machine. This project was conducted with close collaboration with a partner industry in the surrounding areas.

Description

A control circuit for a packaging machine is required to be designed and built. Students were required to:

1. Find optimum component selection and arrangement and prepare the control panel layout.
2. Select components.
8. Install components.
3. Install wire conduits.
4. Wire components.
5. Label each component.
6. Test control box.
7. Prepare CAD drawings for the power panel.
8. Write a report on how to reduce cost on the production of such a control box.

Figure 3 shows the control box for a packaging machine completed by the students.

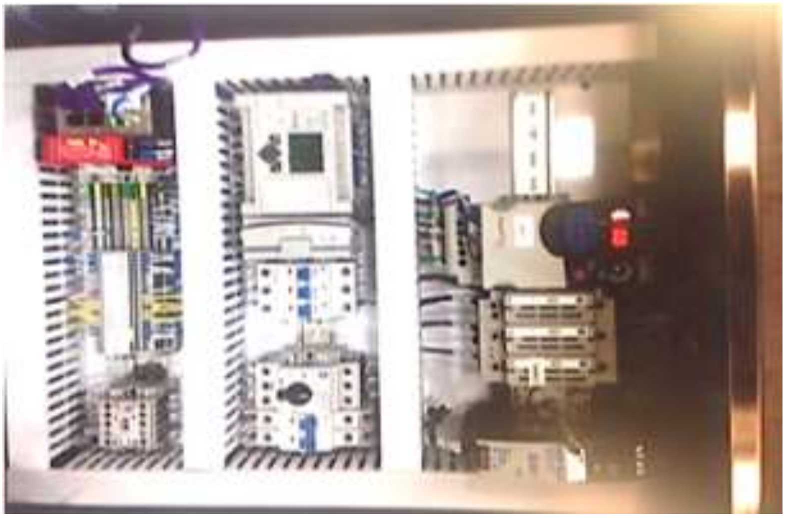

Figure 3 Completed Control Box

Project-III Preparing a Mechanical Drawing for an existing Component (3 Students)
This is an actual project from an industry partner to prepare a Mechanical Drawing for an existing Component

Description

A mechanical component is presently purchased from outside vendor. The company is trying to build such a component. The students are required to:

1. Disassemble the component.
2. Provide accurate measurement for each piece.
3. Provide mechanical 2-D and 3-D drawings for each subassembly.
4. Provide final assembly 2-D and 3-D drawings.
5. Write a procedural report.

Assessment

Experiential learning means learning through action, learning by doing, learning through experience, and learning through discovery and exploration. In order to quantify the students' involvement in the project and gauge their degree of participations and learning through practice, an assessment program is conducted. The following questions were asked from students and their responses are tabulated in the following tables.

Table1: Project I- Solar Energy Design

Internship Project: Solar Energy Implementation					
Student Assessment of Student Outcome					
Proposed ABET Criterion Satisfied: a, b, c, d, f, and g					
Student Outcomes Matched to ABET (a,, b, c,, d, e, f and g)	Student Feedback (Composite Target Score = 3.00)				
	Excellent (4)	Good (3)	Acceptable (2)	Pass (1)	Composite
(a) As a result of this internship my ability to apply knowledge of mathematics, science, and engineering for broadly define engineering project can be rated as:	**4**	**0**	**0**	**0**	**4.00**
(b) As a result of this internship my ability to design and conduct experiments, as well as to analyze and interpret data for an engineering project can be rated as:	**3**	**1**	**0**	**0**	**3.75**
(c)As a result of this internship my ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability can be rated as:	**4**	**0**	**0**	**0**	**4.00**
(d) As a result of this internship my ability to function on multidisciplinary teams can be rated as:	**3**	**0**	**1**	**0**	**3.50**
(e) As a result of this internship my ability to identify, formulate, and solve engineering problems can be rated as:	**3**	**1**	**0**	**0**	**3.75**
(f) As a result of this internship my understanding of professional and ethical responsibility to apply in an engineering can be rated as:	**2**	**1**	**1**	**0**	**3.25**
(g) As a result of this internship my ability to communicate effectively can be rated as:	**4**	**0**	**0**	**0**	**4.00**
Instructor Comments: The composite score exceeds the target score that is set at 3.00 on the scale of 4. Hence the internship met the specified criteria and no action is needed at this time.	**Number of Responses: 4, Duration 4 Weeks**				

Table 2: Project II- Build a Control Circuit and Corresponding Control Box

Internship Project: Build a Control Circuit and Corresponding Control Box for a Packaging Machine					
Student Assessment of Student Outcome					
Proposed ABET Criterion Satisfied: a, b, c, d, f, and g					
Student Outcomes Matched to ABET (a,, b, c,, d, e, f and g)	Student Feedback (Composite Target Score = 3.00)				
	Excellent (4)	Good (3)	Acceptable (2)	Pass (1)	Composite
(a) As a result of this internship my ability to apply knowledge of mathematics, science, and engineering for broadly define engineering project can be rated as:	**5**	**0**	**0**	**0**	**4.00**
(b) As a result of this internship my ability to design and conduct experiments, as well as to analyze and interpret data for an engineering project can be rated as:	**4**	**1**	**0**	**0**	**3.80**
(c)As a result of this internship my ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability can be rated as:	**4**	**0**	**1**	**0**	**3.60**
(d) As a result of this internship my ability to function on multidisciplinary teams can be rated as:	**3**	**1**	**1**	**0**	**3.40**
(e) As a result of this internship my ability to identify, formulate, and solve engineering problems can be rated as:	**4**	**1**	**0**	**0**	**3.80**
(f) As a result of this internship my understanding of professional and ethical responsibility to apply in an engineering can be rated as:	**3**	**1**	**1**	**0**	**3.40**
(g) As a result of this internship my ability to communicate effectively can be rated as:	**3**	**2**	**0**	**0**	**3.60**
Instructor Comments: The composite score exceeds the target score that is set at 3.00 on the scale of 4. Hence the internship met the specified criteria and no action is needed at this time.	**Number of Responses: 5, Duration 4 Weeks**				

Table 3: Project III- Preparing a Mechanical Drawing for an existing Component

Internship Project: Preparing a Mechanical Drawing for an existing Component					
Student Assessment of Student Outcome					
Proposed ABET Criterion Satisfied: a, b, c, d, f, and g					
Student Outcomes Matched to ABET (a,, b, c,, d, e, f and g)	Student Feedback (Composite Target Score = 3.00)				
	Excellent (4)	Good (3)	Acceptable (2)	Pass (1)	Composite
(a) As a result of this internship my ability to apply knowledge of mathematics, science, and engineering for broadly define engineering project can be rated as:	**3**	**0**	**0**	**0**	**4.00**
(b) As a result of this internship my ability to design and conduct experiments, as well as to analyze and interpret data for an engineering project can be rated as:	**2**	**1**	**0**	**0**	**3.66**
(c)As a result of this internship my ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability can be rated as:	**4**	**0**	**0**	**0**	**4.00**
(d) As a result of this internship my ability to function on multidisciplinary teams can be rated as:	**2**	**0**	**1**	**0**	**3.33**
(e) As a result of this internship my ability to identify, formulate, and solve engineering problems can be rated as:	**3**	**0**	**0**	**0**	**4.00**
(f) As a result of this internship my understanding of professional and ethical responsibility to apply in an engineering can be rated as:	**2**	**0**	**1**	**0**	**3.33**
(g) As a result of this internship my ability to communicate effectively can be rated as:	**1**	**2**	**0**	**0**	**3.33**
Instructor Comments: The composite score exceeds the target score that is set at 3.00 on the scale of 4. Hence the internship met the specified criteria and no action is needed at this time.	**Number of Responses: 3, Duration 4 Weeks**				

Conclusion

Several internships with focus on experiential learning were conducted. Three groups of students were involved in the study and performed three industry-supported projects. These projects were actual projects with specific deadlines and budgets. A group of three to five students were involved in each project. The projects were carefully selected with full sponsorship and support of partner industries. Students were involved in design, calculation, computer simulation, construction and testing, commissioning and cost evaluation. These projects offered true hands-on experience to students from a concept to the finished product. These types of experiential learning projects require a close collaboration of faculty/collage and industry. Industry must be committed and supportive to guarantee the successful completion of the projects. Finding these projects are somewhat difficult since industries are concern about safety, supervision and other logistics. The participating students for these projects were junior or senior level students with minimal practical experience. The completion of these projects within time, budget and complete industry partners' satisfaction are good indications of the successful implementation of experiential learning project of this type. Students wrote final reports and presented their projects to industry representatives, faculty and other students. Assessment process were conducted using ABET a through k items. The results were satisfactory. Depending on students' mixture and type of project, the assessment results can vary. For example in project III, item (g), majority of students felt their ability to communicate effectively were good while the result for the same question in project I is excellent.

The following steps can benefit the successful completion of such projects.

1. Faculty involvement with industry
2. Industry support and engagement
3. Demonstrating benefits to industry
4. College/ University support
5. Careful selection of students for right project
6. Faculty supervision and monitoring day-to-day progress
7. Fixing any occurring problem quickly and efficiently
8. Communicating with industry and students
9. Performing assessment
10. Providing written report to industry and acquiring their inputs

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