Utilizing Micro-Credentials to Infuse Renewable Energy Concepts into Engineering Technology Curriculum

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Abstract

Creation of micro-credentials in higher education allows practitioners to add a new skill for career advancement or change, as well as working toward a degree by stacking them. After the completion of GE's Wind Turbine Technical Training Program, Farmingdale State College faculty created a " Wind Energy" micro-credential focused on Wind Turbine operation and design. This program covers an array of topics that mechanical, electrical, and civil engineering students can take. While creating this micro-credential program, the College followed the success stories of wind turbine professionals. Furthermore, Farmingdale State College was able to secure grants and build a state-of-the-art wind turbine technology laboratory, the first of its kind in the Northeast and SUNY system. The laboratory space and its equipment, including mechanical drives trainers and a nacelle trainer, play a pivotal role in keeping Farmingdale State College, the local community, and other SUNY campuses, like SUNY at Buffalo, up to date of the wind energy field and its requirements. This includes staying current with educational and occupational perspectives within the industry.

Introduction

Micro-credentials are certified documents that provide recognized proofs of the achievement of learning outcomes from shorter, less duration, educational or training activities [1]. The interest in micro-credentials has gained momentum once the COVID-19 pandemic began, as a governmental response to the unemployment rate raising so rapidly during this time and universities also seeking to develop new markets as their enrollment numbers were declining [2]. Furthermore, it has been found that students want short, practical, and up-to-date courses for the career path of their choosing [3]. The importance of micro-credentials goes beyond their use in extreme situations, such as the COVID-19 pandemic. Micro-credentials also provide a pathway for students to develop a set of skills at a more reasonable cost than an entire bachelor's or master's degree.

This paper will outline the Wind Energy related micro-credential that Farmingdale State College offers and will include how the coursework was developed, the laboratory equipment that was purchased and is used, and the collaborations that have taken place with external entities and other universities and colleges.

Micro-Credential at SUNY Farmingdale

The Wind Turbine Technology (WTT) Micro-Credential program offered at Farmingdale State College began in 2020. This program consists of 3 courses (9 credits) and the list of required coursework is listed in Table 1 [4].

Basic Coursework	(3 courses, **9 credits**)
WTT 101: Introduction to Wind Energy & Turbine Technology	3 credits
Any WTT course 300 level or higher	3 credits
Any WTT course 300 level or higher	3 credits

Table 1. Required coursework for Farmingdale State College's Wind Energy Technology Micro-credential

The WTT courses offered that are of 300 level or higher include [5].

1. WTT 301: Wind Turbine Mechanical Systems
2. WTT 307: Principles of Fluid Systems
3. WTT 314: Wind Turbine Motor Control
4. WTT 415: Wind Turbine Trouble Shooting

These four courses, along with WTT 101: Introduction to Wind Energy and Turbine Technology, were developed by Farmingdale State College's School of Engineering Technology faculty. Each of these WTT courses are assigned a laboratory period to teach students the hands-on applications relevant to wind turbine technicians. These applications include both electrical and mechanical concepts that are seen inside the nacelle of a wind turbine. An entire room within Lupton Hall (where the School of Engineering Technology is housed on Farmingdale State College's campus) was renovated and transformed to hold the educational trainers that were purchased for these laboratories. Equipment (all manufactured by *FESTO*) that was purchased through funds awarded by a Performance Improvement Fund (PIF) grant included. Figures 1-6 below are pictures of the laboratory equipment that has been purchased for the WTT program at Farmingdale State College. Working with this equipment meets all learning objectives that the instructors and students experienced in the GE Renewable Energy Learning Center. Using this equipment not only meets the learning objectives but it also allows students to learn the skills in a safe and controlled environment and can repeat many parts of the hands-on practices until sufficient competencies are achieved.

1. Mechanical Drives Trainers (3x)
2. Industrial Motor Control Trainers (3x)
3. Nacelle Trainer
4. Electrical Pitch Hub Trainer

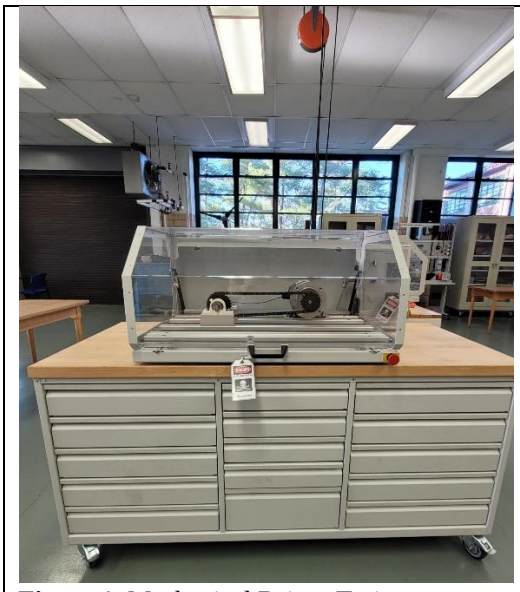

Figure 1. Mechanical Drives Trainer

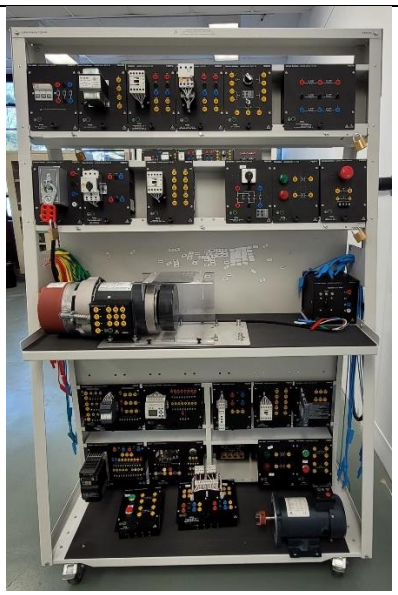

Figure 2. Industrial Motor Controls Trainer

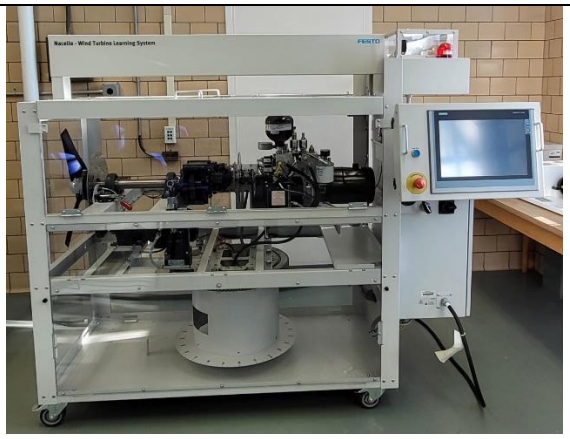

Figure 3. Nacelle Trainer

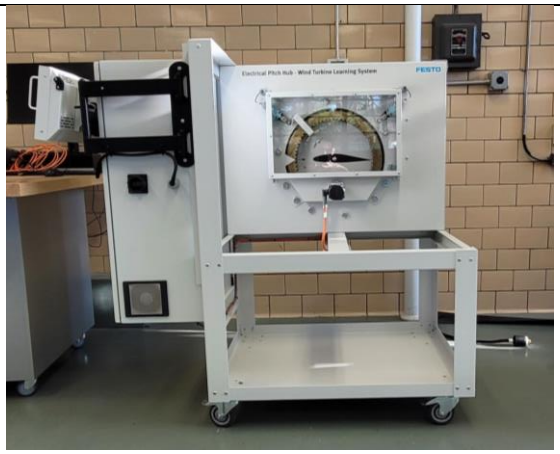

Figure 4. Electrical Pitch Hub Trainer

Five (5) virtual reality headsets with built in software were also purchased, from *Vinci VR*, with funds from this PIF grant. The software contains a number of activities to give users a more realistic idea of what is like to be on top of an offshore wind turbine, how to operate a marine vessel, and how to locate and trouble shoot issues within a nacelle of a wind turbine, while keeping the user safe and at ground level.

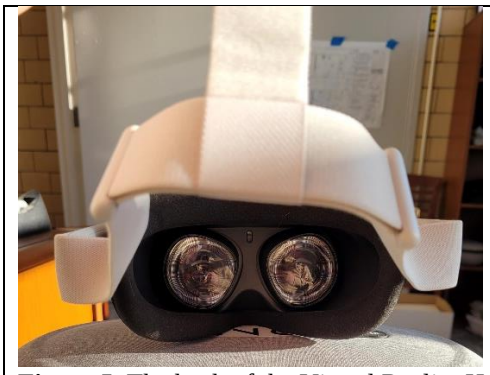

Figure 5. The back of the Virtual Reality Headset

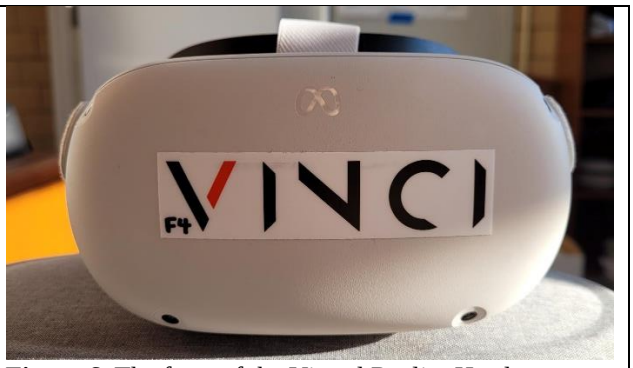

Figure 6. The front of the Virtual Reality Headset

Collaborating with external partners was a vital part to the successful building of this micro-credential. Having a connection with *Tech-Ed Systems*, who distributes the educational training equipment that was purchased, made the entire procurement process that much easier. Furthermore, speaking with experts in the maritime business and other SUNY institutions (such as SUNY Maritime and SUNY Stony Brook), gave Farmingdale State College a better understanding of what was already being done in this space and the future plans that others had in mind.

The list of what was learned throughout building this micro-credential is invaluable. The opportunities this program has for faculty to build their knowledge in the field, the benefits for students to begin or continue to learn a new trade, and the economic impact this program can have once students complete it and go out to work in the field, have all come from the process of developing this program.

Lessons Learned

A number of lessons were learned throughout the entirety of this micro-credential building process, the first being the importance of leadership. Having a leader who not only understood the nuances from an educational standpoint, but also those from the perspective of industry provided an excellent foundation for all individuals who contributed to this project. Furthermore, communicating and working with industry partners played a significant role in this micro-credential development. Attending technical training and listening to recommendations of industry partners in companies like General Electric (GE) provided a clear pathway to building the course work and choosing the appropriate educational trainers that much easier. Staying atop what is happening not only in the respective industry, but also in the political world that affects it is crucial to understanding when a micro-credential can be offered. With students wanting careers in the field, there needs to be a political structure that allows for a pathway, otherwise enrollment will likely be lower than expected in micro-credential programs like these. Lastly, it was also found that selecting faculty and staff members who are passionate about the subject at hand made the development of the micro-credential more enjoyable. With passion came hard work and determination that helped complete the course development and purchasing of equipment.

Conclusion

Farmingdale State College envisions this program moving forward, is to continuously offer this to larger groups of students as the offshore wind career opportunities continue to come to Long Island/New York State. Continuing to collaborate with external partners to stay on top of the opportunities available for these students will be crucial for the College. Learning from these external partners may provide pathways for the College to further expand the topics that are taught within this micro-credential. Furthermore, keeping the possibility open for the program's students to attend appropriate industry safety trainings (such as the Global Wind Organization (GWO) trainings) that the College cannot offer, will only be possible with this continued collaboration.

Based on the lessons learned in this case study the authors are working on expanding the scope of the work and research. The goal is to apply all the learnings from this experience as well as the experiences that have not yet been gained by offering the micro-credentials to be utilized in applications of a broader range of topics.

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