2021 ASEE ANNUAL CONFERENCE
Virtual Meeting | July 26–29, 2021 | Pacific Daylight Time
Paper ID #34231

Engagement in Practice: Lessons From a Large Engagement Program During a Pandemic

Dr. William "Bill" C. Oakes, Purdue University at West Lafayette

William (Bill) Oakes is a 150th Anniversary Professor, the Director of the EPICS Program and one of the founding faculty members of the School of Engineering Education at Purdue University. He has held courtesy appointments in Mechanical, Environmental and Ecological Engineering as well as Curriculum and Instruction in the College of Education. He is a registered professional engineer and on the NSPE board for Professional Engineers in Higher Education. He has been active in ASEE serving in the FPD, CIP and ERM. He is the past chair of the IN/IL section. He is a fellow of the Teaching Academy and listed in the Book of Great Teachers at Purdue University. He was the first engineering faculty member to receive the national Campus Compact Thomas Ehrlich Faculty Award for Service-Learning. He was a co-recipient of the National Academy of Engineering's Bernard Gordon Prize for Innovation in Engineering and Technology Education and the recipient of the National Society of Professional Engineers' Educational Excellence Award and the ASEE Chester Carlson Award. He is a fellow of the American Society for Engineering Education and the National Society of Professional Engineers.

Paul A. Leidig P.E., Purdue University at West Lafayette

Paul A. Leidig is a PhD student in Engineering Education and a member of the instructional team for the Engineering Projects In Community Service (EPICS) program at Purdue University in West Lafayette, Indiana. He received his Bachelors of Science in Architectural Engineering from the Milwaukee School of Engineering and Masters of Science in Civil Engineering from the University of Illinois at Urbana-Champaign. Mr. Leidig is licensed as a Professional Engineer in the state of Colorado and has six years of industry experience in structural engineering consulting. Throughout his student and professional activities, he has focused on community-engaged engineering and design for over thirteen years.

Nusaybah Abu-Mulaweh, Purdue University at West Lafayette

Nusaybah Abu-Mulaweh is a Continuing Lecturer in the Engineering Projects In Community Service (EPICS) Program at Purdue University in West Lafayette, Indiana. She received her Bachelors of Science in Computer Engineering from Purdue University Fort Wayne, and received her Master of Science in Electrical and Computer Engineering from Purdue University in West Lafayette, Indiana. She is currently pursuing her PhD in Engineering Education at Purdue University in West Lafayette, Indiana.

Mr. Andrew Pierce, Purdue University at West Lafayette

Andrew Pierce is the Assistant Director of the EPICS Program at Purdue University.

Engagement in Practice:
Lessons from a Large Engagement Program During a Pandemic

Abstract

2020 was a challenging year with classes moved online creating challenges in community-engagement with its reliance on interactions with community partners. This paper documents how one large community engagement program adjusted to the move online in the spring and the new realities of fall semester when many students returned to campus. Contacts with partners were reduced or eliminated. Teams continued their work and adapted to balance student learning and the community-engagement. With over 120 active projects and over 50 community partners, the adaptations and impact varied across design teams. The student experience remained strong and community partners remained committed their partnership.

Introduction

Community-engaged learning is the integration of academic learning and engagement with communities. The engagement aspects require communication and contact with partners within the community, locally or globally. The pandemic created challenges globally and across education. While some modes could move online, community-engaged learning is more challenging in settings that limit student interactions and engagement with community partners and stakeholders. This paper highlights issues faced by a large and institutionalized community-engaged learning program at a large public Midwestern university during the pandemic including during a move to total remote learning for the entire campus in spring 2020 and subsequent partial return to campus with restrictions for COVID-19 in the fall. Approaches are shared not as completely ideal solutions but ways that we responded and lessons we learned.

Program background

EPICS (Engineering Projects in Community Service) engages over 1100 students in long-term local, regional and global partners. Students come from first to final year and from many majors. EPICS teams, or course sections, typically consist of 8-25 students and are student led with a faculty or industry advisor. Graduate teaching assistants (TAs) support the advisors and each supports 3-4 sections providing a mechanism for consistency across teams. Each section comprises multiple project teams. A common design process, where interactions with community partners is central, guides students through the design process. Once a project is delivered, a new project is identified by students, their faculty mentor(s) and community partner(s). Example projects include assistive technology, database software for human services agencies, and energy-efficient and affordable housing solutions [1-3].

Spring 2020 move to online

Like many campuses, Purdue University moved online in March of 2020 and sent students home where possible. This began an odyssey that would last into 2021. The major milestones are shown in Figure 1. Before the formal announcement, the staff prepared plans to move to online

as a contingency. A central value of EPICS is empowering student leaders to manage the teams and the student leaders were asked to think about contingencies for moving online. This paid dividends as when the move was formally announced, the teams had considered options and could execute faster. It was still a shock to the systems but it helped to have develop a strategy prior to the move. Teams identified aspects of the projects that they might be able to take home to continue to work or how to shift the work to things that could be done virtually. Most of the projects had to be adapted to the new reality. Some of the design work was with software or the development of a design, such as with large construction projects and these projects continued in the move to virtual teams. Some projects had small components that could be taken home with students. The program allowed students to take equipment with approval and materials were sent to students as needed. All of the teams continued to make progress while many were delayed as they could not be transported or required equipment that was on campus.

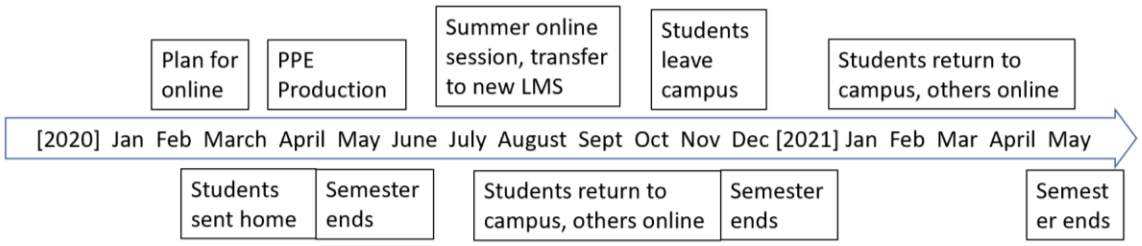

Figure 1 Timeline

We surveyed both the student teams and the community partners on their readiness and suitability of project for online work. Students were polled during the first two weeks of May 2020, and 16.92% of teams felt it was difficult to impossible to continue their projects remotely, 49.23% thought they could work remotely with major modification of their current approach, 26.15% with minor modifications, and 7.69% felt their projects were ideally suited for remote work. The data is clearly impacted by the project but since the data was collected anonymously it could not be broken out into projects.

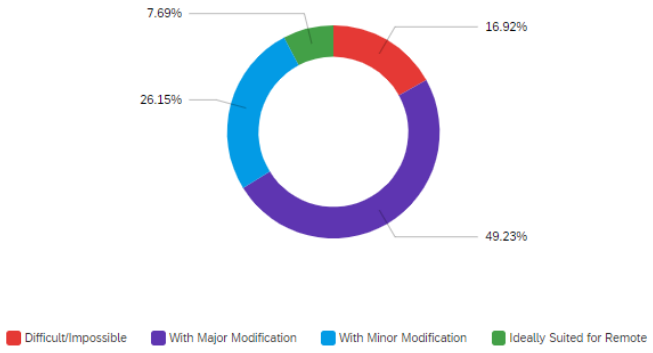

Figure 2 Moving Projects Online

Students were also asked in advance of the campus shutdown to think through several aspects of their EPICS experience, and their responses helped shape our response during the lockdown and subsequent reopening. Students identified challenges they would anticipate with remote work, described the opportunities and/or goals during a potential remote work period, evaluated what aspects of the program were most valuable to them, and provided feedback on methods to establish effective teams. As we moved online, we held information sessions for the instructors.

We shared the information, ideas for how to move ahead and best practices. It seemed that being able to process together was as important as the content shared in these sessions.

While the pandemic caused disruption in many projects, it also provided motivated students to work in creative new ways. A benefit of the move to online is that the students could not tinker and figure things out, but instead had to thoroughly plan and execute their projects. It presented the opportunity for students to engage in more analyses. Test plans were developed. Design for Failure Mode and Effects Analysis (DFMEA) is a part of the design process in normal times and these analyses are not always as complete as desired in the rush to finish projects. Research into alternatives for their current or future designs could also be done. Catching up on documentation was another activity which added value. Many projects include a user manual and students worked on these to improve them and in some cases developed them before the actual designs, which is a technique used in some design processes.

We had to figure out how to run the lab meetings with the design teams. Each team or course section may operate slightly differently with their instructional team and student leaders and we offered some program structure, ideas and flexibility. We had three accounts for GoToMeeting, one for each of the classrooms that were set up to allow alumni, community members or corporate partners to participate in reviews remotely. These accounts provided a virtual classroom space. Students and faculty had their own WebEx accounts and could set up breakout rooms. Generally, the teams all started in the GoToMeeting session together and split into breakout rooms to work and advisors and TA's moved between or into special sessions. An example was the largest division, the EWB-USA team, had over 40 members. The student leaders developed a scheme for the advisors and mentors to meet during the lab time. It began with everyone in the main session together and they broke out. Advisors had their own breakout rooms and the leaders set up a schedule and teams entered the advisors' virtual room per the schedule to discuss team specific issues. Other teams had advisors move between sessions.

The community partners were all very understanding and were also dealing with the pandemic. The move in the spring was short term and we communicated that we would develop a plan together for the following year. Partners were asked in May 2020 to identify any new challenges or opportunities presented by the pandemic, to rate their desired engagement for fall 2020, and whether they would allow in-person engagement or restrict to online engagement only. Most project partners indicated that would continue to engage their student teams, but some found that they no longer had the capacity to engage through the pandemic.

The semester ended with some projects completed but most were delayed. The projects that were further away that had been working remotely seemed to work the best, although planned trips to partners were cancelled putting schedules and plans on hold or forcing alternative scenarios to be put into place. The EWB-USA team shifted to working with a local Non-governmental Organization (NGO) to gather data planned to be collected during a summer trip.

Another remote project that was completed was a greenhouse project that was developed in partnership with the Oglala Lakota College (OLC) in South Dakota. The design was being done collaboratively and weekly online meetings were held under normal operations. While the

design work continued, a planned trip was also cancelled and the manufacture of the greenhouse as well as local permitting was delayed. The greenhouse was being manufactured in Illinois and transported to South Dakota so COVID restrictions in multiple states impacted the project. Ultimately it was delivered but the instructors at both institutions had to jump in and manage the installation and delivery after the semester ended. It was also delivered to an empty campus at OLC as they had also moved to remote learning.

Help with PPE

The move online meant some students, faculty and staff were still in town. The pandemic put a strain on local supplies of PPE and the leadership team offered to be part of an effort to meet these needs. We approached this with the same ideals of engagement and rather than create our own ideas, we looked at how we could add value to efforts that cut across the university. These included a partnership with the human development and family studies faculty to create a production line that turned Tyvek into gowns and caps for hospitals. We cut patterns on large scale and distributed them to local people who could sew. Other efforts made face shields at the advanced manufacturing center. While this did not involve student projects, it delivered thousands of pieces of PPE's to area hospitals and first responders. We explored briefly if we could convert student projects into these efforts but the medical community was too stretched.

Summer 2020

The summer offerings are always smaller and teams were given projects that could be done online that involved software develop and design development that did not involve hardware. The online meant that we could engage students from. Some students in Korea had capabilities get electrical components and did testing on some of the designs that moved the projects forward. In the summer we began the transition to MS Teams as the dominant platform. This smaller scale experiment allowed testing of features that would be used across teams

Fall 2021

Purdue University was one of the first institutions to announce that we would be open for on campus learning. What that meant for our classes, however, was not determined until well into the summer so scenarios were developed as things evolved. Plans were first rolled out for traditional classooms and labs but the engagement teams did not fit with their active learning within the classes. Classroom capacities were set based on all students facing the same way. Other active learning environments ran into similar situations. We were able to increase the capacity of our classrooms with the requirements of masks and face shields but they were still below the enrollment of many class section sizes. That meant that we could not get all of the students within a section into one classroom and would have to rotate student teams in and out.

In addition to the pandemic changes, the university moved to a new learning management system and our program moved to MS Teams as the main communication system. These changes had been planned well before the pandemic. The move to Microsoft Teams provided a means to host online and hybrid teams meetings and include external partners as needed without adding on separate software systems like we had to do in the spring. Channels were set up within Teams

with everyone starting on a general channel for that division. Each project team had their own channel and we could keep everyone within the same software. The program also used electronic notebooks using OneNote and SharePoint for team documents. This made the transition to online in the spring much easier as students still used the same method to document their work. OneNote integrates with Teams well and made this much easier.

Online students

In the summer it was clear that we could have some fully online students as well as in person. Even if students came to campus, they may need to be quarantined so all of the teams needed to be configured to meet remotely and in person. We allowed online students to join any section and set up each to accommodate fully online or temporarily online. About 300 students join EPICS as a substitute for their first-year engineering courses. We felt that creating a dedicated experience for the online first-year students was important and offered one lab time early in the morning and one late afternoon to accommodate time zone variations as the cohort including students from the U.S., South America, Africa, Europe and Asia. It was unclear how many we would have but we ended up with 29 online first-year students who were nearly split in half between the two sections. All of the projects were able to be done remotely.

Semester schedule

The first week was online so students could get organized using MS Teams. The first week has a lot of organization. EPICS allows students to take the course multiple semesters so some students are returning to their project and others are new to the team or to EPICS. The first meeting includes integrating the new students onto the project. Each division has a different enrollment and different number of projects. A task for each team was to develop a schedule when students could physically be in the meeting room with the limited the meeting room capacities. The schedule was left to the individual instructors working with their team leaders. Some teams started with an overall meeting with some joining online and some in the class. After a period of time, the students would rotate out of the classroom. A challenge was where the students would go. At first, this seemed like it would be a significant problem but the university set up tents outside and many of the classrooms in the building had moved to online so they were empty. This allowed students to find places to be as a team and work when they were not in our classroom or the labs which also had capacity limits. Another week that was fully online was design reviews. In the middle and at the end of the semester, students present their work to outside reviewers and we moved fully online. We had an increase of participation from local retirees. The option for online reviews has been with the program for several years so the process was already in place and we simply eliminated the option for in person reviews. This went very smoothly. The labs are typically open 24 hours seven days per week with key card access. With COVID protocols, the labs were limited to Sunday to Friday and closed late in the evenings. Extra student workers were added and each night went through a comprehensive cleaning

Staff

Staff were given options of being in person or online. Anyone who was in a high risk group or requested to be was moved to fully on online for the semester. This meant that some students who were in person had instructors who were online. Each team is supported by an advisor (instructor) and a graduate teaching assistant (TA). Some instructors and some TA's were online and they were matched so that at least one was on campus for the in person labs.

Community partners

A hallmark of the EPICS Program is the long-term engagement of 57 active community partners. Because the pandemic also created havoc for our partners, we gave each of them the option of taking the semester or year off with our students and return after COVID. All of the partners stayed engaged in some manner but the ways we interacted changed in many cases. We could not transport students off campus so most of the work was done remotely. It was a challenge for the new students to not be able to see and experience the partners, however returning students helped that a great deal. Partner interactions actually increased in frequency in some cases as the partners were isolated and online and could pop into a lab meeting much more easily than coming to campus. The nature of many of the projects changed. For example, many of the education projects changed to developing virtual activities. Maintenance and delivery procedures changed with touchless hand offs. For example, one of the local education partners would arrange for a project that needed service to be in the dock area, students would come and remove the project and take it back to campus without seeing the partners.

The communication with global or domestic partners who were farther away including global partners did not change the nature of the communication but they were all also dealing with the pandemic. A challenge for the teams with global partners, however, is that trips have been cancelled. An important core for these partnerships is the students who have been to the partners. Their experience is shared amongst the other students. Those who have been on the trips are graduating and few will remain which is a source of concern until the trips resume.

Professional Development Hours (PDH's)

Students are required to complete a number of PDH's to supplement their project experience. Normally, the PDH's are a mix of in person and online experiences. Some that were training for skills like working with electronics were still in person but with much lower numbers. A benefit of the move to online was the increase in availability of experts to share. The quality and profiles of speakers increased with their availability and the online nature.

Conclusions

Through the process we learned that flexibility and creating contingency plans at least at a preliminary level were very important. A value of EPICS is partnerships and those included the community, faculty, staff and students were vital to responding to the pandemic. Open communication with partners allowed plans to be made. The technology platforms allowing remote contributions enabled collaboration through the year. Many people worked very hard to allow students to return to campus and the results were very positive with no cases traced to

interactions in our programs classrooms or labs. We, like everyone around the world hopes that this is a once in a lifetime event. Coaching student leaders through the process we hope will help prepare them for future challenges when they are in leadership positions on larger scales.

References

[1] Coyle, Edward J., Jamieson, Leah H., Oakes, William C, "EPICS: Engineering Projects in Community Service", *International Journal of Engineering Education* Vol. 21, No. 1, Feb. 2005, pp. 139-150.

[2] Zoltowski, C. B., and Oakes, W.C., "Learning by Doing: Reflections of the EPICS Program", *Special Issue: University Engineering Programs That Impact Communities: Critical Analyses and Reflection, International Journal for Service-Learning in Engineering,* 2014, pp. 1-32.

[3] Oakes, William, Andrew Pierce, Nusaybah Abu-Mulaweh, "Engagement in Practice: Scaling Community-based Design Experiences", *Proceedings of the 2018 ASEE Annual Conference*, Salt Lake City, UT, June 2018.