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Development of a Community of Practice for Rethinking Best Practices in Post-COVID Experiential Learning

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Abstract

In the laboratory classroom, students have opportunities for design, problem solving, and exposure to real-world issues that are not usually present in traditional homework assignments. However, to operate effective laboratories, engineering departments and colleges must address challenges such as budget constraints, space limitations, class size, and limited teaching resources. The COVID-19 pandemic has only exacerbated these issues and added more with the need for online and remote learning experiences without sacrificing the benefits of experiential learning. Laboratory and design courses were significantly impacted by the sudden move to remote delivery during pandemic lockdowns. Instructors and departments made decisions for adapting each course based on specific needs. Throughout that time, instructors in lab and design courses identified both the successes and the continuing challenges to remote and hybrid delivery. When courses returned to in-person modalities, instructors considered what lessons learned can inform the future of experiential learning-based courses. This paper describes development of a Community of Practice (CoP) of lab and design course instructors to develop strategies and best practices across one engineering college as we enter a new era of teaching and learning, post-COVID. This paper describes formation of the lab and design CoP, practical operating details of the CoP, as well as lessons learned from delivery of workshops and meetings. In addition to providing a road map for instructors to form a similar working group at their institution, we will share knowledge gained, commonalities across course types, and a summary of answers to the questions that inspired the formation of this CoP.

Introduction

Laboratory experiences are a form of experiential learning and a common component of undergraduate STEM education. These courses have the potential to provide valuable experiences for students, who benefit by connecting the theories learned in lectures to practice in the laboratory [1], [2]. In the laboratory, students also have opportunities to develop skills and gain experience with design, problem solving, and exposure to real-world issues that are not usually present in traditional hand-written homework assignments [1], [3].

The importance of experiential learning in the classroom has a long theoretical and historical basis; references to the use of 'authentic' experiences in science education in the United States date back to the formalization of the K-12 educational system as we know it around the turn of the 20^{th} century [4], [5]. John Dewey first proposed the revolutionary idea of blending experiences with education in 1938 [6]. Later in 1946, Kurt Lewin learned the importance to the learning process to have some tension or conflict between participants in a training group (T-group) during the subsequent discussion about an experience. Although his findings did not become wide-spread until the 1960s, Jean Piaget started investigating how intelligence is changed by experiences as early as the 1920s. More recently, internships, laboratory experiments, and on-the-job training have witnessed the impact experiential learning has had on education [7], [8]. Our understanding of the role of experiential learning and its positive impact on students is evolving given the changes in both technology and education itself [6].

In theory, experiential learning should be beneficial to students, however effective implementation can be challenging. Research on laboratory instruction from the 1980s to the present suggest that experiences alone are not sufficient to teach students the skills, concepts, and attitudes we set as our objectives – in short, pedagogy matters [9]–[11]. The majority of laboratory and design course instructors in university settings are subject area experts, yet have varying levels of pedagogical content knowledge to help them understand their students and the impacts of the learning environment [12]. Simultaneously, instructors must navigate challenges such as budget constraints, space limitations, class size, and limited teaching resources [13]–[16]. Many instructors resort to inventing and reinventing the wheel, costing time and energy.

The emergence of the COVID-19 pandemic added new challenges for the successful implementation of experiential learning. Laboratory and other design-focused courses were significantly impacted by the sudden and sustained move to remote delivery. While adding new logistical challenges, remote and hybrid instruction exacerbated pre-existing challenges – particularly related to social concerns and wellness – and reified the value of hands-on experiences. In a fall 2020 survey of students at University of Illinois Urbana Champaign, more in-person courses and peer interaction were among the ideas listed as desired improvements for spring 2021. In a survey of students in a project-based engineering course at the University of California, Irvine, 43% reported that a difficulty of laboratory courses was the reduced quality of interaction [17]. On the same survey more than 25% of the students reported the hands-on laboratories and projects helped them stay motivated during the pandemic [17]. More broadly, a survey of college students across the United States [18] and one in the United Kingdom [19] reported increased stress and mental health conditions due to the pandemic.

In this time of heightened challenge, a Community of Practice (CoP) was formed to connect and support instructors involved in experiential learning across multiple departments in the Grainger College of Engineering (GCOE) at the University of Illinois Urbana-Champaign (UIUC). Over the past year, the CoP described in this paper hosted workshops and coffee hours to discuss relevant topics, challenges, and ideas among faculty. Questions the CoP have considered over the past year include: What opportunities exist to improve instruction? What methods exist for developing student engagement? Which methods can be adapted to large undergraduate labs? These are a few of the questions that the GCOE UIUC Undergraduate Experiential Learning Course CoP aimed to answer through gatherings and discussions of instructors. This paper describes the formation of the CoP, logistics of the first semester running the group and events and provides evaluation data collected from participants. We provide a roadmap for others who may want to form similar working groups at their institutions.

Formation of the Community of Practice

During the transition to online lab delivery from spring through fall of 2020, many instructors found themselves in the same workshops, symposiums, and social networks as they worked to improve their practices. By the spring semester of 2021, a set of these faculty, with a common interest of experiential learning through laboratory courses, arranged a meeting to discuss their recent experiences. The group was excited to discover commonalities in the successes as well as commonalities in their continuing pain points. Yet, differences in the methodologies also showed that the group had much to share and learn from each other. With internal seed funding, this newfound CoP arranged to conduct weekly meetings and began to discuss their scholarly plans to improve teaching and learning. The CoP started with six core faculty members. The group decided to host twice monthly meetings for the broader community of instructors focused on experiential learning. The goal of the CoP was to create a space for lab and design instructors to learn and share best practices.

Membership Recruitment

The current project team includes instructional laboratory and design course instructors from across the UIUC GCOE. Additional faculty were recruited by advertising to department associate heads of undergraduate education, our college teaching academy, and word of mouth. In the first semester, 30 faculty and staff members joined the CoP. The faculty engaged in the CoP represent most of the departments across the GCOE, and come from all ranks of positions, from staff to specialized faculty to tenure-track. The courses members teach range from required courses to electives, with sizes varying from small (~25 students) to very large (hundreds of students). Altogether, it is estimated that approximately 3,000 students per year are impacted by these courses, showing the significant impact these instructors have and potential for impact from knowledge gained in the CoP. The staff members who have joined serve in roles such as undergraduate advisors, laboratory support staff, and technology support. Currently, membership has been limited to faculty and staff, however, inviting interested graduate students to join the CoP is being considered for future expansion.

Structure of CoP meetings

When faculty and staff join the CoP, they are invited to a Microsoft (MS) Teams environment. MS Teams serves as the main communication channel for the group. Announcements are made and all files are stored and shared through this platform. The CoP planning team meets weekly to discuss teaching related topics, develop resources, and plan events. Within the larger CoP, an average of two events are held per month. A different member of the CoP takes charge of each event. In the pilot semester, each month, one event was a workshop on a selected topic, which typically had an invited speaker and was more formally structured. The second event was a coffee hour, which was an informal conversation on a chosen topic. Different modalities were used, and attendance varied from event to event, as shown in Table 1. In addition to the archive of the chat on MS Teams, the CoP maintains a website with materials from each event. The goal of hosting materials on a website is to gather resources for laboratory and design instructors into one easy to access location. On average ~9 participants attended each event in the pilot semester.

Due to the ongoing pandemic, the CoP offered an online option at every event. How people used the online option varied throughout the semester depending on the state of the pandemic. This option also offered some flexibility for instructors who were between classes and other meetings. The group plans to remain flexible in the meeting modality based on the needs and desires of the greater CoP participants.

Table 1. Lab and Design CoP meeting topics, format

Meeting Topic	Format	Tech Used
Workshops (formal information sharing with a speaker):		
Adapting a Cell and Tissue Engineering Lab Course for Online Delivery: Lessons Learned and Future Directions	Online	Microsoft Teams, breakout rooms
Creating a Culture of Inclusion	Hybrid	Microsoft Teams, Jamboard
Facilitating Teamwork	Online	Microsoft Teams, Jamboard
Teaching Assistant Panel	Online	Microsoft Teams
Developing Writing Assignments for Lab Courses	Online	Microsoft Teams
Canvas	Hybrid	Microsoft Teams, Canvas, software demonstration
Coffee Hour Chats (informal conversations around a topic with a short intro):		
Technology Across Modalities	In Person	Powerpoint
Training teaching assistants	Online	Microsoft Teams, breakout rooms
Canvas	Hybrid	Microsoft Teams, Canvas
Diversity, Equity, and Inclusion	Online	Gathertown
Teamwork and Assessment	Online	Gathertown
Informal Networking	Online	Gathertown
End of Year Celebration	In Person	N/A

Data Collection

To understand the outcomes of our CoP we developed two surveys: (1) a pre-survey used to gauge faculty interest and needs, administered when faculty joined the CoP and (2) a post-survey administered at the end of the first semester. The pre-survey helped inform meeting times, connectivity of the group, and general interests of CoP members. The post-survey was used internally to understand what worked in the first implementation, what could be changed, and the general needs of the CoP members. Tables 2 and 3 detail the questions asked on pre- and post-surveys during the pilot semester.

Table 2. Questions on CoP pre-survey.

Pre-Survey: CoP Interest Form	
Name	
Primary Department	
Which lab or design courses do you generally teach and what is the average semester enrollment?	Free response
What types of activities are you interested in participating in?	(1) Workshops, (2) coffee hour discussions (3) online discussions, (4) other
What topics are you interested in discussing?	(1) Teams (managing, creating), (2) Instructional design, (3) Training course staff, (4) equity and access, (5) content, (6) technology to facilitate interaction, (7) evidence-based practice, (8) other
Availability	
When I need to figure out something in my lab or design course, I generally __________.	(1) Figure it out myself (2) Talk to my co-instructor or lab manager, (3) Talk to someone else in my department, (4) Talk to someone else in another department, (5) Talk to someone at the teaching center, (6) Use another university resource, (7) Talk to someone outside the university
Is there anything else you would like the organizers to know?	Free response

Table 3. Questions on CoP post-survey.

Post-Survey: CoP Reflection	
To your best recollection, which CoP events did you attend this semester?	[List of events]
Which event did you find the most useful or interesting?	[List of events]
Is there anything from a CoP event you attended that you have already implemented in your class or are planning to implement in the future?	[if yes, “Please tell us more”]
What has been the most helpful about the events we've held this semester	(1) Scheduling (2) Interesting topic, (3) Location, (4) Option to attend remotely, (5) Other
What have been the biggest barriers for attending events this semester?	(1) Not Interested (2) Time conflict, (3) Too busy, (4) Difficult to use Teams, (5) Other
At the beginning of the Fall semester, how connected did you feel to other lab or design instructors in your department?	[5 point Likert scale]
How connected do you feel to other lab or design instructors in your department now?	[5 point Likert scale]
At the beginning of the Fall semester, how connected did you feel to other lab or design instructors across the College of Engineering?	[5 point Likert scale]
How connected do you feel to other lab or design instructors across the College of Engineering now?	[5 point Likert scale]
How much has this Community of Practice helped you feel more connected with other lab and design instructors?	[5 point Likert scale]
What kinds of topics would you like to discuss with other instructors in a coffee chat format?	Free response
What kinds of topics would you like to learn more about in a workshop or seminar format?	Free response
Which modality would you prefer for events?	(1) In person (2) Online, (3) Hybrid
Do you have any other suggestions or requests?	Free response

Reflections

Scheduling proved to be an important factor in successfully executing the CoP events. We anticipated this as a challenge, given the high number of contact hours for laboratory and design instructors and courses. To address this challenge, we have and will continue to host events at different days of the week and times of day to increase the chances of CoP members being able to attend at least one event. We also are somewhat limited by tailoring times to guest speaker schedules. For example, in Spring 2022 we hosted a Teaching Assistant (TA) panel. We held this event on a day in which all panelists were available.

Although the CoP has only been in existence for one semester, it is already having a measurable impact on the instructors involved. Based on the number of faculty on the planning team that planned to implement team contracts in their courses, the CoP is conducting a study of the impacts of this practice on students learning outcomes and satisfaction in group projects. This study is ongoing.

The list of topics that could be covered by the Labs and Design CoP grew as the semester went on, most discussions during CoP events ended with more ideas for future discussions or topics. Table 4 details a list generated by the CoP organizers for future events.

Table 4. Categorized topics for future CoP meetings

Category	Topics

Instructional Design	• Staffing
	    • Staff-to-student ratio
	    • Peer staffing options: undergraduates vs graduate students
	• Student teamwork
	• Procedure styles
	    • Cookbook vs. partially structured vs. unstructured
	• Exercises and assessment
	    • At-home exercises vs. in-lab exercises
	    • Kit design and distribution
	    • Documentation, writing in class

Training Staff	• Necessary TA skills
	    • Providing both technical feedback and encouragement
	    • Create a positive learning environment
	• Training on rubrics: Good, bad, and ugly examples of work

Equity and Access	• Addressing bias and microaggressions in teams • Access to equipment and course resources
Content	• Breadth of coverage was reduced during COVID. What returns? • Keeping remote students engaged • Are the learning objectives clearly stated? Adaptable?
Technologies to Facilitate Instruction	• Software (Zoom, MS Teams, Slack etc.) • Hardware (webcam, cell phone, etc.) • Tools for synchronous vs. asynchronous

Applications post pandemic	• How online exposed weak assumptions about face-to-face methods.
	    • Structures to support group dynamics, collaboration
	    • Assessment methods
	• Deliberate hybrid instruction
	• Flexibility
	    • Accessibility
	    • Pandemic- and non-pandemic-related emergencies
	    • Pivot between face-to-face and online

Models/evidence-based practice	• Communities of Practice
	    • COE, Course Staff, Students, University/National/Worldwide
	• Collaboration
	    • Teams and team contracts
	    • Paired Programming

Future Considerations

As the CoP continues to operate and grow, the planning committee regularly seeks informal and quarterly formal feedback from members. The members are willing to provide rich feedback to the CoP, leading to an experience that can better meets the group's needs. Experiential learning and instructional laboratories provide a data rich venue for the focus of STEM education research projects. This CoP provides an opportunity for education researchers interested in this topic within the GCOE to network and develop collaborations to support these projects. Some members of the project team already have conducted research in this area and can support those who are interested in starting research in this area. Potential topics could include team contracts or diversity, equity, and inclusion within a lab/design course (Table 4).

Conclusions

The Laboratory and Design instructor CoP at the University of Illinois Urbana-Champaign has formalized many of the siloed discussions that occur among instructors, and successfully broadened that community. Data collected to date show that the CoP is a benefit to the community and there is a desire for additional discussions. With two events a month, the CoP has only begun to cover the breadth and depth of topics of interest to the CoP members.

The planning group spent much of the first semester thinking about how to best meet the needs of the community, while creating a sustainable program. To this end, the group has made specific efforts to distribute the planning work, event hosting, and evaluation related tasks. The planning committee draws from five departments, various positions, and seniority at the institution. This provides varying areas and levels of expertise for members to contribute to planning events. As mentioned, the group is currently engaged in the first CoP derived education research project and more opportunities have been discussed. In the future, we plan to assess the impact this CoP had on student perceptions and outcomes, as well as the impact of the CoP.

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