Lessons Learned: Making Shifts: Faculty Development Shifts in a University Makerspace During the COVID-19 Pandemic

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Introduction
There are specific events in history that prompt the question, “Where were you when…?” And there is no doubt that University faculty will be asking, “Where were you when your university shut down and moved to remote learning for the COVID-19 worldwide pandemic?” While this paper is not about where faculty members were when this happened, it is about the lessons learned after a university campus made the decision to close its doors to in-person learning in the Spring of 2020. Specifically, this paper explores broad lessons learned for engineering faculty development as well as staff and departmental supports in a university makerspace during the 2020 spring and fall semesters. We refer to the abrupt transition to online and hybrid courses because of an international pandemic as the COVID-19 pivot.

Context
These lessons learned were discovered at a large, public research university in the southwestern United States. This university boasts an engineering school with an undergraduate engineering population of approximately 6,000 students. This university’s makerspace is available to all engineering students and faculty for coursework, research, and personal projects. The makerspace is over 25,000 square feet and is prominently located in the newest engineering building on campus. The space is highly visible with floor to ceiling windows giving it a powerful presence in the school of engineering. This space predominantly houses machines associated with rapid prototyping. The makerspace is led by three fulltime employees who train a cohort of undergraduate student workers. One unique aspect of this space is how faculty are engaged and supported in using the space in their research and curriculum.

The spring semester at this university began in mid-January 2020. At this point, the makerspace and faculty development programs were operating as they had in previous semesters. This included courses introducing projects that would use the makerspace, monthly faculty lunches in the space in which curriculum design challenges, successes, and opportunities were discussed, and one-on-one curriculum support sessions with the makerspace staff and the curriculum support team. During this time, over 4,000 students and thirty-two courses within the college of engineering were using the makerspace to support student learning in their classes.

This momentum came to a grinding halt on Friday, March 13, 2020 when the university announced all of its classes would transition to online learning for an undetermined amount of time. This was the beginning of a scheduled Spring Break across the university in which no classes were held. Upon return from an extended Spring Break, the university made the decision to move all classes to remote learning throughout the remainder of the semester. As the state of the university and makerspace shifted throughout the summer of 2020, numerous faculty development efforts were implemented within the college of engineering to support the use of the makerspace in the engineering curriculum. These developmental efforts were implemented throughout the fall 2020 semester and are elucidated in the lessons learned portion of the paper.

Participants, Data, Data Collection
These lessons learned are part of a larger research study of faculty development, pedagogical practices, and student support. This includes three semi-structured interviews with the manager of the makerspace (a university faculty member), 4 faculty member interviews, and
artifacts including images, videos, and student projects that demonstrate the results of the instructional and pedagogical shifts throughout the pandemic. See Figure 1 for a timeline of data collection and important events.

**Figure 1: Timeline of Data Collection**

![Timeline of Data Collection](image)

**Lessons Learned**

Throughout the 2020 Spring and Fall Semester there were key moments that illustrated various shifts in the way the makerspace approached faculty development. After the pivot, the makerspace staff adopted a triage mentality. Student projects were left half-started, unfinished, or frozen in cardboard prototypes. Faculty members spent their 2020 Spring Break making decisions about how to adjust their newly created learning objectives to “fit” an online learning environment. Preliminary analysis of faculty interviews, class observations and artifact collections are included. While there are specific lessons learned for the peculiarities of the COVID-19 context; there were also lessons learned that can be extended when issues like masks, social distancing, and limited in-person classes are no longer necessary.

*Shift from Pedagogy to Service*

The spring semester was a state of survival until its conclusion in early May 2020. Faculty development and support included a reorienting the space towards service to support the university. The manager of the makerspace, Dr. Eames, and a few engineering faculty members were invited to work on campus to address the PPE shortage for the University and local hospitals and health care centers.

*On the 16th [of March 2020], I got a call from university health. The medical school, as well as the hospital, collectively said that they were nervous that their protective equipment was going to run out because supplies were tight and they saw spikes in cases and didn’t know how far that was going to go and said, can you help us?... that allowed me to dig into, well, what does protection look like? Why is it needed, you know, under what circumstances, and to see, to learn about that, the processes that were being set up in hospitals around the COVID disease and all that. And the what: What’s the transmission, What are the protocols for cleaning? How are they getting people into and*
out of hospitals, knowing that there are people who are going to come walking through those doors that are sick now, how are they doing it? So, we were able to learn from the people who really had to solve those problems immediately. (Dr. Eames)

While some of the faculty development support was shifted towards pedagogical support, it also shifted towards service for the university and surrounding community. Additionally, through collaboration with the medical school and hospital, the makerspace had the advantage of seeing protocols designed by experts. Dr. Eames stated that these collaborative experiences allowed him to begin developing possible pivots for the makerspace that would allow students to be safe during a pandemic or similar crisis.

Staffing

Two college of engineering faculty members support faculty in the space, the makerspace manager and the director of curriculum. Prior to the COVID-19 pivot, these faculty members implemented one-on-one and community support for professors using the makerspace in their curriculum. During the COVID-19 pivot, the one-on-one support became the most important aspect of their faculty development. However, without the previous planning, support, and understanding of the engineering curriculum, this one-on-one support would not have been as successful. After the COVID-19 pivot, the faculty development support from the manager and director of curriculum will continue to offer both one-on-one support and support for the makerspace professional learning community; however, now there will be options for asynchronous support rather than strictly real-time interactions. Pandemic pivots and protocols have shown that these two staff positions are essential to support faculty development in the space.

Organization

The organization of the space prior to the pivot was collaborative in nature, students were encouraged to work closely, and observe each other’s work. During the COVID-19 pivot, the interaction within the space was severely limited and one could argue not present at all. One lesson learned throughout this process is that collaboration between students is an essential component of the faculty development process. This opportunity to provide feedback about what is happening in the space, specifically what is or is not working is what one faculty member described as “the heartbeat of the space” and will be implemented after the COVID-19 pivot. The lesson learned here is that interaction is essential for sharing of ideas, etc.

Prior to the COVID-19 pivot, students would visit a common space in the makerspace and use their student ID to check materials in and out. During the shutdown, student staff members created an app in which students could virtually check materials and tools in and out and a student staff member would deliver the physical items to the student. This app saved valuable student employee time and allowed students to continue working rather than leave their project and spend time in line. Makerspace staff, students, and faculty agree that this system should and will remain after COVID-19 protocols are no longer necessary. They stated that this “will allow [them] to operate in a different way forever; [and] will allow more in person time.” This lesson learned illustrates physical interaction in the form of checking in and out materials was recognized as non-essential and through the innovation spurred by the pivot, faculty and students had valuable time to focus on pedagogy and learning.

Instructional Strategies

Finally, the instructional strategies of the space changed throughout the COVID-19 pivot. For example, Dr. Smith develops the prompts her senior design course each year. In 2020, this gave her an opportunity to create a prompt that felt relevant and feasible enough for students to
still create quality prototypes within the confines of a COVID-19 pivot. There was uncertainty if the makerspace would be available for the entirety of the semester, and further uncertainty if students would be permitted to access campus. Regardless, for senior design, Dr. Smith did not want to eliminate the prototyping process from her course. Dr. Smith’s first consideration was what student prototyping expectations were within reason. Her initial thought for this change was to would limit students to hand tools that could be found in a garage.

So, what I did was I thought, well, let's come up with a project that the students can prototype at home, like, in a garage type setting, right. With hand tools. Something that, the way I put it as a, maybe a typical suburban garage would have access to, and those would include screwdrivers, wrenches, saws, cordless drills. But, your typical suburban garage does not have a laser cutter, so we're not going to use those things. (Dr. Smith)

Realizing what environments during the pandemic would be like for students, Dr. Smith began figuring out how students could prototype. However, Dr. Smith soon realized that not all students would have access to a garage or tools necessarily. She worked with Dr. Eames to help further develop a method for students to prototype. Dr. Eames described his reasoning:

Our heaviest user, the senior design for mechanical engineering, the design project for that class has previously been created so that it can be completed using [a] normal garage set of tools... You can see the red buckets of it now. So, we were talking to, Dr. Smith about, well, the problem is that the assignment has been set up for, if you have a garage, you can do it. Some of these kids are in an apartment, no garage in sight. So, then I said, well, we could build a toolbox and check out a toolbox. (Dr. Eames)

Because students were not able to access the makerspace and were collaborating virtually with their “garage in a box” more collaboration and time was spent in the prototyping process.

This focus on purposefully designed inclusive pedagogy was a lesson learned and a moment of reflection for makerspace staff and faculty to re-evaluate their curriculum, pedagogy and instructional practices.

Taking these lessons beyond the shift

The COVID-19 pivot is an abrupt and disruptive event in engineering education. Our hope is that this lessons learned paper contributes to and furthers discussion of how to support faculty development in an engineering makerspace. We recognize that these lessons learned are specific to a single university, makerspace, and moment of time; however, there are some strategies shared that can be permanent changes to ultimately support engineering educator’s growth in incorporating prototyping, projects, and makerspaces in their curriculum. These faculty development lessons learned represent the important themes of service, leadership, and diversity and inclusion for engineering and makerspace faculty and staff. Ultimately, we hope these lessons learned provides an opportunity for faculty and makerspace staff to shift their awareness towards the contextual aspects of equity and inclusion (Secules, 2020).

References