Leading by Example: Leveraging Academic Innovation Centers in Times of Crisis

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We can't solve problems by using the same kind of thinking we used when we created them.

Albert Einstein

1 Introduction

Institutions of higher education worldwide have opened academic innovation centers for the benefit of their students (Barrett et al., 2015; Kim et al., 2018; Levy et al., 2016; Waters, 2016). These innovation centers provide a wide range of educational opportunities. Some, like the Invention Studio at Georgia Tech or the Texas Inventionworks at the University of Texas at Austin, focus on providing students with access to the latest technological innovations (Forest et al., 2014; Galaleldin et al., 2016; Hynes & Hynes, 2018; Wilczynski, 2015). Others, like the Siebel Center for Design at the University of Illinois or the Integrative Design, Arts, and Technology Center at Carnegie Mellon University, focus on encouraging innovation, creativity, design thinking, and problem-solving among students through collaborative working spaces (Böhmer et al., 2015; Bowler, 2014; Farritor, 2017; Jennings et al., 2018; Rieken et al., 2017).

Over the past few years, many educational researchers have studied the relationship between academic innovation centers and higher education (McCarthy et al., 2018; Schrock, 2014). The benefits that these centers offer university students are increasingly well-known (Carlisle & Weaver, 2018). For example, academic innovation centers are known to foster students' interests in science, technology,

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engineering, and mathematics (Honey & Kanter, 2013; McKenna & Bergie 2016; Sheridan et al., 2014; Whitmer, 2016). Innovation centers can also be particularly effective in terms of engaging underrepresented populations (Sheffield et al., 2017), improving undergraduate classroom experiences (Blackley et al., 2017; Hira et al., 2014; Maloy & Edwards, 2018; Sweeney, 2017), helping students forge pathways into technology careers (Clauson & Sheth, 2017; Monis, 2018; Pines et al., 2015), and encouraging students to develop new literacy skills (Gravel et al., 2018; Koh & Abbas, 2015).

As a result of this research, universities around the world are investing their resources in building academic innovation centers, offering new programs centered around design thinking and emerging technologies, and encouraging their students to pursue careers focused on innovation and technology (Dugdale & Strawn, 2017; Halverson & Sheridan, 2014; Wong & Partridge, 2016). These initiatives are driven by the idea that providing students with access to the resources of academic innovation centers will have a positive effect on higher education and encourage more students to pursue entrepreneurial and collaborative opportunities (Kurti et al., 2014; Peppler, 2010; Youtie & Shapira, 2008). But what happens to these initiatives during crisis situations? How can academic innovation centers respond to the needs of their institutions and students during disasters such as the COVID-19 pandemic?

This chapter addresses these questions by exploring how an academic innovation center at Florida State University – the Innovation Hub – was able to encourage its students to engage in creative problem-solving through design thinking, emerging technologies, and experiential learning during the COVID-19 pandemic. The results demonstrate that academic innovation centers, during a time of global crisis, have a unique opportunity to lead by example, enhancing their educational impact by connecting students directly with real-world challenges as creative problem-solvers with the power to make a difference.

2 The Innovation Hub at Florida State University

The Innovation Hub at Florida State University – https://innovation.fsu.edu/ – was established in 2018 with the mission to foster a collaborative community founded on a culture of creativity and innovation that identifies issues, explores opportunities, and develops solutions using design thinking and emerging technologies. It makes the latest technological innovations (such as 3D printers, laser cutters, and virtual reality devices) freely available to all students at Florida State University in a 15,000 square foot setting that includes program rooms, study spaces, hang-out spaces, a digital fabrication lab, and a virtual reality lab (see Fig. 1).

Like other academic innovation centers, the Innovation Hub is motivated by the belief that the real-world challenges our students will face will be unprecedented in complexity and importance. We share a vision of students from all disciplines working together to combine their unique expertise and perspectives under the guidance of experienced mentors and educators to create novel and effective solutions to the

Fig. 1 The innovation hub at Florida State University

vexing, complex, and wicked problems of our day through experiential learning, transdisciplinary collaboration, technical skills acquisition, critical thinking, creative problem-solving, co-curricular opportunities, and teamwork.

Every week during the academic year, thousands of students representing a hundred different majors from across campus come together in the Innovation Hub to experiment with new technologies and explore new ideas. Earnest students desire more than anything to have a positive impact in the world, and the Innovation Hub provides a space where curious and thoughtful individuals from different backgrounds, experiences, and disciplines are inspired to work together to engage in creative activities, break down barriers, and design new solutions to challenging problems that have real-life implications.

The faculty and staff of the Innovation Hub view problems as learning opportunities. When the COVID-19 pandemic struck Florida State University, the Innovation Hub pivoted along with the rest of the university to find solutions to the problems facing us all. In the early weeks of the coronavirus crisis, with campus closed to students and classes moved online, we looked for opportunities that would enable the Innovation Hub to have a positive impact on our students, our university, and our community during this crisis. We identified three initiatives that offered the Innovation Hub the opportunity to lead by example:

1. Leveraging the power of Design Thinking to develop innovative solutions to pandemic-related challenges by students.

2. Leveraging the power of emerging technologies to transform our Digital Fablab into a manufacturing facility for personal protective equipment (PPE).
3. Leveraging the power of experiential learning to develop online co-curricular training resources for students to develop new skills with innovative technologies.

Together, these three initiatives allowed the Innovation Hub to make full use of its resources during this global crisis, provide robust new services to the campus community, and battle the spread of COVID-19 in our local community. They also allowed us to demonstrate to our students and faculty that the Innovation Hub not only teaches creativity and problem-solving skills in the abstract but also is fully capable of implementing those skills in a concrete fashion to solve real-life problems in a time of crisis.

3 Leveraging the Power of Design Thinking to Solve Complex Problems

Design Thinking serves as the foundation of the Innovation Hub. As the key to student engagement, it provides the motivation for helping students gain technical skills for creative problem solving. The process of Design Thinking places the emphasis on problem-solving rather than technology. It provides a framework through which students identify and empathize with a problem, reframe the problem to make it actionable, utilize unique methods of ideation to develop solutions, then prototype, and test their solutions (Brown, 2009; Bielenberg, et al., 2016). The Design Thinking practice is rooted in interdisciplinary teamwork, and values diversity to understand problems from many perspectives. Through its focus on Design Thinking, the Innovation Hub can attract a wide range of students based on their shared passion for improving the world.

How could the Innovation Hub continue to emphasize the power of Design Thinking for our students during the COVID-19 pandemic? Our answer to this question came directly from a course on Design Thinking – "Innovation by Design" – that the Innovation Hub teaches to 240 students each semester. When classes moved online in Spring 2020, we seized the opportunity to encourage students to apply their design thinking skills to coronavirus-related challenges. This allowed us to demonstrate the relevance of Design Thinking in crisis situations and helped us explore new methods for practicing and teaching the process of Design Thinking online.

To accomplish this goal, we used Google Slides to create Design Thinking tools such as virtual post-it notes and collaborative whiteboards that replicated the methods of Design Thinking online, including stakeholder mapping, research sensemaking, persona cards, journey maps, ideation, idea filtering, and prototyping (see Fig. 2). Students developed solutions that included an app that uses a reward system to incentivize people to stay home; personalized online gym service; biodegradable

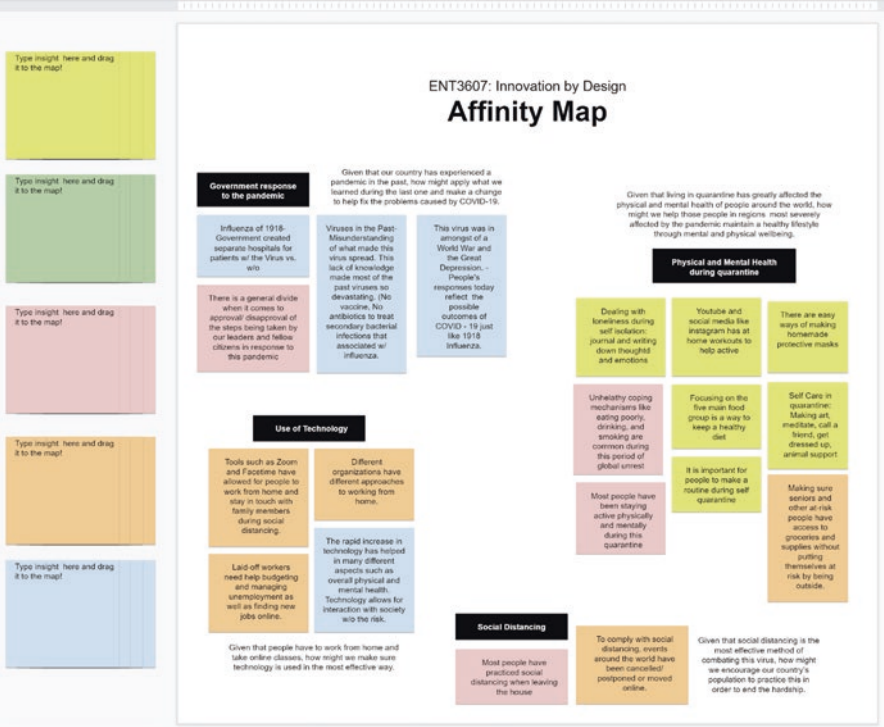

Fig. 2 Design Thinking in the online "Innovation by Design" classroom

packaging for online shopping; recruitment of social media influencers to reduce social isolation; and an academic task tool to help students stay on top of their schoolwork.

Design Thinking techniques also feature prominently in another class offered by the Innovation Hub – "Designing Your Life with Innovation" – which leverages Design Thinking to explore potential career opportunities, prototype lifestyles, and build student confidence. After this course moved online, students identified three alternative career paths they could explore to overcome the challenges posed by the COVID-19 pandemic regarding the job market and their future opportunities. They collaborated in small design teams that helped them ideate, prototype the life they would like to have, and provide encouraging support to each other (Burnett & Evans, 2016).

These outcomes are significant because they document the Innovation Hub's ability to provide rich interactive environments that serve the Design Thinking process and help comfort isolated students by connecting them with their classmates and giving them a sense of purpose. The world's grand challenges and technical innovations are increasing in parallel exponential rates. It is our responsibility as educators to leverage these technologies creatively to help our students develop innovations that will address these challenges. The methods we developed and

implemented with our classes in the Hub will live on well past the COVID-19 threat, providing educational opportunities that will be valuable for students and faculty for years to come.

4 Leveraging Emerging Technologies to Manufacture Personal Protective Equipment

The Innovation Hub makes many different emerging technologies available to students and faculty at Florida State University, including 3D printers, a laser cutter, a vinyl cutter, electronics kits, ARM computers, and VR head-mounted displays. As students begin developing their ideas, they often require a means of prototyping solutions to move their projects forward. In the Hub, students can operate virtual, reductive, and additive techniques of prototyping solutions. Rapid iterative fabrication allows students to fail quickly as they work toward more successful solutions (Sheridan et al., 2014; Wilczynski, 2015). The concept of "failing forward" (Marsh et al., 2017; Smith et al., 2015) feeds directly into the goals of physical prototyping.

How could the Innovation Hub continue to use emerging technologies for physical prototyping during the COVID-19 pandemic? Our answer to this question came when the Innovation Hub staff learned about the high demand for ventilator valves, as well as the opportunities for 3D-printing plastic replacement valves to meet that demand. We immediately asked our undergraduate student interns to research projects and design solutions related to the COVID-19 pandemic. Their ideas inspired us to explore how we might use the Innovation Hub's 20 3D printers and digital fabrication equipment to fight the spread of COVID-19 in our local community.

To accomplish this goal, the Innovation Hub worked with FSU's College of Medicine and College of Engineering to research the types of medical equipment we might be able to fabricate. We quickly realized that we did not have the necessary equipment to manufacture highly complex medical devices such as ventilator valves, so we decided to focus on mass-producing personal protective equipment (PPE) for frontline healthcare workers (Wellock, 2020). With PPE shortages looming across the state, this equipment was already in high demand in Tallahassee, Florida, where we are located, so we began exploring NIH-approved face shield designs that could be sanitized for reuse and that would be relatively simple to produce (face shields do not need to be air-tight like masks). After working collaboratively with local healthcare providers and frontline workers to finalize our designs, the Innovation Hub started producing face shields in April 2020 (see Fig. 3).

Our efforts to produce face shields quickly encountered issues with material sourcing as viable materials were difficult to acquire. We worried that we would be unable to meet the high demand for PPE (printing one face shield initially required nearly 4 hours on a 3D printer). Thankfully, with the expertise of the Innovation Hub's digital fabrication lab manager, we were able to reduce this print time to

Fig. 3 Personal protective equipment manufactured at the Innovation Hub

slightly over 1 hour per shield. Additional 3D printers donated from FSU's Learning Systems Institute also nearly doubled our throughput capability, and our external and internal partners were also able to help the Innovation Hub locate, transport, and fabricate viable shields for PPE assembly. With these production obstacles circumvented, the Innovation Hub manufactured and distributed more than 2000 face shields to local hospitals, physicians, and healthcare providers over the course of 5 weeks.

These outcomes are significant because the Innovation Hub was able to leverage the same equipment that our students use for their projects to learn valuable lessons about manufacturing while building connections and making a difference in our local community. By serving as an exemplar in this way, the Innovation Hub encourages undergraduate students to find value and validity in their own work. We do not innovate and design in a vacuum, and it is important for innovation centers to find solutions to complex problems that meet community needs (Hennelly et al., 2019; Holman, 2015). Thanks to the lessons learned from this collaborative endeavor, the Innovation Hub will be able to support our local community more effectively and work together with our partners to solve future problems through emerging technologies.

5 Leveraging Experiential Learning Opportunities Through Online Resources

Experiential learning is a core requirement at Florida State University where all students are required to engage in at least one experiential learning activity prior to graduation. The Innovation Hub serves as a central location on campus where a

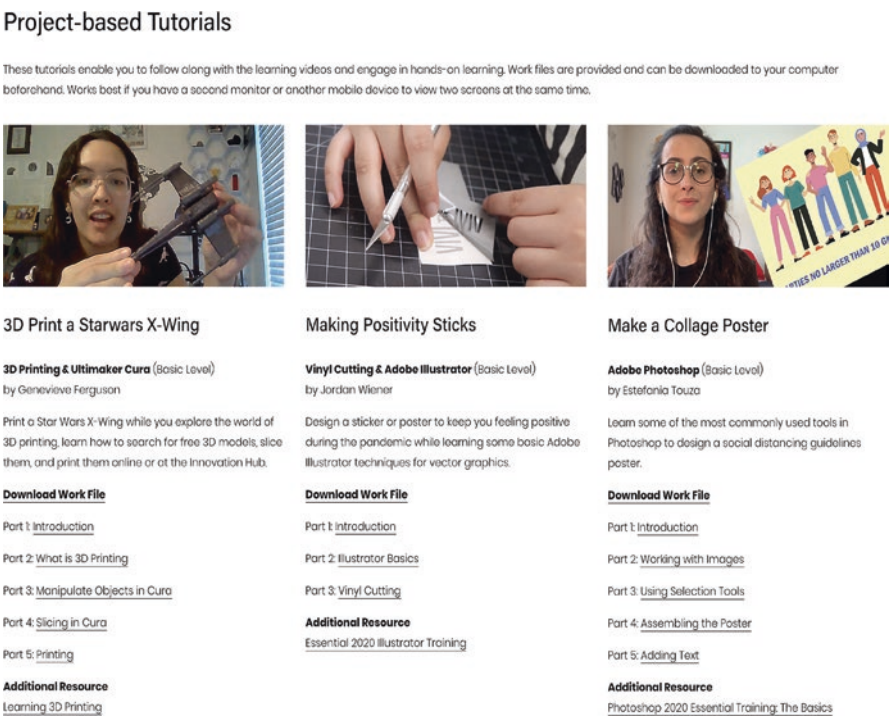

Fig. 4 Online tutorials developed by Innovation Hub students

wide variety of experiential learning opportunities related to innovation and technology come together. Each week during the academic year, students at the Innovation Hub have opportunities to participate in workshops, hackathons, design sprints, and other formative experiences related to innovation and technology.

How could the Innovation Hub continue to support these experiential learning opportunities during the COVID-19 pandemic? Our answer to this question involved moving these educational opportunities online during the Spring 2020 semester by creating a series of asynchronous learning modules including such topics as 3D Design; Advertising, Media, and Public Relations; Computer Programming; Content Development; Design Thinking; Digital Fabrication; Entrepreneurship; Graphic Design; Photography and Digital Media; Social Entrepreneurship; Unmanned Aerial Systems; Video Production; Virtual Reality; and Web Development.

To accomplish this goal, we invited our undergraduate student interns to develop a series of interactive video tutorials designed by university students for university students (see Fig. 4). Thanks to the funding from the Office of the Provost, the Innovation Hub employs more than 20 undergraduate student interns each year, representing more than a dozen different departments from across campus. This

paid student internship program is highly competitive (more than 300 talented students applied to intern in the Innovation Hub during the 2019–2020 academic year). As a result, each intern was able to bring a wide range of valuable innovation and technology skills to their work at the Hub. When the university moved online in March 2020, these student interns pivoted their work efforts to develop video tutorials in their own areas of expertise, supervised by the Innovation Hub's Assistant Director of Education.

The resulting suite of video lessons (https://www.innovation.fsu.edu/learn) provides students with the chance to acquire innovative skills while working from home in times of crisis. These lessons also help build community online, as students can share the results of their training, and collaborate on projects using online tools. For the student interns, creating tutorials for others promoted deep learning (Pellegrino & Hilton, 2012), since they not only had to figure out new technologies but also learn instructional design, scriptwriting, audio recording, video editing, and webcasting skills. Student interns also received expert mentorship on how to plan for and deliver training in various formats. Some students even created mobile applications to provide access to information about COVID-19 (https://covid19-central.com/).

These outcomes are significant because they help demonstrate to students how to solve problems in ways that will retain their educational value in the post-COVID-19 age. These video tutorials will help FSU teach future online courses more effectively. These tutorials can also be arranged into a comprehensive suite of co-curricular lessons that students can follow outside of class, earning badges through the university's online badging system, and perhaps even earning the designation of "Innovation Scholar" at graduation. These results point to the larger benefits that academic innovation centers can offer institutions of higher education, all of which can help increase student engagement with innovation and technology across the university.

6 Academic Innovation Centers and the Future of Education in Crisis Situations

In a time of crisis, the Innovation Hub at Florida State University was able to engage in creative problem-solving using the very tools, technologies, and methods that we teach to our students. These accomplishments have positive implications for the future of teaching and learning in the post-COVID-19 era – implications that will benefit not just university students, but academic faculty and staff as well. They make it clear that the mission, vision, and goals of academic innovation centers such as the Innovation Hub are not abstract concepts. The Hub accomplishes the very tasks that we teach our students – empathizing with human needs, engaging with emerging technologies, and designing solutions to meet those needs. From an educational perspective, there can be no greater lesson (Marty et al., 2020).

By leveraging the resources of the Innovation Hub during the COVID-19 pandemic, we were able to document the educational powers of academic innovation centers and demonstrate the value of design thinking, emerging technologies, and experiential learning in times of disaster. By serving as positive role models for students learning how to adapt in times of global crisis, academic innovation centers such as the Innovation Hub can help students better understand how to leverage the power of innovation to solve difficult problems. They also help educators better understand how to teach those lessons to their own students. By building closer relationships with academic innovation centers, educators can see how their facilities, equipment, and creative potential can be transitioned to community service with educational benefits; provide students with experiential learning opportunities to have a positive societal impact; and learn how their classes can be repurposed to leverage new educational opportunities during crisis situations.

We believe that the demonstrated success of the educational philosophies shared by academic innovation centers today will help carry academic institutions into the post-COVID-19 era. The skills and abilities that academic innovation centers are designed to teach are the very skills and abilities that can help students make sense of our complex world and help instructors teach effectively in the post-COVID-19 classroom. We sincerely hope that our experiences at Florida State University will inform and inspire other institutions to embrace the power of academic innovation centers to encourage their students and faculty to face challenging situations as they arise, and to work together to find positive solutions to the complex problems of our day.

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