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Cultivating an Entrepreneurial Mindset: An Interdisciplinary Approach Using Drones

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INTRODUCTION

A central pedagogical goal at the University of San Diego is to educate Changemakers: individuals who, through empathy, critical thinking, and problem solving, will be prepared to address society's biggest challenges. While such problems are best addressed by interdisciplinary teams, most of higher education focuses students within disciplinary boundaries. To address this problem we have created a new course, Drones for Good, where students from the Shiley-Marcos School of Engineering and the Joan B. Kroc School of Peace Studies come together to design a pro-social drone (Choi-Fitzpatrick 2014). We chose drones because they provide an ideal combination of technical and ethical challenges for students to wrestle with in an interdisciplinary setting.

Elsewhere we describe the overall structure of the course (Hoople and Choi-Fitzpatrick 2017; Reddy, Hoople, and Choi-Fitzpatrick 2018; Hoople, Choi-Fitzpatrick, and Reddy 2018), here we focus on our efforts to help students develop an entrepreneurial mindset. We agree that “Engineers equipped with this mindset understand the bigger picture, can recognize opportunities, evaluate markets, and learn from mistakes to create value for themselves and others (KEEN 2018).” The inclusion of entrepreneurial content within engineering has gained traction in recent years (Täks et al. 2014; Morgan et al. 2012; Bilán et al. 2005; Antoncic and Hisrich 2003). Our approach is unique in that we situate this entrepreneurial training within an interdisciplinary classroom in order to develop solutions that positively impact society. We thus address both ABET criteria 2 (applying engineering designs in context) and 4 (consideration of ethical and professional responsibilities).

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The foundation of our course is a semester-long project to design a drone that will have a positive impact on society. Students are grouped in teams – 2 engineering students and 2 peace studies students. We start the semester by examining what it means for something to have a positive impact on society. We then have the students build a small drone, ensuring hands-on experience with this technology. During the last phase of the course we introduce entrepreneurial content and have the students develop minimum viable products (Ries, 2011), create a business plan using the social model canvas (Burkett, 2013), and develop a compelling pitch for a final competition. This paper is guided by the question “How does our interdisciplinary approach impact student’s ability to develop an entrepreneurial mindset?”

Key words: Entrepreneurship, Interdisciplinary, Social responsibility

METHODS

In this paper we present preliminary data collected through a short (~10 minute) anonymous survey. Students were asked to respond to both Likert-style and open ended questions. We administered the survey during class and had 19 respondents. Findings from this data are in line with qualitative and quantitative data gathered across each iteration of this class.



Figure 1. In our course interdisciplinary teams debate, build, and fly drones.

PRELIMINARY RESULTS

Across two classes and one workshop students consistently report value in the class' heterogeneity. In this class our data clearly shows that student and team heterogeneity positively impacts students' self-reported engagement with an entrepreneurial mindset. The interdisciplinary nature of the teams forces students to confront issues that homogeneous teams of engineering or peace students would never address. Directly confronting difference required students to recognize and articulate the importance of an entrepreneurial perspective. In our discipline-specific classes we can tell students the importance of approaching problems in this way, but this advice usually lands on deaf ears. It is not until students have a chance to try it out that they see the value of this approach. This observation is borne out by the survey data. When asked "What impact has being on an interdisciplinary team had on your ability to think with an entrepreneurial mindset? (Strong Positive Impact/Moderate Positive Impact/No Impact/ Moderate Negative Impact/Strong Negative Impact)" 95% of the class reported a positive impact (Strong positive impact: 10, Moderate positive impact: 8). This finding is illustrated by a representative quote:

"I think I never would've considered taking an entrepreneurial mindset approach to technological innovation if it hadn't been for discussion lead by [peace] students. I would have been lost in technical specs and functions, rather than social implementation or even our user." Engineering Student

Another positive finding from our class is that students see the relevance of thinking with an entrepreneurial mindset within their respective disciplines. In other classes, our students tend to have believed that an entrepreneurial mindset is only relevant for founding a startup. Our approach in Drones for Good seems to be resonating with students. When asked "How relevant do you think an entrepreneurial mindset is in your chosen field (e.g. engineering or peace)? (Very Relevant/Somewhat Relevant/Neither Relevant nor Irrelevant/Somewhat Irrelevant/Very Irrelevant)" over 80% of the class found this material relevant (Very Relevant: 12 Somewhat Relevant: 4). In the words of another student:

"I love the idea that entrepreneurship is not limited to starting a business or founding a start-up. But that it can take place anywhere at any time. My perspective of entrepreneurship has shifted from the idea that entrepreneurship is recipe to realizing that entrepreneurship is a mindset." Engineering Student

An important lesson learned from this survey is the perceived merit of our focus on entrepreneurial thinking. Previous classes had focused on empathy and we have considered iterating again to focus on social justice. Based on these data, however, we plan to maintain the focus of the course on entrepreneurial thinking for the next iteration as it seems to be working programatically as well as pedagogically.

NEXT STEPS

“Understanding what the world and social justice needs is a different type of mindset and lens than just making a quick buck. Entrepreneurial mindset is not just creating a company and making money, its finding a problem and creating a solution.” Engineering Student

A key learning outcome for our course is to *train students to apply entrepreneurial thinking to develop innovative solutions that will have a positive impact on society*. We see entrepreneurial skills as a tool - the ultimate goal is to get students thinking creatively about how to have a positive impact on society. In each of our respective fields we see a traditional pedagogy that promotes socio-technical dualism. Engineering curricula often talk about the importance of the technical solution and then incorporate societal needs as an afterthought. Conversely social science programs tend to focus on describing the social aspects of the problems, but do little to train students in how technology will play a role in the solutions. We hope to highlight a pragmatic socio-technical approach in which students, regardless of discipline, learn to approach problems in an integrated fashion. Our use of the term pragmatic highlights our commitment to an approach that (1) strikes both engineering and peace students as credible, and (2) can be utilized by our peers in engineering education. We believe training students to think with an entrepreneurial mindset is an important tool in accomplishing this lofty goal. In the future, to assess our approach, we plan to develop rubrics so that our external judges can help us evaluate if students have achieved the entrepreneurial mindset we desire to instill. More broadly, we are in the midst of transforming these broader lessons into a textbook for practitioners. We introduce entrepreneurship as one of several possible learning objectives for the class, contextualize the course within our institutional environment, and provide clear action steps for implementing key modules within the classroom.

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Gordon D. Hoople (right) is an Assistant Professor of Integrated Engineering in the Shiley-Maros School of Engineering at the University of San Diego. He is designing a new engineering curriculum to educate changemakers who understand that engineering is an inherently socio-technical activity. His research interests lie in engineering education and rapid prototyping. Before a career in academia, he worked as a structural dynamics consultant testing drones, aircraft, rockets, and roller coasters.

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