Sports Concept Design: An Entrepreneurial Co- and Extra-Curricular Activity

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Abstract

A new special topic course and an extracellular activity were created in Spring 2014 within the Department of Mechanical Engineering at Widener University aiming to introduce students to the process of designing and development of new technologies. Students were asked to develop a new sports-related application for an existing sensing system by Nike, Inc. (Beaverton, OR) and create an elevator pitch to sell their idea. Seven undergraduate teams, ranging across all engineering majors and years, competed in a culminating event showcasing their pitches and products. Upon successful completion of the activity students gained a broad background in engineering concept design, including opportunity recognition, market analysis, and prototyping.

I. Introduction

In *Engineer 2020* by the National Academy of Engineering, qualities that future engineers should embody are defined and discussed as well as different models of entrepreneurship education in engineering[1]. Among others, leadership, imagination and innovativeness are discussed. Along with these characteristics, the ability to effectively communicate ideas and managing interpersonal relations and personalities are also vital in becoming a successful engineer. Entrepreneurship is the development of a new business, idea, product or service concentrating on opportunity identification and evaluation as well as resource gathering leading toward the start-up and growth phases[1,2]. There have been several studies that show addition of entrepreneurial education within universities has a positive impact on the future entrepreneurial successes of engineers[3-6].

To expose students to the entrepreneurial process, a competition was created at Widener University through The Kern Entrepreneurial Engineering Network (KEEN). The goal was to offer students exposure to product design recognition and principles; including both the identification of a potential market and the analysis of a proposed idea to meet a perceived market need. The primary exercise was to have students conduct a product opportunity exercise that identified and assessed the relevance of Nike, Inc. (Beaverton, OR) sensing technology for new athletics-related markets. In particular, “precise identification of the targeted customer segment and an articulation of the value proposition were of great interest” for the competition as well as “validation of these claims through customer interaction”[7].

Figure 1. (left) Pack kit: 2 pucks, USB dongle, and receiver module. (right) In-shoe pressure pads: 2 insole-like pads. Reprinted from Nike.com

The specific sensor suite that is the subject of this competition included a 3-axis accelerometer and a pad consisting of four pressure sensors. These were incased in an insole-shaped, flexible electronics' pack that electrically connected the pressure sensors to a housing that contained the accelerometer, which disseminates the information from all sensors and transmits it. The students were also given access to software for wirelessly receiving and displaying sensor information. This collection of equipment is typical for use with a standard shoe, acknowledging that teams rearranged how these sensors were to be used, whether or not they were installed in shoes, and what the software was to be utilized.

Table 1. Student population breakdown within sports design concept challenge groups. Undergraduate major acronyms - BME: Biomedical Engineering; CE: Civil Engineering; ChE: Chemical Engineering; EE: Electrical Engineering; ME: Mechanical Engineering; OT: Other. Class year acronyms – Fr: Freshman year; So: Sophomore year; Jr: Junior year; Sr: Senior year. [*]Business major, [#]Biology major, [+]Co-curricular team

Team	Total Students	BME	CE	ChE	EE	ME	OT	Fr	So	Jr	Sr
1[+]	2	0	0	0	0	2	0	0	1	1	0
2	6	1	1	0	0	2	1[*]	0	6	0	0
3	6	2	0	1	0	1	2[*#]	6	0	0	0
4[+]	2	2	0	0	0	0	0	0	1	1	0
5	4	1	2	0	0	1	0	0	4	0	0
6[+]	2	1	0	0	0	1	0	0	1	1	0
7[+]	4	1	0	0	1	2	0	0	2	0	2

Teams were asked to effectively communicate their product/service concept in the form of a 90 second video. Students were offered assistance from the university's TV Club and access to the Club Advisor, an adjunct film professor. The TV Club was allowed to help students in both filming and planning of their video pitch with each group allotted about four hours of total time with the Club Advisor for production discussions and video editing. The concept must make use of at least some subset of the targeted Nike, Inc. (Beaverton, OR) sensor suite; additional sensors and technical components/equipment may also be used as part of the product architecture. A

functional prototype is not expected as part of this competition; however, teams were encouraged to show how the product/service would function and/or be used via storyboards, simulations of use, or other media.

II. Co-curricular Component

The Special Topics' class (ENGR 388) allowed the competition and to be used as a semester-long case study in the process of bringing a concept to the prototype stage. Students explored the disconnect between the need to look at more data regarding tech commercialization ideas (to lower investor risk) and the need to move ahead quickly (because "first to market" matters). Students took away the tools and teaching strategies to enable student teams to perform these quick, but insightful assessments on their own in classroom or industry settings.

For successful completion of ENGR 388, students were challenged to develop and "pitch" an athletic related product/service concept that exploited Nike, Inc. (Beaverton, OR) sensors, resulting in a student-produced video that presented the product/service concept. The original goal of the class was to allow the students to create a prototype model of their concept. Due to problems with the software, this was not seen to fruition. Software issues will not be discussed in this paper. Instead the students were asked to design and setup experiments that would gain the intermediate knowledge needed in order to create the software. For example, a group was interested in incorporating the design into mouthguards for "real-time" concussion analysis[8]. They first performed a literature review on accelerations that can lead to traumatic brain injuries and concussions. This followed by the group devising a series of tests that would need to take place in order to answer fundamental questions about the accelerations and timing that the existing devices could pick up, along with placement of the pressure pads, and overall range of the devices.

III. Extra-curricular Component

There was a parallel extracurricular component where teams participated in the competition without the in-class element. Extra-curricular teams consisted of 3-6 students with at least 75% of teams consisting of undergraduate engineers (Table 1). It was encouraged teams include at least one non-engineering undergraduate student as a means of encouraging cross-school collaboration with students from business, communications, and the arts. Teams had students representing business and biology majors in additional to the engineering majors. For the extra-curricular component or "storyboard competition," teams were also asked to create a student-produced video that presented the product/service concept in a simulated or storyboard manner. The key difference between the extra and co-curricular components was that a functional prototype was not needed.

The motivation behind incorporating the extra-curricular component was to allow students, specifically freshman and seniors, who were unable to commit to an entire special topics course the option of still being exposed to this opportunity. Initially, six student teams expressed interest and started the competition. Mainly due to time commitments, only three teams presented at the competition.

IV. Competition

Students from both the co- and extra-curricular portions of the activity presented their videos, as well as, pitches in a culminating networking evening with ten judges from outside industries, sports industry, local media representatives, and university shareholders (department chairmen, sports' coaches, engineering and marketing alumni). From a judging perspective (Table 2), the pitch video was expected to identify the targeted customers and their needs or objectives, effectively communicate the product/service, "summarize critical elements of the business model including cost/price, if the product/service is sold/leased/subscribed, and review how this concept has been validated with target customers"[7].

Table 2. Competition rubric: Ranking scale of 1 – 5 with a culminating score out of 80 points was determined for each team. 5: Excellent, 4: Above average, 3: Average, 2: Below average, 1: Poor

Pitch Video/Q&A Content
1. Product/concept was clearly conveyed
2. Idea(s) were realistic/feasible
3. Motivation/need for product was clearly addressed
4. Market clearly identified
5. Addressed all necessary components in detail
6. Well organized with clear introduction of topic/idea, leading up to conflict and resolution with summary of key points/highlights
7. Explains what their product/idea does and how it adds value
8. Described why their product/idea is unique and different (and/or better)
1. Knew material/answers to questions
2. Spoke at appropriate levels/speed
3. Dressed appropriately and professionally
4. Overcame objections confidently
5. Technical terms were well defined in language appropriate for the target audience
6. Energetic, engaging, poised and confident
Extraneous
1. Closure left feeling of excitement in audience
2. Novelty/Uniqueness of idea/concept
3. Extra "credit" points (left to juror)

A secondary goal of the competition event was to allow students a safe and monitored experience to learn the art of networking. After each team presented its pitch videos, each participated in a 15-minute question and answer period from the audience and judges. Following the Q & A timeframe, time for the students to continue discussion of their concepts with fellow students, professors, and the judges was given over light refreshments. For many students, especially the freshman and sophomores, this was the first chance that they have had to network with professionals from their own discipline. The goal of this networking event was to allow students to feel more confident while marketing their products as well as themselves.

Table 3. Team topics and corresponding average scores based ten judges following rubric in Table 2. All team pitches can be seen on YouTube[10].

Team	Topic	Average Score (/80 points)
1	Helmet: Concussion Estimator	60.2
2	Mouth guard: Concussion Tracker	65.85
3	Rock Climbing Helper	43.8
4	Longboard Rider	60.8
5	Soccer Goal Helper	46.7
6	Soccer Tracker	67.5
7	Golf Swing Analysis	62.7

Team Six proved the victor creating a product concept of embedding the accelerometer into a soccer ball with pressure pads embedded on the player's shoes[9]. The concept was that an external application on a wireless device or computer would allow monitoring of individual plays. All of the teams pitch videos can be seen on the "WU KEEN Challenge" channel on YouTube[10].

V. Discussion and Conclusions

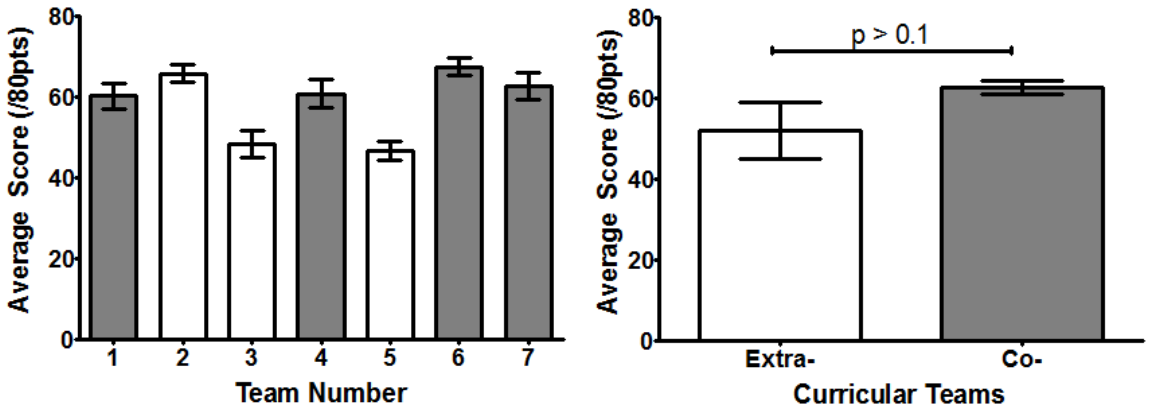

Figure 2. (left) Average score for each team. (right) There is a statistical difference ($p > 0.1$, student's t-test) between average scores for the extra-curricular teams (white) and the co-curricular teams (grey).

The motivation for having two separate cohorts – one as part of an extracurricular activity and one as part of a class - was two-fold: to allow the class students more in depth time to explore the technology and understand the psychological and marketing aspects of the pitch as well as obtaining course credit. In the end, the authors saw no real difference between the two cohorts in terms of motivation or excitement of project. This was reinforced qualitatively with no significance between the average scores of the two cohorts (Figure 2). To make any real conclusions based on the outcomes of the two cohorts, a larger sample number (number of participating teams) is necessary.

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