Business Education & Accreditation
Vol. 8, No. 2, 2016, pp. 79-86
ISSN: 1944-5903 (print)
ISSN: 2157-0809 (online)

IBFR
www.theIBFR.COM

INTRODUCING ENTREPRENEURSHIP INTO AN UNDERGRADUATE SOFTWARE DEVELOPMENT COURSE

D. R. Plante, Stetson University, USA
M. Branton, Stetson University, USA
G. Oliphant, Florida Southern College, USA

ABSTRACT

During the past decade, undergraduate computer science students have become progressively more interested in pursuing less traditional paths of employment after graduation. While most still choose to work for established businesses, others are choosing to start businesses of their own. For students in computer science, developing novel software products is one viable approach to this end. To address our students' growing interest in entrepreneurship, during the last three years, we have modified the content of our Software Development course to introduce the Lean Startup philosophy and simulate the process students starting their own businesses would take to do so. The class begins with students "pitching" their ideas to other students in the class, then choosing the project(s) they will work on, interviewing clients and potential customers to determine the requirements for the product, and finally, developing the product. Four software products have been developed in this period, including one that received second place in an innovation competition and attracted the attention of a venture capitalist. In this paper, we will further describe details of the course, the products developed, and student attitudes both during and after the class is over.

JEL: L26, O3

KEYWORDS: Entrepreneurship, Technologies

INTRODUCTION

At Stetson University, the Joseph C. Prince Entrepreneurship Program provides courses and a minor in entrepreneurship for students in any major. Through a grant from the Coleman Foundation, the program is working with faculty in Music and the Arts & Sciences to infuse entrepreneurship into courses in different majors and departments. As part of this initiative, the Department of Mathematics and Computer Science has revamped its Software Development II (SDII) course to not only include a component on entrepreneurship, it has done so by attempting to simulate the process students would undertake should they choose to develop a software product as part of a new business venture. The course does not attempt to be complete in teaching all aspects and models of entrepreneurship. Rather, it only focuses on the Lean Startup philosophy, as the primary objective of the course is for students to develop a substantial project for clients rather than be an authoritative course on entrepreneurship. Students in the course learn the five principles of the lean startup philosophy, examine case studies of real startups that required substantial software development projects, and apply the concepts to a project of their choosing. In the following sections, a brief literature review will be provided, followed by the methods, processes, and tools used in the course. Finally, results for the course are provided, along with concluding comments.

LITERATURE REVIEW

During the past decade, there has been a discernable increase in the number of entrepreneurship programs and educators offering courses and degrees in entrepreneurship (Duval-Couetil and Long, 2014; Katz, 2003; Kuratko, 2005; Torrance, 2013). However, while over 2,100 colleges and universities have introduced entrepreneurship into curricula by 2011 (Baum and Ma, 2011), over half of the students taking such courses have indicated that they do not feel adequately prepared to start their own businesses (Bureau of Labor Statistics, 2012). Also the success of present entrepreneurship programs in actually getting students to start companies is still less than clear (Schramm, 2014). Winkler and Case (2014) explain that this may partially be due to the methodological diversity and scale of academic programs being offered, with some students taking only a single course while others obtain a more immersive curriculum with entrepreneurship comprising a substantial component of their educational. It is also the case that the most desired dependent variable for measuring the success of an entrepreneurial education, namely the actual starting of a business, is often completely ignored in metrics for success, mostly because few students of entrepreneurship actually begin a business either while in or immediately following their education (Winkler and Case, 2014). For example, Reynolds and Curtin (2008) find that the formation of a new business most often occurs among those more than ten years out of college. Winkler, Troudt, Schweikert, and Schulman (2015) also find greater self-efficacy as well as higher levels of entrepreneurial intentions in older students, potentially because of prior life experiences. Yet, as noted by Pryor and Reedy (2009), there is considerable interest in understanding the drivers for entrepreneurship, especially with popular culture displaying such highly visible success stories of young and successful entrepreneurs as Bill Gates, Mark Zuckerberg, Sergei Brin, and Elon Musk.

While predicting future interest in entrepreneurship for Millennials and future generations is difficult, some interesting traits may play a role in their deciding employment paths. For example, more so than previous generations, Millennials expect a strong work-life balance, with three out of four stating that it drives their career choices (Twenge, Campbell, Hoffman, and Lance, 2010), potentially preferring the flexibility of self-employment. At the same time, for the first time in American history, student loan debt exceeds credit card debt (Demos, 2011). Two-thirds predict they will perform in the top 20% of their adult jobs, but the physical impossibility of this has led to increased signs of anxiety, stress, and depression, as well as lower scores in self-reliance (Twenge, 2009). How these conflicting traits will impact student choices in starting businesses is yet to be determined.

Because the actual starting of a new business venture is so often delayed, longitudinal research frameworks are often used (Winkler and Case, 2014). For example, intention models (Bird, 1992; Boyd and Vozikis, 1994; Shapero and Sokol, 1982) were developed to measure links between interest and action as intentions are the best single indicator of future behavior (Bagozzi, Baumgartner and Yi, 1989.) Winkler and Case propose "entrepreneurial self-efficacy as a self-motivational construct that explains entrepreneurial actions based on self-reflection and associated self-regulatory feedback cycles." The results of their study is consistent with previous studies relating entrepreneurial intent and self-efficacy.

While not specifically an assessment of entrepreneurial tendencies, some progress in understanding the interests of college students towards business careers are provided by Pryor and Reedy (2009). In their work, they analyze data obtained through the Cooperative Institutional Research Program (CIRP) surveys of first-year college students on their interests in business careers. The data only tangentially relates to entrepreneurship, and the authors caution that the data should be viewed more broadly as student interest in business versus actually beginning a business venture. However, as the data has been collected over a period of over forty years, patterns within various demographic groups are culled. Coupled to the previously mentioned research on self-efficacy and intention models as predictors, value may be obtained from the wealth of data provided by the CIRP data.

Clearly, the greatest possibility of success for students who enroll in entrepreneurship courses will be enhanced if students acquire a strong working knowledge of the various aspects of starting a business, leading to enhanced self-efficacy and hopefully qualifications. For computer science students in particular, learning how to effectively use their skills and knowledge of computer science to develop software products coupled with principles of entrepreneurship to apply that knowledge to starting a new venture should lead to greater success. Daimi and Rayess (2008) describe the rational, description, outcomes and assessment of a course they planned on introducing in Software Entrepreneurship. Assessment in their course includes a combination of exams, case studies, projects, a research paper, and reports. Doboli, Kamberova, Impagliazzo, Fu, and Currie (2010) have introduced a model of entrepreneurship education that involves the inclusion of add-on modules to the computer science and computer engineering disciplines at Hofstra University and Qatar University. With their model, work is broken into breadth and depth components. They assess interest in entrepreneurship via a survey provided to the class, and found that more than half of student expressed an interest in further pursuing entrepreneurship. Winkler, Troudt, Schweikert, and Schulman (2015) use an experiential model, presenting a case study in which they infuse entrepreneurship to creating a virtual e-business. As will be described below, our paper describes a depth model focused on applying entrepreneurship to developing an actual product.

METHODOLOGY

General Structure

At Stetson University, all computer science (CS) and computer information systems (CIS) majors are required to complete a two-semester software development course sequence. The first of these courses introduces students to the software development lifecycle, with students developing software products in teams, utilizing version control, issue tracking, and pair programming. The second course, Software Development II (SDII), is completely comprised of two group projects: one maintenance project, and one full development project. The maintenance project introduces students to the complexities of working with code developed by others, with that code often poorly designed, developed, and documented. The second project is typically a student-chosen project on essentially anything the students are interested in. Historically, a popular project choice was the development of a game of some sort. Larger projects are typically segmented into parts where each is completed by smaller teams of two to four students. One important aspect of this work is that a large final project requires that all components interoperate as a commercial software product require, so each smaller team must successfully complete their portion for the final project to be successful. For nearly two decades now, the major goal of the SDII course has been to simulate the environment students will face in developing software in practice upon graduating.

During the last three years, however, the SDII course has been modified to include an additional dimension, namely entrepreneurship and how software development proceeds when done in support of a new venture. In addition, for the last two years, support for this project has been provided by the Coleman Foundation, with Stetson being chosen as one of only nineteen universities receiving these grants nationwide. While a number of possible approaches or theories for entrepreneurship exist, the goal of the course is not to teach a survey of entrepreneurship per se, but rather, to introduce one approach and have students apply it to one major project. As one very successful model for entrepreneurship for technology startups has been the Lean Startup (Ries, 2011), this approach has been adopted for the course. One motivation for the Lean Startup philosophy is the work of Steven Blank and his work on determining the successful strategies for developing products that succeed (Blank, 2013). Blank points out the amazing fact that nine out of ten attempts to launch new products fail, with the waste of billions of dollars to develop products that essentially nobody is waiting to buy. The Lean Startup works to mitigate this path to failure by focusing intentionally on develop products people want.

The approach in this course differs from that of Doboli, Kamberova, Impagliazzo, Fu, and Currie (2010), who include both depth and breadth add-on modules to the computer science and computer engineering courses. As any new venture will ultimately adopt some approach and apply it in depth, rather than utilizing all approaches at one time, we have chosen depth over breadth in introducing entrepreneurship into the SDII course. Also, it should be noted that the two professors who have taught this course for the last fifteen years have a combined total of over 30 years of professional software development experience in addition to being academics, both having experience consulting with start ups.

Course Process

In pursuit of the goal of promoting entrepreneurship, very early in the course the Director of the Joseph C. Prince Entrepreneurship Program at Stetson, as a guest lecturer, conducts a dialog with students about entrepreneurship, the challenges faced by being an entrepreneur and what sorts of personality characteristics fit well with being an entrepreneur. The Director also introduces the students to the basic steps an entrepreneur takes from inception to delivery of a software product as part of a new technical venture. The class is then introduced to the lean startup philosophy, along with its five principles (Ries, 2011; Lean Startup, 2016). Discussions begin centered around the central tenet of determining more quickly what works in developing a product and discarding what does not, alluding to how the class will achieve success in implementing such a strategy in product development. A number of case studies are viewed from Lean Startup (2016), and discussions of what successful companies practiced and observed during their own launches continue.

Concurrent with the above discussions on entrepreneurship and case studies, students are asked to generate a list of possible software products they would like to develop, and each student is asked to make a pitch to the class about their ideas. The professor and students also solicit suggestions from various administrative departments on products they use, problems faced with these products, and ideas for better or new products. Students then conduct market research pertaining to the viability of their ideas, including talking to potential clients who would be in the market for their proposed product, and with this new information, pitching to the class once more. After discussion on the ideas presented, students decide on the project or projects they will develop throughout the course. As a typical size for the class ranges between 5 and 20 students, the decision on project(s) selection is based on the size and scope of the projects proposed and student interest. If two projects are chosen, two rounds of voting by the students are used to select the two projects that have been pitched.

For a single project, only one round of voting is required. Retaining the requirement of a maintenance project for the course, the selection of the maintenance project has been modified to build student proficiency with the language and tools that will be used for the core project. For example, if the final project is to be a web application, students may break into smaller teams, with one group working on Android mobile development, one on iPhone development, one on web front end development, and one on back end and database development. All students participate in the core design and interfaces, but development takes place separately, conforming to the agreed-upon interfaces. Each smaller team then works on a separate maintenance project appropriate for their component of the product, typically chosen from online open source projects. The maintenance phase generally lasts for three weeks, at which point students move on to the final project.

For the final project, students are required to submit their code to online repositories (e.g. Github or Bitbucket) so that other students may instantly access other groups' codes in their development. Students develop test cases to test their code, perform code reviews, and provide in-class weekly updates on progress, and must set and meet short- and long-term milestones. Ideally (though success varies), students develop iteratively such that they may present updates to clients for the project (e.g. the administrative department suggesting the product, or if their own idea with no clear client, the professor

for the course.) Following the lean startup approach, pivoting to adjust to client needs is critical for limiting wasted time developing a product that differs from what clients actually want. More frequent meetings with clients is the best means for keeping the project on track. The course ends with the final product being presented to the Department and any clients or groups involved with the process.

RESULTS AND DISCUSSION

Four projects have been completed over the last three years. A brief description of each is provided below.

Xeres (2013)

The Xeres project originated from a need presented to the class by Stetson's IT department. After eight months evaluating different product reservation systems to track loaned out equipment, IT found all to be either too complex and expensive or very affordable but inflexible. Serving as the clients for the class, IT worked closely with the class as a reservation system was developed. By the end of the semester, Xeres was installed and continues to be used by IT. In its original form, the product allowed items to be reserved, loaned, and tracked. The system was both calendar and menu driven with a very easy to use interface, flexible product entry and modification, and dynamic property generation. Three students continued debugging, developing and updating the program after the semester was over, developing more flexibility into the product to morph it form a reservation system for equipment to one that could be used for multiple other uses, such as reserving rooms or tickets for sporting events. The students presented the project at the 2015 Cairnes Foundation Innovation Competition and received the $5,000 second place award (Park, 2015) and the interest of a venture capitalist to fully fund their company upon graduation. Unfortunately, disagreements between the students on stock distribution stymied incorporation efforts.

MobileBlueLight (2014)

In collaboration with Stetson's Public Safety department, students developed a mobile blue light application for iPhones and Android phones. Students in the class noted that fixed blue lights for making emergency calls, especially for students walking alone at night, were few and far apart. Certain areas of campus, such as fraternity row, had none. The mobile apps developed by the students allowed ready access to Public Safety with the swipe of their finger on the app-ready phone. One group in the class developed the back end program to drive the product, while a different team developed the web application that would run on Public Safety's monitoring desktop. Through interviews with Public Safety, students developed a means to reduce false positive alerts, rank alerts in priority, and make the application web-based so that no software needed to be installed on monitoring computers. By the end of the semester, a fully operational prototype was working on both types of phones, the desktop, and back end servers. While initially, students displayed an interest in continuing work on the application, interest dropped when classes began again the following semester due to time constraints.

TutorMe (2015)

In 2015, two projects were completed. Both projects were web-based applications. *TutorMe* was targeted at Colleges, Universities and Schools, and was an application that could be used by students to schedule tutoring appointments, allow tutors to manage their schedules, allow students to rate tutors, allow tutors to log problem students, and provide analytics to instructors and persons managing a tutoring service so as to be able to assess the service and students' use of the service. Students in the class contacted different schools using existing products to determine short-comings and features that would be desirable. Based on the feedback received as well as other on-line market research, the product developed contained features that were found to be needed, and not present in existing products. Most of the features were

completed by the end of the semester. Four members of the team that worked on the project decided to continue and work on making the product commercial. After consulting with the professor and Director of entrepreneurship, the students continued to draw up legal documents required to work together. Progress has been slow, but work continues.

OddJob (2015)

The second 2015 project, *OddJob*, was designed to be an "Uber for Odd Jobs" that need completing and individuals who provide services to accomplish those jobs. It was designed to allow the posting of the odd jobs, posting of resumes and skills by providers, contractual agreements to perform work, searchability for jobs and providers based on type of job and geographic location, and rating of providers and customers. While a fair number of the features were completed, a fair amount of work remained by the end of the class to make the product viable. Two of the students from the team who worked on this agreed to continue working on the project to bring it to market, though efforts have stalled.

CONCLUDING COMMENTS

A depth model for including entrepreneurship into a sophomore-level software development class was presented in this paper. The Lean Startup approach (Ries, 2011; Lean Startup, 2016) was introduced into the class over three consecutive years, with four software products developed. For two of the products, a group of students in each class continued work and development with the intention of taking the product to market. For one product, student entered and received second place in an innovation competition and attracted serious attention from a venture capitalist interested in fully funding the product, though in the end, stock distribution disagreements doomed the venture. While none of the four projects led to a successful new venture, students received valuable experience in entrepreneurship as applied to new technical start up efforts. Students received guidance from the Director of Stetson's entrepreneurship programs at various stages of work, most importantly at the beginning of the course by way of introduction, and at the end of the course and beyond, when interested students required help in continuing work towards incorporating and moving ahead with the venture.

REFERENCES

Bagozzi, R. P., J. Baumgartner and Y. Yi. (1989). "An Investigation into the Role of Intentions as Mediators of the Attitude-Behavior Relationship," *Journal of Economic Psychology*, 10(1), p. 35 – 62.

Baum, S., and J. Ma. (2011). "Trends in College Pricing." *The College Board.* Retrieved from http://trends.collegeboard.org/downloads/College_Pricing_2011.pdf.

Bird, B. J. (1992). "The Operation of Intentions in Time: The Emergence of the New Venture", *Entrepreneurship: Theory & Practice*, 17(1), p. 11 – 20.

Blank, S. (2013). *The Four Steps to the Epiphany*. Pescadero, CA: K&S Ranch.

Boyd, N. G. and G. S. Vozikis. (1994). "The Influence of Self-Efficacy on the Development of Entrepreneurial Intentions and Actions," *Entrepreneurship: Theory & Practice*, 18(4), p. 63 – 77.

Bureau of Labor Statistics (April 19, 2012). *College Enrollment And Work Activity Of 2011 High School Graduates*. Retrieved from http://www.bls.gov/news.release/hsgec.nr0.htm/.

Daimi, K. and N. Rayess. (2008). "The Role of Software Entrepreneurship in Computer Science Curriculum", *Proceedings of the 2008 International Conference on Frontiers in Education: Computer Science and Computer Engineering* (*FECS)*.

Demos, Young Invincibles (December 2011) *The State of Young Americans: Economic Barriers to the American Dream*. Retrieved from http://www.demos.org/state-of-young-america.

Doboli, S., G. L. Kamberova, J. Impagliazzo, X. Fu, and E. H. Currie. (2010). "A Model of Entrepreneurship Education for Computer Science and Computer Engineering Students," *Frontiers in Education Conference (FIE)*, p. T4D-1 – T4D-6.

Duval-Couetil, N. and Z. Long. (2014). "Career Impacts of Entrepreneurship Education: How and When Students Intend to Utilize Entrepreneurship in their Professional Lives," *Journal of Business and Entrepreneurship*. 26(1), p. 63 – 87. http://tinyurl.com/pdr7fr4.

Katz, J. A. (2003). "The Chronology and Intellectual Trajectory of American Entrepreneurship Education 1876 – 1999," *Journal of Business Venturing*, 18, p. 283 – 300.

Kuratko, D. (2005). "The Emergence of Entrepreneurship Education: Development, Trends, and Challenges," *Entrepreneurship Theory & Practice*, 29(5), p. 20.

Lean Startup (2016). Retrieved from http://theleanstartup.com.

Park, C. (2015). "Stetson Wins Innovation Challenge: Second Annual Competition Draws Eight Teams from Area Schools", Business Incubator Event, *News-Journal On Line*, Retreived from http://cairnsfoundation.com/images/content/cairns2015innovationchallengewinner.pdf

Pryor, J. H. and E. J. Reedy. (2009). "Trends in Business Interest Among U.S. College Students: An early exploration of data available from the Cooperative Institutional Research Program," Ewing Marion Kauffman Foundation (November 1, 2009). Available at SSRN: http://ssrn.com/abstract=1971393 or http://dx.doi.org/10.2139/ssrn.1971393

Reynolds, P. D. and R. T. Curtin (2008). "Business Creation in the United States: Panel Study of Entrepreneurial Dynamics II Initial Assessment," *Foundations and Trends in Entrepreneurship*, 4(3), p. 155 – 307.

Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. New York: Crown Business.

Schramm, C. (2014, May 6). "Teaching Entrepreneurship Gets an Incomplete," *The Wall Street Journal*. Retrieved from http://www.wsj.com/news/articles/SB10001424052702304279904579515953479728072#livef%20yre-comment.

Shapero, A. and L. Sokol. (1982). "The Social Dimensions of Entrepreneurship," in C. A. Kent, D. L. Sexton, and K. H. Vesper (eds.) *Encyclopedia of Entrepreneurship* (p. 72 – 90), Englewood Cliffs, NJ: Prentice Hall.

Torrance, W. E. F. (2013). "Entrepreneurial Campuses: Action, Impact, and Lessons Learned from the Kauffman Campuses Initiative," *Ewing Marion Kauffman Foundation Research Paper*.

Twenge, J. M., S. M. Campbell, B. J. Hoffman, and C. E. Lance. (2010). "Generational Differences in Work Values: Leisure and Extrinsic Values Increasing, Social and Intrinsic Values Decreasing." *Journal of Management,* 36(5), p. 1117 – 1142.

Twenge, J. M. (2009). "Generational Changes and Their Impact in the Classroom: Teaching Generation Me," *Medical Education*, 43: 398–405. doi: 10.1111/j.1365-2923.2009.03310.x

Winkler, C. and J. R. Case. (2014). "Chicken or Egg: Entrepreneurial Self-Efficacy and Entrepreneurial Intentions Revisited", *Journal of Business and Entrepreneurship*, 26(1), p. 1-21.

Winkler, C., E. E. Troudt, C. Schweikert, and S. A. Schulman. (2015). "Infusing Business and Entrepreneurship Education into a Computer Science Curriculum – A Case Study of the STEM Virtual Enterprise," *Journal of Business and Entrepreneurship*, 27(1), p. 37-62.

ACKNOWLEDGEMENTS

The authors thank the Coleman Foundation for their support of entrepreneurship at Stetson University.

BIOGRAPHY

Daniel Plante is a Professor of Computer Science in the Department of Mathematics and Computer Science at Stetson University, DeLand, Florida. He received his PhD degree in physics from the University of Notre Dame in 1995 and his ME in computer science from North Carolina State University in 2003. He is a member of the ACM, the IEEE, and the IEEE Computer Society. He also is co-owner of Akili Consulting, Inc., a software development and consulting business, and a partner with Panoptic Media, LLC, an online media sales company.

Michael Branton is a Professor of Mathematics and Computer Science in the Department of Mathematics and Computer Science at Stetson University, DeLand, Florida. He received his PhD in mathematics from the University of North Carolina in 1982 and is the co-owner of Enigmatix, Inc., a software development and consulting business.

Gary Oliphant is an Associate Professor of Business in the Barney Barnett School of Business and Free Enterprise at Florida Southern College, Lakeland, Florida. He received his PhD degree in Marketing and MBA degree from Florida State University. He was the Coleman Director of the Stetson Coleman Fellows program that offered an interdisciplinary entrepreneurship program. He has owned several different companies, one of which was the second largest real estate publication in the United States. Dr. Oliphant is an entrepreneur turned educator.