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INFORMATION SYSTEMS EDUCATION JOURNAL

Addressing the 21st Century Paradox: Integrating Entrepreneurship in the Computer Information Systems Curriculum

Guido Lang
guido.lang@quinnipiac.edu
Quinnipiac University
Hamden, CT 06518

Jeffry Babb
jbabb@wtamu.edu
West Texas A&M University
Canyon, TX 79016

Abstract

The Computer Information Systems (CIS) discipline faces an identity crisis: although demand for CIS graduates is growing, student enrollment is either in decline, or is at least soft or flat in many cases. This has been referred to as the 21st century paradox. As one solution to this problem, we propose to integrate entrepreneurship in the CIS curriculum. An analysis of *N* = 253 universities in the United States finds that only 39.5% offer both CIS and entrepreneurship degrees. Large, private, research-oriented universities were found to be most likely to offer both degrees. A follow-up qualitative analysis of eight ABET accredited IS programs in business schools that also offer a full-time entrepreneurship degree finds that only one university gives students the option to take one entrepreneurship class as part of their IS major. We propose to infuse entrepreneurship in CIS classes based on the lean startup methodology and offer a learn-build-measure feedback loop, along with open source software and agile development practices, as a pedagogical framework for instructors. The paper concludes with a discussion of how entrepreneurship in the CIS curriculum creates graduates that are better prepared to enter the job market.

Keywords: 21st century paradox, ABET, entrepreneurship, lean startup, learn-build-measure feedback loop

1. INTRODUCTION

Enrollment in CIS is down and/or flat for many programs. Either students are not interested in CIS, our core competency has been encroached by software engineering, or we have failed to maintain our relevance; these are some of the problems faced by our discipline. At the same time, employer demand for both the technical and inter-personal/organizational qualities that a CIS graduate possesses is strong and growing (BLS, 2014). We believe that among the possible solutions available for some CIS programs facing the 21st century paradox (Burns, et al., 2014) could be to consider integration of entrepreneurship in the CIS curriculum or at least adopting its perspective. This would not merely be for the purposes of suggesting that the entrepreneurship path is one that would be successfully pursued by all of our graduates, but rather that beyond the feasibility of such success is a perspective and "lens" through which the CIS discipline can be seen from pedagogy in the academy, practice in the field, and research.

For the purpose of this work, we define entrepreneurship as "an individual's ability to turn ideas into action" (Commission of the European Communities, 2006, n.p.). As such, entrepreneurship includes creativity, innovation, risk taking, and the ability to plan and manage projects in order to achieve objectives. Entrepreneurship also implies a sense of self-organization and leadership. In addition to providing a foundation for entrepreneurs wishing to establish a social or commercial activity, this view of entrepreneurship also helps people in their day-to-day life at home, as citizens, and as employees by making them more aware of the context of their work. In fact, entrepreneurship has been identified as one of eight key competencies necessary for personal fulfillment, social inclusion, active citizenship, and employability identified Education & Training 2010 Work Programme (European Parliament, 2006). The propositions regarding entrepreneurship and CIS in this paper are directly aligned with a recent call by the European Commission for universities to "integrate entrepreneurship as an important part of the curriculum, spread across different subjects, and require or encourage students to take entrepreneurship courses." (Commission of the European Communities, 2006, n.p.) This call seems equally applicable for universities elsewhere, including those in the US.

Given the wide-ranging benefits of entrepreneurship, we are interested in the following research questions:

- What are established methodologies to foster entrepreneurship?
- What aspects of the CIS curriculum and discipline are amenable to an entrepreneurship perspective?
- What is the state of cross-curriculum collaboration and integration of entrepreneurship and CIS in the United States?
- How can schools integrate entrepreneurship in the CIS curriculum?

This paper proceeds as follows. First, we describe the lean startup: a popular methodology to foster entrepreneurship. Next, we use aspects of model curricula to propose where entrepreneurship "fits" with the CIS curriculum. Then, we describe the methods used to assess the state of cross-curriculum collaboration between entrepreneurship and CIS in the United States. Section four presents the results, followed by a set of recommendations on how schools can integrate entrepreneurship in the CIS curriculum. We conclude with ideas and propositions of how entrepreneurship enhances the CIS discipline.

2. THE LEAN STARTUP MOVEMENT

Previous research suggests that business opportunities are created rather than discovered (Alvarez & Barney, 2007). Specifically, the process of creating a business opportunity is best thought of as an incremental, iterative cycle of action and learning in which the entrepreneur engages with potential customers to co-create a business opportunity (Prahalad and Ramaswamy, 2004). In line with this theory, a recent set of practices subsumed under the umbrella term "lean startup" has emerged in the field of technology entrepreneurship. The principles of the lean startup methodology are largely based on insights drawn from information technology startups, particularly in a business-to-business context.

Lean startup is a prescriptive methodology aimed at reducing the amount of waste in startups (Ries, 2011). The lean startup methodology views a startup as a temporary organization designed to search for a repeatable and scalable business model. A business model, in turn, describes how an organization creates, delivers, and captures value. Thus, any activity that does not directly contribute to the search for a business model is considered waste. In contrast to the traditional trilogy of information systems development - which focuses to deliver on time, on budget, and to specifications - the key challenge for a startup is to build something that people (i.e. customers) want. At the core, the lean startup methodology recognizes that startups are different from companies: whereas the primary focus of a company is to execute an established business model, a startup's goal is to search for a viable business model. Whereas IT departments in traditional companies usually solve a known problem for a product owner or in-house customer, a startup solves an unknown problem for an unknown customer. Although the lean startup methodology is not written in stone, the build-measure-learn cycle, agile development, and the use of open source software have emerged as its core practices over the past few years.

The "lean" in lean startup is not new and is an extension of the metaphor into the area of entrepreneurship from its origins in

manufacturing, supply-chain, business process optimization, and software development (George & George, 2003; Holweg, 2007; Naylor et al., 1999; Poppendieck & Poppendieck, 2003). Furthermore, lean is often included in the family of agile software development models, methods, and practices (Dybå & Dingsøyr, 2008). That the "lean" metaphor extends well into organizational issues, technical issues, and those related to the design, implementation, and upkeep of information systems bodes well for the lean metaphor both as a means of understanding entrepreneurship and its application to CIS.

In contrast to the profit motive of established companies, the goal of a lean startup is to gain validated learning about customers (Ries, 2011). What matters most to a lean startup is not to generate revenue, but to prove the viability of its business model. Of course, part of the viability of the business model concerns revenues, especially the unit economics of their business (e.g. customer acquisition costs, expected revenue per customer, etc.). Ries (2011) proposes that the most efficient and effective way to achieve validated learning about customers is to quickly and iteratively engage in a feedback loop of "build-measure-learn" (see Figure 1).

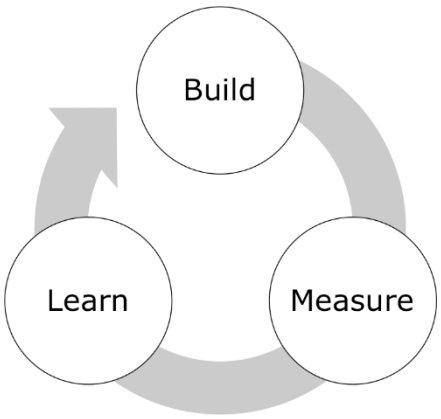

Figure 1: The build-measure-learn feedback loop in a lean startup (Ries, 2011)

Starting with a strong founder's vision about the customer's problem or need, a lean startup begins to build a so-called "minimum viable product" (MVP), with the goal of gaining as much validated learning about the customer as possible. An MVP "[...] is that version of the product that enables a full turn of the build-measure-learn loop with a minimum amount of effort and the least amount of development time" (Ries, 2011, p. 82). MVPs can be landing pages, wireframes, or other simple prototypes that lack many of the features of a full-blown product. What is most important about the MVP is its ability to gather validated learning about customers. In the second stage, measure, the MVP must be put in front of customers to elicit qualitative feedback and/or quantitative measurement of customer behavior. Lastly, in the learn phase, the startup must evaluate the data gathered from the measure stage and decide whether to pivot or persevere. In the learn startup methodology, a pivot refers to a fundamental change in the business model of the startup.

3. THE LEAN STARTUP IN THE CIS CONTEXT

In the Information Technology and Information Systems context, the rapid and iterative development of an MVP is best (and typically) accomplished through agile software development practices. Agile development is best thought of as a set of systems development principles or values. These principles include (Beck et al., 2001):

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

One popular agile development framework is Scrum (Schwaber & Sutherland, 2013). In Scrum, a product owner creates a prioritized wish list of features, called a "product backlog." The development team then plans a "sprint", which is a pre-defined time of work (usually lasting one week to one month), during which some of the features in the product backlog are moved in the "sprint backlog," to be worked on during the sprint. Every day the team meets briefly to assess its progress and discuss challenges in a so-called daily scrum. The scrum master is responsible for keeping the team on track so that at the end of the sprint a working piece of software is ready to be released. As the next sprint begins, the team decides again which features to move from the product backlog to the sprint backlog. Using an agile development methodology, like scrum, enables software developers to iteratively develop an MVP in a relatively short amount of time.

Lastly, technology startups tend to rely on open source software when creating their MVPs. In addition to open source software being free of charge, a large and growing community of open source contributors and developers serve as a global helpdesk in case of questions or problems. Examples of such open source software include the LAMP stack (Linux, Apache, MySQL, PHP) as well as web development frameworks such as Ruby on Rails (Ruby), Django (Python), and Meteor, Node.js, Angular (JavaScript), as well as various HTML5/CSS3/JavaScript front-end frameworks such as Boilerplate and Bootstrap. These tools have been created with agile development practices in mind and are thus ideally suited for the rapid development of MVPs. Together with the build-measure-learn feedback loop and agile development, open source software forms the technological basis for the lean startup methodology.

As of this writing, it does not appear that the lean startup methodology has been systematically studied and validated, in an empirical sense. The phenomenon is largely focused on nascent success found in business-to-business technology startups. Nevertheless, it appears that a set of practices that focus on customer-centered, iterative development seem to have taken hold in practice in a compelling way. We believe that the CIS discipline is uniquely positioned to teach/infuse most of these practices in its curriculum. In the next section, we describe the methods used to assess state of cross-curriculum collaboration and integration of entrepreneurship and CIS in the United States.

4. THE NATURE OF THE CIS CURRICULUM AND THE FIT FOR ENTREPRENEURSHIP

It is also important to understand the Information Systems discipline in order to see how and why lean entrepreneurship provides a particular metaphorical and analogous lens through which we can understand future possibilities for the application of information systems with respect to the 21st Century Paradox (Burns, et al., 2014).

Information Systems (IS) is a computing discipline, among the spectrum of computing disciplines, which addresses the problem space of computing in a unique manner. Figure 1 reflects a proposal for the IS domain within the computing problem space (Shackleford et al., 2006).

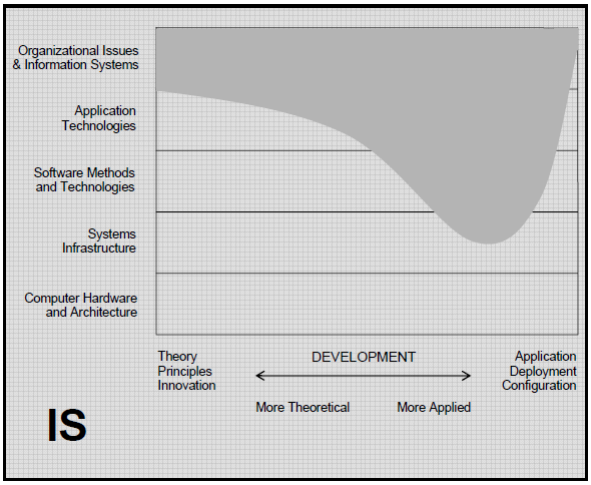

Figure 2: Information systems in the problem space of computing (Shackleford et al, 2006)

Information system (IS) has been characterized as a discipline which involves an applied understanding of the nexus between hardware and software, used by individuals and organizations to exchange data and information for goal-driven purposes (Checkland et al., 1997; Valacich et al., 2014). IS has evolved as an inter-disciplinary endeavor where, from the position of computing, it fully engages the "edge case" of organizational issues and application areas of computing (see Figure 2). It is possible then to characterize IS as a facet of computing that is "in service to" societal and organizational issues and needs, where the design, development, delivery, maintenance, and oversight of evolution of information systems is a key focus. In some degree or proportion, we are multi- and inter-disciplinary and "serve" several masters. Of course this assertion is not without controversy and debate. That is, IS is not pursued, conceived of, or implemented uniformly. IS can be interpreted in favor of a focus on the organizational impacts of IT artifacts such that the organizational issues are at the core of study and concern. It has been suggested that this perspective would refer to the discipline as Management Information Systems (MIS). On the other hand, some see the discipline as being firmly rooted in the technical, often referring to the discipline as Computer Information Systems (CIS). In terms of how this distinction influences programs of study in IS, the following is offered: "…programs

in Computer Information Systems usually have the strongest technology focus, while programs in Management Information Systems emphasize the organizational and behavioral aspects of IS." (Shackleford et al., 2006) We characterize this distinction as it may impact the means by which a program chooses to implement aspects of entrepreneurship, particularly from the lean startup perspective. While possibilities exist from both ends of the IS "spectrum," many of our assumptions are based from the perspective of programs which lean more towards CIS. Nevertheless, we recognize that the terms CIS, MIS, and IS may have different meanings across schools. Thus, we use the term CIS in an encompassing sense, meant to cover CIS, MIS, and IS programs across the entire spectrum of the discipline.

5. METHODS

In order to understand the state of cross-curriculum collaboration and integration of entrepreneurship and CIS, we first had to develop a comprehensive list of universities offering a CIS degree. To do so, we searched the membership directories of both AACSB and ABET. We found a total of 239 AACSB accredited business schools offering a full time undergraduate CIS degree in the United States. A total of 28 universities offer ABET accredited information systems programs in the United States. Fourteen universities are both AACSB and ABET accredited, leaving a total $N = 253$. We then used data provided by AACSB (for accredited schools) and the university websites to determine if a university offers a full-time entrepreneurship degree or major. In addition, we were interested in understanding potential factors associated with a university offering both CIS and entrepreneurship degrees. For one, we noted whether or not a university is private or public. Next, we used the Carnegie Classification of Institutions of Higher Education to classify if a university is predominantly research-oriented (i.e. doctoral/research university, research university with high research activity, or research university with very high research activity). Lastly, we recorded the number of full time undergraduate students enrolled in the business school as a proxy for university size.

Next, we conducted multiple two-sample t-tests to understand statistically significant differences between the group of universities that only offer a CIS degree and the group of universities that offer both CIS and entrepreneurship degrees. To conduct the t-tests, we recorded whether or not a university is private (0 = no, 1 = yes), whether or not a university is a research university (0 = no, 1 = yes), and the number of full time students enrolled in the business school.

Based on this analysis, we selected a small group of universities ($N = 8$) that offer an ABET accredited program in information systems and that also offer a full-time entrepreneurship degree. For this group, we then accessed the university websites in order to investigate the apparent collaboration between CIS and entrepreneurship in terms of cross-curricular offerings.

6. RESULTS

Out of 253 universities offering a CIS degree, 100 (39.5%) also offer an entrepreneurship degree. Out of these 100, 97% are AACSB accredited, 8% are ABET accredited, and 5% are accredited by both AACSB and ABET. Universities offering both a CIS degree and an entrepreneurship degree (Group 1) are significantly more likely to be private than universities offering only a CIS degree (Group 2) ($M_1 = .28$, $M_2 = .17$, $t = 2.03$, $p < .05$). Moreover, universities offering both a CIS degree and an entrepreneurship degree are significantly more likely to be research universities than universities offering only a CIS degree ($M_1 = .55$, $M_2 = .42$, $t = 1.97$, $p = .05$). In addition, universities offering both a CIS degree and an entrepreneurship degree are significantly larger – as measured by the number of full-time students enrolled in the business school – than universities offering only a CIS degree ($M_1 = 2148.05$, $M_2 = 1659.20$, $t = 2.82$, $p < .01$). Lastly, universities offering both a CIS degree and an entrepreneurship degree are just as likely to be AACSB or ABET accredited than universities offering only a CIS degree (AACSB: $M_1 = .97$, $M_2 = .93$, $t = 1.32$, $p > .1$; ABET: $M_1 = .08$, $M_2 = .13$, $t = 1.56$, $p > .1$). In other words, large, private, research-oriented universities are likely to offer an entrepreneurship degree in addition to a CIS degree.

We found a total of eight universities offering an ABET accredited information systems degree while also offering a full time entrepreneurship degree. These universities include:

- Drexel University
- James Madison University
- Quinnipiac University

- Radford University
- Rowan University
- University of Houston
- University of Nebraska at Omaha
- University of Tampa

Additional information about each university can be found in Table 1 (see Appendix). A closer investigation of the CIS programs at these universities indicates that none includes an entrepreneurship course as part of the required classes. Only Drexel University gives students the option to take an entrepreneurship class as an elective in their CIS degree (see Table 2 in Appendix).

At Drexel University, the MIS major consists of 24 credits (6 x 4 credit courses), including 8 credits (2 x 4 credit courses) of MIS electives. Students may choose any two from a list of five MIS electives, including one entrepreneurship class: "Business Plan for Entrepreneurs" (MGMT 365). According to the course description, "[i]n this course, students learn how to prepare a comprehensive strategy for launching a new business. The vehicle for achieving this is the preparation of a start-up business plan based on a selected opportunity" (Drexel University, 2014). Thus, MIS students at Drexel University may take one dedicated entrepreneurship course as part of their major.

Clearly, entrepreneurship is not part of the CIS curriculum at most universities. However, it is also possible to bring entrepreneurship and entrepreneurial thinking into "traditional" CIS classes. The following section describes ideas and recommendations for an integration of entrepreneurship in core CIS classes, based on the ABET criteria for accrediting computing programs.

7. RECOMMENDATIONS

Based on the results of our study, it is clear that entrepreneurship is currently not part of the CIS curriculum – at least not at schools which offer an ABET accredited full-time CIS degree and a full-time entrepreneurship degree. Thus, for schools offering entrepreneurship classes, we suggest considering adding those classes to the list of eligible CIS electives. We use ABET as a filter as ABET is thought to hold consistent guidelines for the discipline for the past 10 years.

According to the criteria for accrediting computing programs 2014-2015 (ABET, 2014), information systems programs must have one year of course work that includes "coverage of the fundamentals of a modern programming language, data management, networking and data communications, systems analysis and design and the role of Information Systems in organizations" as well as "advanced course work that builds on the fundamental course work to provide depth." Whereas ABET provides guidelines with regards to the content of what to teach, the lean startup methodology may be used for insights with regards to how to teach and instill an entrepreneurial mindset in students.

As described above, the lean startup methodology consists of a set of practices, including the build-measure learn feedback loop, agile development, and the use of open source software. We suggest adapting the learn startup methodology in CIS classes in order to help students achieve validated learning about technical concepts. Recall that a lean startup aims to achieve validated learning about customers by quickly and iteratively cycling through the build-measure-learn feedback loop. We believe that a student in a CIS class can achieve validated learning about technical concepts by quickly iterating through a learn-build-measure feedback loop (see Figure 3). The learn-build-measure feedback loop recognizes that students need to first learn the skills necessary to build something (like an MVP).

First, students must learn how to build whatever they will build in the next phase. This could be something simple, like a wireframe, or something more complex, like a website. In either case, it is crucial that the instructor creates a learning environment (including learning materials and exercises) that prepares students for the next phase. Moreover, to foster entrepreneurial thinking, students should be given the freedom to choose what they want to build – in collaboration with the instructor. Also, students should explore the problem space for which they will build a solution. As part of that exploration, students should establish ways to validate their learning. In other words, students should identify ways to put what they will build in front of actual customers. Pedagogical techniques for independent learning, like the flipped classroom model (Frydenberg, 2012), can be used to allow student to learn at their own pace.

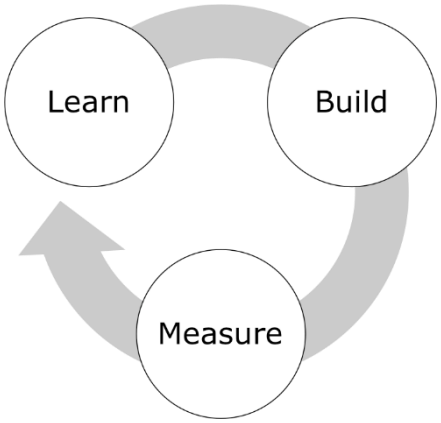

Figure 3: The proposed learn-build-measure feedback loop in CIS education

Next, students engage in building. Given that this phase tends to be the most technically complicated of the three, it makes sense to have students build in class. As such, class time becomes more like a workshop or lab, in which the instructor works with students one-on-one to solve issues they might encounter. In line with the lean startup methodology, students should make use of open source software and engage in agile development practices.

Lastly, students measure what they have built via customer responses in the form of verbal, written, or behavioral feedback. Depending on the class, customers might be students outside of class, other faculty, administrators, or people outside the university. The point here is to get students to receive feedback from outside the class. Based on the feedback, students then decide if and how to persevere or pivot. Ideally, students will be able to iterate several times through the learn-build-measure feedback loop over the course of a semester. At the end of the semester, the instructor can assess the validated learning achieved through the customer feedback and the artifacts created in the process.

We believe that by implementing a learn-build-measure feedback loop in CIS classes, instructors would help students attain a number of valuable skills and abilities. In particular, we propose that the top three skills fostered by a learn-build-measure feedback loop, are (from the list of student outcomes (a) through (i), ABET, 2014):

- An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs;
- An ability to use current techniques, skills, and tools necessary for computing practice;
- An ability to communicate effectively with a range of audiences.

The first student outcome is directly addressed in the build phase of the learn-build-measure feedback loop. To accomplish said outcome, it is crucial that students engage in the development of actual information technology artifacts, such as wireframes, prototypes, and other forms of MVPs. Similarly to the first student outcome, the second student outcome is also covered in the build phase. By engaging in agile development coupled with the use of open source software, students learn and apply systems development as it is practiced in many technology startups today. Finally, the third student outcome is addressed in the measure phase. As students engage with potential customers and other stakeholders to receive feedback on their artifacts, they communicate with various constituents that have varying backgrounds and levels of technical knowledge.

As such, we feel that a focus on entrepreneurship in the form of entrepreneurship classes and/or a learn-build-measure approach to CIS education will not only help students become entrepreneurs, but also help students be better prepared to enter the workforce with a set of practical skills that are equally applicable in information technology positions at large organizations.

Certainly further research is needed to test the efficacy of entrepreneurship classes in a CIS curriculum and our proposed learn-build-measure feedback loop in CIS education. One potential downside of such a hands-on, practical approach to CIS education is a potential lack of theoretical knowledge gained by students. Also, by focusing so strongly on building something like an MVP, students will become skilled in a particular programming language or application, which might or might not be part of their career in the future. In addition, it is possible that similar pedagogical practices are already in use at CIS programs without our knowledge. However, a hybrid approach which blends learn-build-measure with more traditional approaches, which may favor theory, can be explored. Eventually, particularly in the case of ABET-accredited programs, some room is left to define

and design a blend of upper-level coursework to augment or complement the learn-build-measure approach.

8. CONCLUSION

In this paper, we explore the potential of entrepreneurship to help CIS overcome the 21st century paradox of declining enrollment and growing employer demand (Burns, et al., 2014). In particular, we analyze the extent to which entrepreneurship classes are part of the CIS curriculum in ABET accredited IS programs. We find that, among schools that offer ABET accredited IS programs and full-time entrepreneurship programs, only one university offers students the option to take one entrepreneurship class as part of the CIS major. Next, we propose to infuse entrepreneurial practices based on the lean startup methodology in CIS classes. We offer a learn-build-measure feedback loop, along with open source software and agile development practices, as a pedagogical framework to guide instructors wishing to incorporate the lean startup methodology in their classes.

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Appendix

Table 1: ABET accredited IS programs in schools offering a full-time entrepreneurship degree

School	Location	AACSB	Private	Research university	Enrollment
Drexel University, Bennett S. LeBow College of Business	Philadelphia, PA	Yes	Yes	Yes	2,879
James Madison University, College of Business	Harrisonburg, VA	Yes	No	No	3,101
Quinnipiac University, School of Business	Hamden, CT	Yes	Yes	No	1,495
Radford University, College of Business and Economics	Radford, VA	No	No	No	1,329
Rowan University, Rohrer College of Business	Glassboro, NJ	No	No	No	924
University of Houston, C.T. Bauer College of Business	Houston, TX	No	No	Yes	3,412
University of Nebraska at Omaha, College of Business Administration	Omaha, NE	No	No	Yes	NA
University of Tampa, John H. Sykes College of Business	Tampa, FL	Yes	Yes	No	1,565

Table 2: Curricula of selected programs

University (Degree)	Required courses in major	Entrepreneurship electives
Drexel University (Bachelor of Science in Business Administration, Major in MIS)	1. Systems Analysis and Design 2. Database Design and Implementation 3. Management Information Systems Strategy 4. Domestic and Global Outsourcing Management + 2 major electives	1. Introduction to Entrepreneurship 2. Business Plan for Entrepreneurs
James Madison University (Bachelor of Business Administration in CIS)	1. Principles of Programming 2. Operating Systems and Server Administration 3. Enterprise Architecture 4. Computing and Telecommunications Networks 5. Database Design and Application 6. Intermediate Computer Programming 7. Systems Analysis and Design 8. Information Systems Development and Implementation + 2 major electives	[None]
Quinnipiac University (Bachelor of Science in CIS)	1. Systems Analysis & Design 2. Object-Oriented Analysis & Design 3. Object-Oriented Programming 4. Enterprise Systems 5. Networking & Data Communications 6. Database Programming & Design 7. IT Project Management 8. Information Systems Internship + 2 major electives	[None]

University (Degree)	Required courses in major	Entrepreneurship electives
Radford University (Bachelor of Science in Information Science and Systems)	1. Principles of Information Technology 2. Principles of Computer Science I 3. Principles of Computer Science II 4. Web Programming I 5. Introduction to Information Security 6. Data Management and Analysis with Spreadsheets 7. Database I 8. Software Engineering I 9. Decision Support Systems 10. Senior Seminar 11. Information Science and Systems Capstone [No major elective]	[None]
Rowan University (Bachelor of Science in MIS)	1. Principles of Systems Design 2. Business Systems 3. Design of Database Systems 4. Advanced Database Management 5. Network Management 6. Business Web Applications 7. Project Management 8. Managing International Business 9. E-Business: IS Perspective 10. Enterprise Computing II 11. MIS Capstone Experience [No major elective]	[None]
University of Houston (Bachelor of Business Administration in MIS)	1. Systems Analysis and Design 2. IS Tools 3. Transaction Processing I 4. Database Management I 5. IT Project Management 6. MIS Management and Lab + 2 major electives	[None]
University of Nebraska at Omaha (Bachelor of Science in MIS)	1. Introduction to Personal Computing 2. Introduction to Computer Programming 3. Introduction to Computer Science II 4. Organizations, Applications, and Technology 5. Introduction to Applied Statistics for IS&T 6. IT Ethics 7. File Structures for Information Systems 8. Managing the Data Base Environment 9. Business Data Communications 10. Managing in the Digital World 11. Intro to Project Management 12. Information Systems Analysis 13. Systems Design and Implementation + 4 major electives	[None]
University of Tampa (Bachelor of Science in MIS)	1. Application Development 2. IT Infrastructure 3. Systems Analysis, Design, and Project Management 4. Data and Information Management 5. Enterprise Architecture and Systems Design 6. Global Information Systems Management + 1 major elective	[None]