

## **AC 2007-676: GRADUATE CERTIFICATES IN ENTREPRENEURISM ? A SURVEY OF EXISTING PROGRAMS AS A GUIDE TO CREATING NEW GRADUATE CERTIFICATE PROGRAMS**

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# **Graduate Certificates in Entrepreneurism – A Survey of Existing Programs as a Guide to Creating New Graduate Certificate Programs**

## **Abstract:**

Graduate Certificate programs are emerging as a way for traditional graduate students to add a narrow academic concentration outside their primary degree area, and for the general citizenry easy access to graduate level instruction. In this paper, two universities that have been active in internal entrepreneurial engineering activities at both the undergraduate and graduate level will report on a cooperative survey of existing entrepreneurship and project management-focused Graduate Certificate programs made in preparation to creating their own programs.

These Graduate Certificate programs were examined for program ownership, number of hours required, internal or external student focus, classes required or offered as electives, time limits on degree completion, as well as several other program attributes of interest to the academic community. While the authors found a wide divergence of graduate certificate programs available in the U.S. and other countries, there were commonalities in structure and content that would be of interest to other universities considering creating such a graduate certificate in their own institution.

In this paper, the authors will present the results of their survey and will also discuss the process by which each institution is implementing their own graduate certificate. In addition to the published paper, the detailed data gathered during the survey will be made available to other educational institutions that are interested in considering this as a method to increase graduate level entrepreneurial activities in the internal and external communities that they serve.

## **Background:**

Interest in collegiate-level engineering or technology entrepreneurship has been increasing at a rapid rate over the past 10 years. Examples of this interest are easily found:

- The Entrepreneurship (ENT) Division within ASEE in 2000 and ENT Division membership now has over 550 members, indicating a strong interest from individual faculty members and their institutions.
- A supportive national organization for these entrepreneurial efforts (the National Collegiate Inventors and Innovators Alliance - NCIIA<sup>1</sup>) was formed in 1995 under financial support of the Lemelson Foundation<sup>2</sup>, with the number of NCIIA member institutions now standing at 339. The NCIIA provides encouragement of technology entrepreneurship education through training and developmental grants to support technology entrepreneurship courses, programs and E-teams.
- ASME is establishing the Center for Engineering Entrepreneurship and Innovation (CEEI) which will initially provide collegiate-level entrepreneurship support. This effort

will be followed by support of entrepreneurship and innovation for both professional (post-baccalaureate) engineers and high school youth. ASME plans to teams with its sister organizations (IEEE, ASCE, etc.) to open CEEI resources to all engineering disciplines.

- The Kauffman Foundation has invested significant funds “nationwide to catalyze an entrepreneurial society in which job creation, innovation, and the economy flourish.”<sup>3</sup>

At the same time, feedback from major industry continues to identify the changing role of Engineers as they progress through their professional career<sup>4</sup>. As the engineer progresses in their career from pure technologist, to technology development, to manager with merged technology and business responsibilities, their assignments may include leadership and development activities that are intrapreneurial in nature – requiring many of the same characteristics and traits as entrepreneurs beginning their own technology-based firms<sup>5,6</sup>.

With engineering entrepreneurship being a relatively new phenomenon within undergraduate and graduate engineering programs, thousands of working engineers who graduated prior to 2000 are becoming interested in developing their invention, innovation and entrepreneurship skills to either enhance their current career or explore starting a company. For many colleges and universities, providing entrepreneurship courses is viewed as a service they should provide to meet both internal and external demand, a step to help keep U.S. engineers competitive and innovation leaders, a way to support their alumni, and possibly a revenue source.

For the authors of this paper, baseline data was needed to help their institutions (the University of Arkansas and The Pennsylvania State University) quantify the current landscape in graduate-level certificates in entrepreneurship. Both programs have established undergraduate engineering entrepreneurship programs and specific graduate classes, and starting a graduate certificate program in technology entrepreneurship was viewed as a logic next step that needed more analysis.

In the summer of 2006, the authors conducted an on-line survey to identify and examine currently available graduate certificate programs in entrepreneurship that seemed to address the goals of their institutions graduate engineering programs. Most of the information contained in the survey was obtained directly from web site program descriptions, with phone-call backup when needed to clarify aspects of the program not fully described on the web site.

After completing the survey, the authors felt that other individual faculty and educational institutions would be interested in this consolidation of information, and that the ASEE Annual Conference would be an appropriate venue for distribution of that information. This paper was written to accomplish that distribution.

#### Method for Comparison of Graduate Certificates in Entrepreneurship:

The accumulated survey information was used to create the Grad Certificate Comparison Matrix (termed GCCM) in a flat Microsoft Excel spreadsheet for ease of access to a wide variety of interested faculty. The focus, for this phase, was on U.S. institutions and forty-eight graduate

certificate programs with elements of entrepreneurship were identified at thirty-seven institutions. The detailed data for each program resulted in a GCCM size (48 rows by 70 columns) that was impractical to include in this paper, so only the initial analysis and highlights are presented in this paper. The GCCM (Microsoft Excel Spreadsheet) can be downloaded from <http://microEP.uark.edu> (start with the Documents navigation button, click on the Conference Presentations submenu item, and then download the Graduate Certificate Comparison Matrix spreadsheet listed under the ASEE Annual Conference June 2007 – Honolulu, Hawaii).

By giving readers direct access to the GCCM, two benefits are achieved. First, any reader may extract the detailed data of interest to their program as the certificate name and URL for each program is provided for direct examination of the program web site. This allows the reader to understand the full details of each program and provides contact information to each program's management team. Second, any reader that wishes to add other program information to the GCCM may do so and return the electronic file to the web site administrator for review and posting. In this way the GCCM can continue to mature and maintain its usefulness as other institutions become interested in this type of graduate certificate program.

There were several programs found whose title included Strategic and Project Management. While the authors recognize that these programs might not be directly related to Entrepreneurship, they could be programs that would well support professional engineers as intrapreneurs in large companies and were left in the survey group.

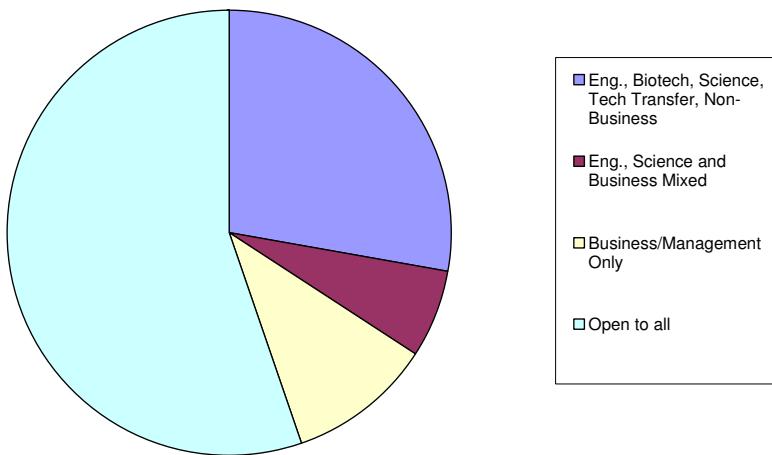
In creating the GCCM, the authors consolidated the course types offered by the various programs into general course categories with an indication if the course was a required course or an elective course. It was not an unexpected result that each institution's course offerings were organized in fashions that did not always fit a clear general course category in the GCCM. The authors made every effort to accurately consolidate each programs' specific courses into the categories that best matched the content, while making attempt to create meaningful consolidations. It should be noted that the authors did not submit the GCCM to each program for review before publication.

#### Certificate Program Focus:

Approximately half (26 programs) are described as “open to all” majors, with the remainder of the certificate programs focused specifically on some combination of engineering, business/management, biotech, or science graduates with BA or BS degrees. Figure 1 shows the breakdown of graduate certificate programs into 4 categories:

- Engineering, BioTech, science, technology transfer, and non-business only
- Engineering, science and business mix
- Business and management only
- “Open to all”

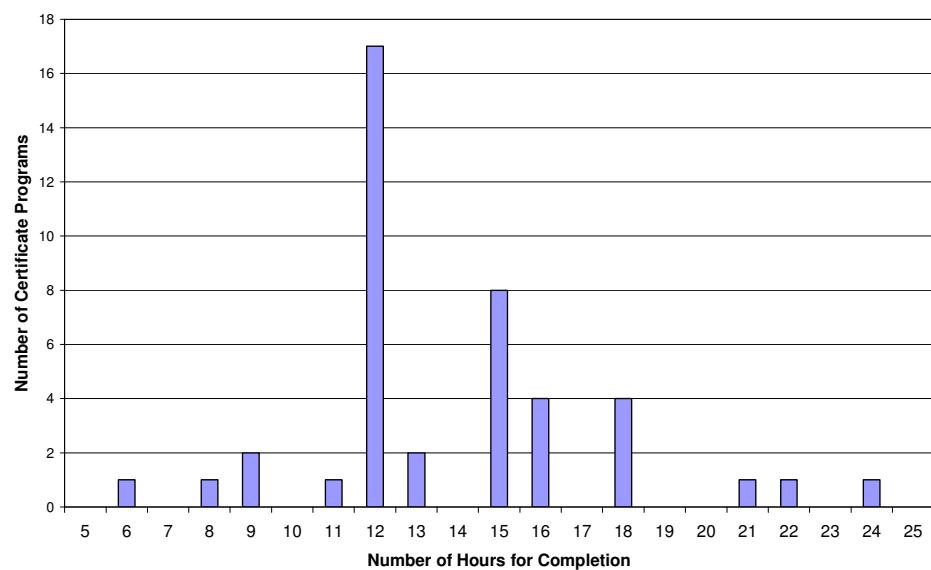
**Figure 1: Required Educational Background for Certificate Programs**



#### Number of Standard Semester Hours Needed for the Certificate:

The range of standard semester hours to complete the certificate program ranged from 6 hours to 24 hours, with the median number being 12 hours. The distribution of the hours needed to complete each certificate program is shown in Figure 2.

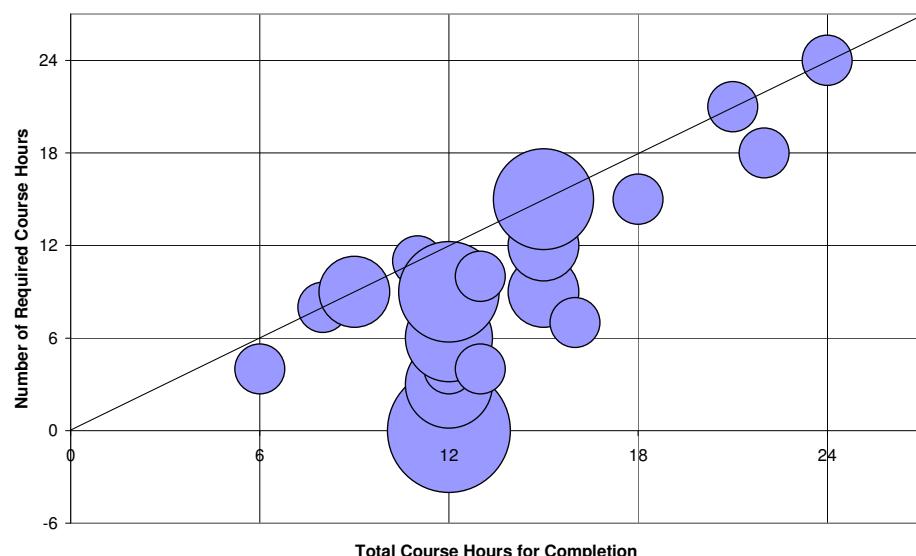
**Figure 2: Distribution of Graduate Certificate Program Required Hours**



About 85% of the programs have a set list of some required courses, making this a strong characteristic of the programs. However, only about one third of the programs are fully defined

with no elective courses as options. Figure 3 displays this information in a bubble chart, with the total hours for completion on the X axis, the total required hours on the Y axis, and the size of the bubble showing the number of programs at each intersection (the smallest bubble represents one program, and the largest bubble at the 12/0 intersection representing six programs). A line representing programs where the courses are all required has been placed on the graph for clarity.

Figure 3: Comparison of Required Course Hours versus Total Hours



#### Summary of instruction methods:

Of the 48 programs, 28 exclusively used on-campus/in-class instruction, with no use of Web-based/non-live instruction and no use of Distance education/live instruction. Therefore, the majority of the certificate programs are not using newer instruction methods that can expand reach to students away from campus.

#### Course Categories and Courses:

The number of columns in the GCCM was originally more than 70, but a goal in the data collection was to define course content areas that could be grouped into logical categories. As would be expected, there were almost no course titles in the certificate programs that were exactly the same, so ten general course categories were defined (listed below).

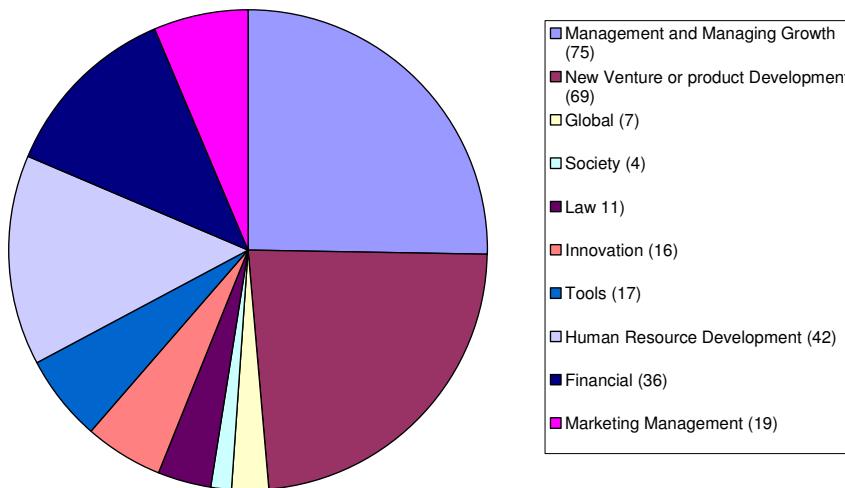
- Management and Managing Growth
- New Venture or Product Development
- Global
- Society
- Law
- Innovation

- Tools
- Human Resource Management
- Financial
- Marketing Management

In each of these ten course categories, course titles were defined that allowed approximate groupings of all the courses that were specified as either required or elective in each program, which reveals the focus areas for each individual program. For example, the Telecommunications and Entrepreneurship Certificate program at University of Hawaii/Manoa is focused on engineering entrepreneurship, and has two required courses in the New Venture or Product Development category, and electives from standard telecommunications or engineering course offerings.

Figure 4 shows the total number of courses (required or elective) in the ten course categories. This figure shows that the top three course categories are: Management and Managing Growth, New Venture or Product Development, and Human Resource Development.

**Figure 4: Number of Courses in General Course Categories**



#### Which Degree Program or Academic Unit Controls the Certificate Program:

As discussed earlier, the focus of the certificate programs varies from engineering, business, mixed business plus engineering, and “open”. The list of different colleges or units that control certificate content is even longer:

- Graduate School
- Business school

- Management Dept.
- Technology Management
- Engineering
- School of Technology Entrepreneurship
- Business and Technology
- Business, Engineering and Medical School
- Corporate Education
- Entrepreneurship Center
- Public Policy and Management

The GCCM data shows that control of the graduate entrepreneurship certificate programs is typically with just one unit, and in only 17 programs is there more than one college or unit listed as controlling the certificate or there is partnering on the certificate program. Therefore, cross-campus collaboration to share control of the certificate program is fairly uncommon.

In the case of the University of Arkansas, the Walton College of Business (WCOB) created the Graduate Certificate in Entrepreneurship at the request of the College of Engineering to bring this kind of training primarily to its PhD students. The Management Department of the WCOB defined the degree themselves, with the College of Engineering taking the role of a customer depending on the expertise of the supplier to provide them with the proper product. The new Graduate Certificate in Entrepreneurism requires twelve hours, of which nine of the hours are required new courses specifically designed for the Grad Certificate and three hours are elective. While the Graduate Certificate in Entrepreneurism was initiated for the College of Engineering, any graduate student on campus is welcomed into the program. The WCOB has stated that it wishes to focus on internal graduate students for some amount of time before it advertises the availability of the Graduate Certificate in Entrepreneurism to outside students. Within the University of Arkansas graduate system, a student can be enrolled for up to twelve hours of graduate credit as an undeclared major, so admission to a specific graduate program is not a requirement for a professional wishing to participate in the Graduate Certificate in Entrepreneurism program.

#### Summary:

The authors have accumulated an overview of graduate certificate programs of interest to the Engineering Education community, and through this paper and available download on the web have made it available to that community. The observations on the characteristics of this body of information are meant to be a guide to other institutions that may be considering the creation of these type graduate certificates, and readers of this paper are urged to contact individual programs of interest in order to fully understand the lessons learned by these institutions in creating their individual programs.

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<sup>1</sup> <http://www.ncgia.org> (January 15, 2007)

<sup>2</sup> <http://www.lemelson.org/home/index.php> (January 15, 2007)

<sup>3</sup> <http://www.kauffman.org/foundation.cfm> (March 7, 2007)

<sup>4</sup> Bertoline et al.; “Enabling A Strong U.S. Engineering Workforce For Leadership Of Technology Development And Innovation In Industry: Critical Skill-Sets For Early Career Development Leading To The Professional Master Of Engineering”; ASEE Annual Conference, June 18-21, 2006, Chicago, IL

<sup>5</sup> Pinto, Kharbanda; “Lessons for an Accidental Profession” included in The Human Side of Managing Technological Innovation, 2<sup>nd</sup> Edition (edited by Katz); Oxford University Press, 2004, ISBN 0-19-513531-8; PP 186-197.

<sup>6</sup> Dorf, Beyer; Technology Ventures: From Idea to Enterprise with Student DVD, 2<sup>nd</sup> Edition; McGraw-Hill Science/Engineering/Math, 2006, ISBN-13: 978-0073294421; Chapter 8