UNIVERSITYWIDE ENTREPRENEURSHIP EDUCATION: A MODEL FOR SCALING UP

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ABSTRACT

This article presents a model for scaling up entrepreneurship education universitywide. It addresses the nature of existing entrepreneurship education and proposes that entrepreneurship should be made available to all interested students as part of general education and capstone courses. Entrepreneurship is presented as a valuable set of skills for all students regardless of their career path or type of organization they join. An integrated model proposes that the core discipline, business skills, and practice in the community are essential to learn entrepreneurship. An entrepreneurship competency model and student journey, along with guiding principles, are presented to help implement the model. The universitywide program includes three main components: 1) the undergraduate minor, 2) the graduate certificate, and 3) commercialization councils.

INTRODUCTION

Entrepreneurship education is touted as important for economic and student development. Yet, the entrepreneurship education literature is focused on classroom pedagogy and programs that impact relatively few students. If entrepreneurship education is important it must be offered at scale. This article takes a university level perspective to entrepreneurship education. It describes how existing university courses, programs, processes, and resources can be used to scale up Entrepreneurship Education (EE) universitywide. To advance teaching entrepreneurship, this article describes how to integrate general education courses along with senior capstone courses, high impact activities, graduate programs, and research commercialization.

Existing entrepreneurial education research and program descriptions focus on student impact (Walter et al., 2012; Sánchez 2013; Unterfrauner et al., 2021; Safari et al., 2023), economic impact (O'Connor, 2013; van Gelderen, 2023; Walter & Block, 2016), and pedagogical techniques (Costin et al., 2019; Isabelle, 2020; Boldureanu et al., 2020; Bohlayer & Gielnik, 2023; Motta & Galina, 2023; Kakouris & Liargovas, 2020). These are all critical topics for effective entrepreneurial education. We broaden the scope and impact of entrepreneurship education by providing the structure to use university resources to offer EE to all interested students.

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It is critical to recognize that entrepreneurship skills are just as applicable to high technology startups as they are to large corporations, non-profit organizations, government agencies, and other organizations with a myriad of objectives. The ability to recognize socially responsible opportunities, and to create paths to deliver, operate, finance, and promote these opportunities is applicable to all majors, not just to people who start companies. Entrepreneurship education is critical for everyone who wants to create value and good in society.

Our objective is to create a universitywide program to reach interested students in all majors. This article quickly reviews existing entrepreneurship education and makes the case for expanded entrepreneurship education. The challenges of offering entrepreneurship education universitywide are then explored. An integrated model of entrepreneurial education is presented to address these challenges by building an inclusive model of EE. Guiding principles to implement this approach universitywide are suggested along with an entrepreneurship competency model and a student journey to guide interested students through their formal education. The article then describes the three specific facets needed to offer entrepreneurship universitywide:

1. The undergraduate minor
2. The graduate certificate
3. Commercialization councils

EXISTING ENTREPRENEURSHIP EDUCATION

Entrepreneurship is the energy animating the modern world—for good and for bad. Every aspect of the modern world was either created or affected by entrepreneurs. Therefore, it is imperative to teach students all facets of entrepreneurship—how to be an entrepreneur, how to work with and for entrepreneurs, how to fund and partner with entrepreneurs, how to manage entrepreneurs, and how to regulate and restrict entrepreneurs. These are essential skills for maximizing the positive impact of entrepreneurship while minimizing its potential negative impact—for the entrepreneur as well as for society.

The amount of literature on entrepreneurship education is large and growing fast (Fellnhofer, 2019). The number of articles on topics such as pedagogy, impact on student intention to be entrepreneurial, increasing entrepreneurial mindsets and self-perceptions, and development of entrepreneurial skills is increasing rapidly (Aparicio et al., 2019). Although many universities offer extensive entrepreneurship curriculum and extracurricular activities (Katz, 2008), a focus or method to offer EE across the entire university does not appear to be addressed.

Recent review articles describe the state of entrepreneurship education. Tiberius and Weyland (2021) identify two frontiers of EE, student psychology and creating value, while referring to pedagogy as a "*black box*." Much of the research on EE indicates the need for more rigor studying pedagogy. Nabi et al., (2017) draw attention to the need for research into pedagogy. Englis et al. (2023) emphasize the necessity for experimental designs to establish more "*theory-driven*" and robust research designs. Rideout & Gray (2013) point out that methodological weakness in EE research undermines confidence in the effectiveness of EE. Some authors even wonder if entrepreneurship can be taught in a classroom setting.

Notwithstanding the need for rigorous pedagogical research there is evidence that EE increases students' intention to be entrepreneurial. Aparicio et al., (2019) remark on how

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intention to be entrepreneurial is a common research topic. Li et al., (2023) find that EE increases intention to be entrepreneurial as do several other authors (Rauch & Hulsink, 2015; Ahmed et al., 2020; Lis et al., 2018; Yi & Duval-Couetil, 2021).

In addition to research on increasing intention to be entrepreneurial, significant research discusses the impact of EE on students' self-perceptions and intentions. EE is seen to raise students' entrepreneurial intention and self-efficacy (Rauch & Hulsink, 2015). Bohlayer and Gielnik (2021) show how a lack of error mastery, or a helpless attitude towards problems, can weaken an individual's learning. Unterfrauner et al., (2021) show that maker spaces (shops) increase students' entrepreneurial self-efficacy. Costin et al., (2019) show how simulation games can be used for EE to increase both competencies and self-efficacy. Finally, Isabelle (2020) goes even further, demonstrating the benefits of "*gamification*" and competition in EE (Bell & Bell, 2020).

The research on EE also shows the effectiveness of teaching entrepreneurial skills. Kujala et al. (2021) assert the importance of teaching entrepreneurial skills. Fisher et al. (2008) show the usefulness of EE in teaching a variety of entrepreneurial skills. Galvão et al. (2020) demonstrate that EE increases entrepreneurial skills. Einav (2022) shows that EE can be effective during Covid lockdowns. Costin et al., (2019) show how simulation games can be used for EE to increase both competencies and self-efficacy (Gibb, 2000; Iglesias-Sánchez et al., 2016).

The literature, however, does not describe how to offer EE on a truly large scale, universitywide. Offering EE to all students requires a clear understanding of the need for EE, the numerous constituents involved, the curriculum development process, interdisciplinary education, and the unique needs for EE. This article incorporates all these issues to present an integrated model of entrepreneurial education.

UNIVERSITYWIDE CHALLENGES

Offering entrepreneurship education universitywide brings with it numerous challenges not faced when offering a single course, program, or even a degree. Resources, administration, faculty, committees, students, family, and even society in general present unique challenges. Therefore, understanding the actors, their drivers, and acceptable solutions to resource allocation is critical.

Resources

Teaching courses in one area versus another has resource implications. Adding a number of entrepreneurship courses necessarily means that roughly the same number of other courses will not be taught. There may not be a strict accounting, but at scale, teaching hundreds or thousands of students, this impact is impossible to ignore. Because all universities are resource constrained, a clear view and open discussion about the costs and benefits must be initiated.

Stakeholders across the university and beyond must be cultivated to support the diversion of resources to entrepreneurship. Administrators, faculty, curriculum committees, students, parents, employers, and society in general need to be provided with the information and reasoning necessary to agree with expanding entrepreneurial education.

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Administrators

Entrepreneurship programs and courses are sometimes treated as add-ons rather than core to modern education. As such they are often funded by donors, grants, or temporary sourcesof funds. These sources are limited and cannot scale up EE universitywide. Given the limited, ad hoc nature of many programs, administrators may not be primed to think of vastly expanding entrepreneurship education. A major challenge that must be addressed is to help administrators think of EE as an essential part of education for all students and not just for a relatively small number of students who voluntarily find their way to entrepreneurship courses and programs.

Administrators are continuously set upon by nearly every program in the university for additional resources. This competition for a fixed level of resources becomes a series of resource allocation decisions like those made by investors or executives in other large organizations. Therefore, the case must be made that entrepreneurial education is essential and should be a regular part of general education and every senior capstone course. It cannot be seen as an extracurricular, nice to have add-on, but as essential to prepare students from all majors for success in their field.

Faculty

Faculty and departments whose courses might be displaced will naturally object to adding entrepreneurship courses, particularly if they are counted towards graduation requirements.

On the other hand, faculty seeking to offer interdisciplinary courses that prepare students for post-graduation organizational life may want to expand their students' skill sets within the bounds of their major disciplines. Therefore, it is essential to partner with faculty who see the need to augment their students' preparation.

Curriculum Committees

Resistance to expanding entrepreneurial courses is often manifested in department, college, and university level curriculum committees. Procedural, policy, content, and resource issues can be used to maintain the status quo and keep entrepreneurial courses from being offered or being counted toward meaningful graduation requirements. A critical component in offering entrepreneurial education to all interested students is to ensure entrepreneurial courses are part of the graduation requirements. Therefore, working with faculty and committees to accept entrepreneurship courses is a long-term process.

Students and Parents

In many discussions, entrepreneurship is reduced to simply starting a business. It is true that we celebrate and support students who start companies right after graduation, but most students get jobs in existing organizations. Entrepreneurial skills—attracting resources and adding value—are critical for any organization, not just startups. Essential to promoting any curriculum is making sure students and parents understand this.

Culture/Society

For a variety of reasons, parts of universities and of society do not welcome

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entrepreneurship education. Sometimes entrepreneurship education yields less than encouraging results (Oosterbeek et al., 2010; Walter et al., 2012; Bohlayer & Gielnik, 2023; Li et al., 2023; Martin et al., 2013). Some countries are hostile to the idea of entrepreneurship—but interestingly, it is in such countries that entrepreneurship education seems most likely to result in entrepreneurial efforts (Walter & Block, 2016; Ratten & Usmanij, 2021).

AN INTEGRATED MODEL OF UNIVERSITYWIDE ENTREPRENEURSHIP EDUCATION

Figure 1 describes an entrepreneurship education model based on a hierarchy of learning and experience.

Core Discipline

Core to EE is a student's major or core discipline. Entrepreneurship should be grounded in what students are learning in their major. It is in their disciplines that students learn the basis of how to create value for their future employers. Therefore, entrepreneurship must be taught as part of the student's regular plan of study from their general education requirements to their senior design or capstone courses.

Business skills

Regardless of the type of organization that students enter, they will need a fundamental understanding of how organizations run and thrive. This requires a broad array of business skills not usually taught in other disciplines. Unfortunately, business minors and certificates, even those in entrepreneurship, often require students to take a series of business courses that business majors must take. This requirement means that non-business majors take courses that include a significant component of unneeded material but that fail to equip them with entrepreneurial skills. Therefore, business skills for non-business majors should be taught in specifically designed courses to meet their needs.

Practice

Entrepreneurship must be practiced for students to understand and acquire the skills. In recognition of this, many entrepreneurship courses and programs include significant practical components in their pedagogy. This article proposes to include similar co-curricular activities such as competitions, mentoring, trips to companies, and so on as a required part of EE.

Community

Entrepreneurship is not practiced in a vacuum; it must be practiced in connection with the student's core discipline's community. Regardless of the discipline, connections with companies, alumni, practitioners, and industry groups must be cultivated to provide ample opportunities for students to become involved in the industry's practices and issues. Therefore, participation in the students' community must be part of EE and scaled up to accommodate all interested students (Figure1).

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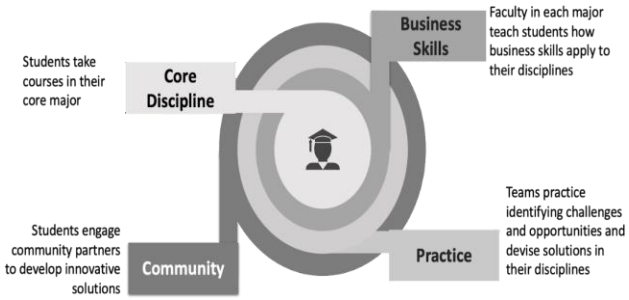

Figure 1
INTEGRATED MODEL OF ENTREPRENEURIAL EDUCATION

GUIDING PRINCIPLES

In addition to the model itself, there are guiding principles useful to implement universitywide.

Scalable

The challenge of offering entrepreneurial education across campus is to scale it up. An example of scale might be helpful. If a university with 30,000 undergraduates offers entrepreneurship as a general education requirement and half the students are interested, then 15,000 students divided by 4 years means 3,750 would take the course per year or 1,875 per semester. Six sections of 300 students would be required to meet the demand. This example assumes the university curriculum committee approves an entrepreneurship course as something like a social science elective.

Other co-curricular activities such as competitions and trips to companies also need to be scaled. For example, each college or department needs to create its own pitch competition rather than have only one universitywide competition. Visits should include companies, state and local governments, volunteer organizations, as well as non-profits and non-government organizations.

Interdisciplinary

Scaling up is a critical element to keep in mind but not the only one. A core characteristic of entrepreneurship is that it is multidisciplinary. Connecting students from different majors in both general education and especially as a core characteristic of the senior design courses is essential.

Project Based

Entrepreneurship courses also must be project based. The application of general principles to real opportunities lacks the necessary complexity to sufficiently teach students how an issue works in a complex organization. Therefore, to ensure core disciplines are integrated with business skills to address real situations, entrepreneurship courses should be project based.

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Innovation and Entrepreneurship

Innovation and entrepreneurship skills are largely interchangeable. The knowledge, skills, and abilities to recognize an opportunity and to build a plan to deliver that idea to a constituency are just as applicable to a high technology startup company as they are to a larger corporation or non-profit organization. Understanding operations, marketing, and finances are just as critical across all organizations. Since most students will join an existing organization rather than start a company, entrepreneurial skills must be learned in a way that makes them transferable to most employers.

All educational levels

Students that enter senior design courses with no prior introduction use valuable time to understand basic concepts. Therefore, entrepreneurial education needs to be at all levels, including lower and upper division undergraduate courses as well as graduate courses (Newman et al., 2019).

Competency Based Curriculum

Since entrepreneurship can be defined in many ways, the university must convene a universitywide group to establish a competency model. Constituents expect a curriculum to be based on successful practice and research. Most important is for the curriculum to augment the core discipline preparation of students for a successful life and career. In addition, accrediting bodies such as the AACSB require entrepreneurship courses, including entrepreneurship courses and instructors from non-business majors, to meet specified standards.

Table 1 shows the Entrepreneurship Competency Model as developed by a university level committee whose charge was to define what entrepreneurship education should include. It is closely aligned with NACE jobs skills. This is not a theoretical model of entrepreneurship but rather a practical model of entrepreneurship topics to address throughout the entire program spread over a number of courses. Three main divisions, People, Idea and Venture, are further divided into subcategories. It is critical that students, faculty, employers, and parents recognize that entrepreneurship education is based on a rigorously defined curriculum designed to prepare them for a career, not just to start companies. The courses and activities build into a complete whole over the course of a student's educational journey.

Table 1
ENTREPRENEURSHIP COMPETENCY MODEL

The People	Self-Awareness and Emotional Intelligence
	Leadership and Team Development
	Global and Social Awareness
The Idea	Opportunity Identification and Development
The Venture	Growth and Long Term Viability
	Business Skills

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It's a Journey

EE topics cannot all be taught in a single course or experience. Rather, EE is best taught in a journey that students experience throughout their formal education and career. For example, students may participate in orientation courses before they even enter the university. The Wicked Problems course that students can take over the summer before they enter the university introduces them to identifying challenges they are passionate about. Lower division courses that introduce students to entrepreneurship concepts help them think about how to address those challenges and identify the skills they need to develop to meet them. Throughout their major course of study, students learn highly specific content-based skills to make a contribution to those challenges. Finally, in their senior capstone courses students apply what they learn in a discipline-based approach to address a challenge they are passionate about. Table 2 summarizes this journey (Table 2).

Table 2
Student Entrepreneurship Education Journey

State of Education	Description
Pre-enrollment	After their acceptance to the university, in the summer before they actually come to the university, students can enroll in a course that helps them identify challenges they would like to address.
Lower Division Courses	As part of general education students can take courses that introduce them to the concepts of entrepreneurship and the basic skills of innovation and entrepreneurship.
Major Courses	Students learn specific skills to address challenges in which they are interested.
Capstone Courses	Students apply what they have learned in their educational journey to a project that addresses challenges that they are passionate about.

The Model to Scale Up Entrepreneurial Education Universitywide

The model to scale up entrepreneurship education universitywide has three major facets:

1. The undergraduate program
2. The graduate program
3. Commercialization councils

Undergraduate Program

The undergraduate program has two tightly connected part's

1. The entrepreneurship minor
2. Co-curricular activities

Undergraduate minor

The minor allows students from all majors to earn a minor in entrepreneurship without adding additional units to their plan of study. At first this may sound impossible, but it actually fits easily into existing programs.

The suggested minor is 15 semester hours (45 contact hours) consisting of five three-semester-hour courses:

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1. The first course is a freshman/sophomore level general education course meeting a social science elective. This course introduces students to specific topics in the competency model with an emphasis on the people components of self-awareness, emotional intelligence, leadership, team development, and global and social awareness. To a lesser extent this course addresses idea identification and venture concepts.
2. The second course is a sophomore/junior level general education course that also meets a social science elective. This course introduces students to the skills of innovation and entrepreneurship. The first and second general education courses are specifically designed for non-business majors to cover the wide range of business topics usually requiring many business courses to acquire.
3. The third course is an elective that may be from the student's home discipline or another department that offers a related course. For example, referring to the hierarchical model of EE, a student may take a clinic course to practice what they have learned in a guided course to help an existing company with a specific entrepreneurial project. With this practice students will be better prepared to work on their own projects.
4. The fourth and fifth courses are the capstone courses students take in their home major. This is where students integrate everything they have learned into a project-based course, usually with a team of students with similar interests. The difference is that these courses contain entrepreneurial content to help students prepare their ideas for application in a real setting. The capstone courses partner with the department offering the minor to ensure the appropriate materials from the competency model are covered, namely the idea, viability, and business skills.

By taking the right general education courses and counting augmented capstone courses and a related elective, students can earn an entrepreneurship minor without adding any additional units to their plan of study.

This minor plan requires the department offering the minor, the partnering departments, and the university curriculum committee to each take specific actions.

Offering Department(s)

Departments that want to offer the minor must perform the usual requirements to offer a minor with some specific variations for the scalable model:

Define the competencies needed to earn a minor in entrepreneurship.

Either offer the general education courses or accept other course offerings to count towards the minor. For example, if a business department wants to offer the minor, it needs to offer the introductory and skills courses (see 'General Education Entrepreneurship Courses' below).

1. Gain approval for the general education courses through the department, college, and university curriculum committees to meet general education requirements.
2. Work with the partner departments to augment capstone courses with entrepreneurship content to meet the requirements of the competency model.
3. Accept the augmented capstone courses from other departments to count towards the entrepreneurship minor.
4. Determine which courses will count as electives.
5. Gain the approval of the offering department faculty, the college, and the university curriculum committee for the minor.
6. Work with partner departments to make the requirements known to students and advisors.
7. Ensure the minor meets regional and discipline-based accreditation standards.

Partner Departments

Any or all departments from Agronomy to Zoology may partner with the offering department to allow students from their major to earn the entrepreneurship minor. To do so

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without adding additional courses to their curriculum they need to do the following:

1. Accept the general education courses approved by the offering department to count as meeting their general education requirements.
2. Work with the offering department to augment the capstone courses with the necessary material to meet the competency model requirements.
3. Ensure academic advisors are aware of and able to ascertain student interest in entrepreneurship and advise them from the time they enter the major on how to take the courses necessary to earn the minor.

University Curriculum Committee (UCC)

1. Approve the introduction and entrepreneurship skills courses as general education courses.
2. Approve the entrepreneurship minor as an educational credential recognized by the university that will show up on the students' transcripts.

It should be noted here that not all entrepreneurship programs are in business schools. Some business schools have not embraced entrepreneurship with programs residing in other departments such as sociology. Other programs, such as arts entrepreneurship and agriculture entrepreneurship, as well as programs in food science, forestry, computer science, engineering, marine science and others, may serve as offering and/or partnering departments. The point is entrepreneurship skills are applicable to students in every major regardless of their intended career path.

General Education Entrepreneurship Courses

Course Description: Survey of Entrepreneurship: The course introduces non-management students to entrepreneurship, both its history and contemporary applications. This course will provide a base upon which students can become informed about the competencies that entrepreneurs need to develop and how entrepreneurs approach identifying, exploring, and implementing ideas, as well as the career path of entrepreneurs both pre- and post-graduation.

Course Description: Entrepreneurship Skills for Non-Majors: The course introduces non-management students to the contemporary entrepreneurship world, including essential entrepreneurship skills, principles of marketing, accounting, economics, finance, market research, opportunity identification and exploration, and opportunity implementation. This course will provide foundational concepts in the above areas and will help students to develop needed skills related to budgeting and finance, applications of technology, effective communications, leadership and teamwork, and risk assessment.

Co-curricular activities

Referring to the Integrated Model for Entrepreneurship Education, students must have a significant practice component. Within the general education as well as the capstone courses are requirements to participate in high impact activities. These activities include participating in pitch competitions and new venture incubators; going to visit companies, signing up to be mentored, attending visiting lectures, and consulting community members; participating in make-a-thons, ambassador programs, and Women-Who-Launch events; learning startup horror stories; and getting involved in other innovation and entrepreneurship activities. Making

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these activities a required part of courses ensures that all students have a practical experience applying entrepreneurship skills in a realistic setting.

Resources

Resources to teach courses should be made available from the university level to the colleges to cover the sections being taught. At the general education level this is a student credit hour issue routinely addressed by the head academic officer such as a provost; it may require shifting teaching resources (permanent or temporary funds) to cover new general education courses in entrepreneurship. The capstone courses are already being offered in the various departments and should not require shifting teaching resources. Therefore, covering the courses necessary to scale up entrepreneurship courses to offer a minor should not require new additional resources.

Most universities already offer entrepreneurial activities on a co-curricular or extracurricular basis. Mentoring, visits, incubators, and competitions require new resources. These resources will only be needed more as the number of students grows. Similarly, the resources are not necessarily tenure-track faculty. They may be made available on a college level or from the central administration depending on who sees the value of equipping their students for more productive careers (Bhatia, 2020; Pittaway & Cope, 2017; Thomassen et al., 2019).

Graduate Program

The graduate program also has two closely linked component's

1. Entrepreneurship certificate
2. Commercialization.

Graduate Entrepreneurship Certificate

The certificate allows students from all majors to earn a certificate in entrepreneurship. In some majors, students may need to add additional courses to complete the certificate.

The suggested certificate is 12 graduate semester hours consisting of four three-semester-hour courses:

1. **Introduction to Entrepreneurship:** This course introduces students to the variety of innovation and entrepreneurship topics.
2. **Business Plan:** The second course teaches students how to write a business plan.
3. **Implementation:** The third course is a clinic-like course that applies the business plan in reality. For example, a student, possibly with a faculty member, actually begins the process of forming a company and developing the product or service offering.
4. **Implementation:** The fourth course is a continuation of implementing the business plan and may include funding, company formation, and scaling up the business.

The certificate is designed to be a concentration in the MBA program and a certificate for continuing education students not enrolled in a graduate program, as well as an offering to other non-business graduate students to earn a certificate in entrepreneurship to complement their core discipline degree.

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The graduate program is closely connected to graduate research programs as well as the university technology transfer program. In fact, teaching resources and the portfolio of technologies being readied for commercialization are shared across campus.

The resources for the graduate program are made available through regular teaching allocations from the university. No outside funding should be solicited or used to teach regular courses.

Commercialization Councils

A central component to learning entrepreneurship is actually doing it. Like other professional schools, background is essential, but mastering a skill, like as preparing a legal brief or performing a surgery, requires hands-on, real-life practice. Again, the research commercialization function has two tightly connected facets (Costa, 2017).

1. **Graduate courses:** As mentioned in the graduate program section, students participate in entrepreneurial education by participating in real-life commercialization of research. Such opportunities may be in startup companies, but they may just as likely be in commercialization pathways such as preparing licensing materials, consulting services, policy preparation, and partnering with municipalities on projects (such as waste water remediation strategies). The objective is to put research to use in a way that creates value.
2. **Commercialization councils:** Like other professional education disciplines (medical, legal, veterinary), a university must establish a credible entrepreneurial practice that both teaches and creates new techniques.

A commercialization council is made up of professionals in an industry group with significant ties to the university; for example, the plant science industry that has significant partnerships with various departments on campus. Executives from plant science companies, investors in plant science, as well as entrepreneurs in plant science, form a council to identify and support likely faculty, students, and technology opportunities, provide the resources and support to commercialize research. Students participating in this real industry-university collaboration have the opportunity to learn entrepreneurship and to integrate their core disciplines with business skills as they practice what they know connected to the community in the most realistic way possible.

In addition to the educational objective of the commercialization council, the business objective is to prepare research to make a sustainable contribution to society. The contribution may come in the form of the research being adopted by some kind of organization or in the form of a startup company readying the research-based company for investment.

The resources for commercialization are outside the usual funding for teaching courses. Nevertheless, the part of commercialization associated with students preparing the business plan and implementing it as part of the certificate should be paid for by the university. This should include space for the startup companies that are the object of the educational programs, as well as access to the same equipment, materials, supplies, expertise, and consultation from other parts of the university as are made available for other professional schools. Actual support for a startup company, however, should be part of the resources and support that commercialization councils offer to the university attempting to commercialize their research.

SUMMARY: THE INTEGRATED MODEL

In summary, a universitywide model for teaching entrepreneurship is one model that includes an undergraduate program with co-curricular activities and a graduate program that

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includes a credible research commercialization program. To design such a program requires applying a set of guiding principles such as being interdisciplinary, project based, closely tied to a competency, and organized as an easy-to-follow journey for students and staff. Finally, it must have real practical components and connection to the community.

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