Innovations in University Education in Innovation: Moving Beyond the B.S.

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Abstract
This article focuses on university education in innovation. We examine and present a novel system we have developed that is achieving our vision of instantiating a robust education that teaches, develops, and grades innovation in the education system. This paper is discussing a paradigm shift, offering new degrees with a common core focused on innovation, with teams of students learning and practicing the key elements of the innovation process. First we examine the motivation and need for a radically new approach, not a new major or a course, that is based upon a new common core and family of degrees. We describe how we knew that to effectively reach our goals the program had to span across departments, college boundaries, and beyond the very core of the university. Second, we show how in doing so we created a family of degrees that moved us beyond the centuries-old B.S. and B.A. educational constraints with a new, innovative “Bachelor of Innovation™” (B.I.) family of degrees that includes a core built around multi-disciplinary multi-year innovation partnering with real companies. Lastly we summarize the unique aspects of the program and the rationale behind them, from the 3-year multi-disciplinary team experience to the trademarked name. We present our B.I. program as its own case study in innovation within higher education, reviewing the key challenges we faced so that other innovative institutions and departments may learn from our experience. We conclude with lessons learned and the future of the B.I. family of degrees.

1 BACKGROUND AND INTRODUCTION

The Need
Innovation is at the core of modern economic growth. Executives and companies across the world are seeking new means to improve their innovation efficiency, and seminars and short programs for teaching and coaching innovation abound. The need to produce new innovative approaches to procure a new generation of innovators exists at both the national and international levels. Yet, as we started the 21st century, if one sought a fundamental degree program focused on innovation, one would find a few graduate courses and virtually nothing at the undergraduate level.

R. Florida1 and others have argued the most significant output for an education or innovation system is knowledgeable workers who have the know-how to innovate, not any particular technologies to be transferred. The National Academy of Engineering report on “Educating the Engineer of 2020”2 concludes:

“If the United States is to maintain its economic leadership and be able to sustain its share of high technology jobs, it must prepare for this wave of change. While there is no consensus at this stage, it is agreed that innovation is the key and engineering is essential to this task; but engineering will only contribute to success if it is able to continue to adapt to new trends and provide education to the next generation of students so as to arm them with the tools needed for the world as it will be, not as it is today.”

Furthermore, it also reports:

“an undercurrent of awareness that current complexities are so daunting that tinkering at the edges—reforming one course, one program, one department at a time, developing isolated instances of success here and there—is no longer a viable response if we are to build the kind of robust programs in research and education now needed to strengthen the U.S. engineering community by 2020.”

The need for a dramatic reform in education to focus on innovation is not something we are claiming. Rather, it is a nationally recognized need, which took us years to address. This article presents: 1) the content of the nation’s first undergraduate program with a core in innovation, and 2) a case study illustrating in detail how we navigated the University hierarchical system of boundaries protecting the BA and BS degrees to achieve a unanimous and comprehensive acceptance of the B.I. family of degrees.

The comprehensive nature of the Bachelor of Innovation™ is directly in line with national reports and recommendations, taking a bold step rather than minor variations in majors. The Bachelor of Innovation™ (B.I.) is a unique multi-disciplinary program at the University of Colorado at Colorado Springs (UCCS). The B.I. is a family structure, much like a bachelor of science (B.S.) or a bachelor of arts (B.A.), in which particular majors are defined.

In terms of innovation, we sought, achieved and continue to provide a robust and disruptive innovation, rather than a small incremental innovation. As is often the case with industry innovation, the disruptive innovation creates a profound, rapid transformation when there exists a status quo that dominates the landscape. Even if we could have achieved the same results within an existing degree with incremental innovations over time, we would have encountered the same problem facing education in general and science, technology, engineering, and mathematics (STEM) education in particular: the speed of the marketplace and its rapidly changing landscape make baby steps irrelevant as soon as they are implemented. It was clear that a huge, robust and profound change was essential. As is often the case with disruptive innovation, we had to be willing to make a bold move and step into uncharted territory, guided by a vision of where we were going.

Defining Innovation

The term innovation bears different meanings to different people. The first issue in defining an innovation curriculum is therefore to clarify what innovation itself really means. Innovation is not creativity, though creativity can be an element of it. Innovation is also more than just invention or novel research, because it leads to specific outcomes.

As Ray Mears of 3M has said in multiple talks, “Research is the transformation of money into knowledge – Innovation is the transformation of knowledge into money!” With these two major misconceptions cleared up, we are ready for formal definitions.

Peter Drucker offers the definition

“Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service. It is capable of being presented as a discipline, capable of being learned, capable of being practiced. Entrepreneurs need to search purposefully for the sources of innovation, the changes and their symptoms that indicate opportunities for successful innovation. And they need to know and apply the principles of successful innovation.”

Clearly, Drucker considers innovation as a teachable subject, but his definition proved too focused on entrepreneurship to convince faculty outside of a business college to accept.

A broader formal definition from West & Farr (1990) states that innovation is:

“the sequence of activities by which a new element is introduced into a social unit with the intention of benefiting the unit, some part of it or the wider society”.

In the end we took the essence of these definitions and put them in a form we hoped people would remember. We offer this crisp definition:

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3Ibid, Page 13
4Drucker, Peter “Innovation and Entrepreneurship” Harper and Row, 1985
INNOVATION IS THE TRANSFORMATION OF IDEAS INTO IMPACT.

Further, we view innovation broadly and consider it to be the central element of education for our century. Innovation is an educational attitude, a state of mind, and a creative process, as much as a specific task or action. It is not just knowledge; it has aspects of skill and art. Like almost any team sport, innovation is something to be practiced, and thus learning by doing is at the core of our program.

Effective innovation is more than just changing organizations; it is also a personal transformation: “Once you’ve worked on a truly innovative project you realize how important transformation is to the success or failure of a project. Your way of thinking changes, your priorities change, your company changes and your way of working changes forever. True innovation is not just about changing a product, a service or even a marketplace; it’s also about recognizing and relishing the need to change yourself.” 6 When one thinks about the general goals of education and life-long learning, this view of innovation is central. We cannot teach students all the things they need to know, but if we can empower them to learn to learn, and to relish the ever-increasing changes that will face them, then we truly have educated our students.

In business, an expected source of innovation typically streams from relatively new companies. Unfortunately, many experts in the field believe that once a small, innovative company becomes big, it becomes a non-innovative large corporate bureaucracy7,8. Ironically, however, people still look to old established research universities when it comes to innovation. Many among the academe, and even the government and public, mistakenly consider research universities cornerstones of innovation, even though innovation is more likely to exist in the smaller institutions. Top research universities produce and teach knowledge and research, not innovation. With a few noted exceptions such as Stanford and MIT, most universities talk about innovation as if it were a sideline technology transfer activity, and when innovations spring forth from such universities, it is usually because there is a concentration of the innovation raw materials — an abundant diversity of ideas, talent and natural innovators. Even then, the innovations build on university research, not university programs. Innovation often happens in spite of the university’s educational programs, not because of them.

Looking deeper one sees that despite the research output, universities are typically the antitheses of models of innovation: they cling to a centuries-old model of how to operate and what “products” to offer. In their world, a “new product” takes 1-2 years to plan, 4-6 years to produce and 2-5 more for market assessment after release, so change presents serious investment and risk. Academic processes and products change more slowly than the ivy growing over their buildings, which is diametrically opposed to the pace at which society is changing.

It therefore comes as no surprise to find that top universities and established businesses are often unwilling to take significant risks.9 As one administrator at a top 40 school said, as he rejected a plan for truly integrated business and engineering program, “why should we risk a radical change, we’ve been doing it this way for over 100 years and are doing well.” This attitude is an academic example of innovation blindness10 by a market leader.

The change needed to introduce innovation into education is further hampered by the deep silos within universities, where hyper-specialized experts spend decades building their reputations and the resources to pursue their research, generally without any regard to issues like profit or direct impact. And none of them want their areas to be removed or reduced from an existing degree. This begs the questions: “How can one add in serious work on innovation? What would be removed? How does one get the needed multi-disciplinary nature, with faculty whose skills don’t usually include transiting from research to innovation?” With tenure, academic freedom and faculty governance as the norms, it’s a very difficult environment for actual innovation to emerge.

6Ralph Ardill oral presentation at the London Innovation Conference, 2003. Slides were online at one time, but no longer available. See also Jim Brown, “Lifting The Barriers To Innovation, A Practical View From The Trenches”, in “IT innovation for adaptability and competitiveness: IFIP TC8/WG8.6 seventh Working Conference on IT Innovation for Adaptability and Competitiveness, May 30-June 2, 2004, Leixlip, Ireland”


10Scott Jensen, “The simplicity shift: innovative design tactics in a corporate world”, Chapter 9
Our problem, therefore, was determining how to introduce innovation into one of the most conservative forms of business, the university, to allow a new approach to undergraduate education, which includes substantial amounts of material on, and practice in, innovation.

2 “TEACHING” INNOVATION

It's not difficult to imagine introducing a course on innovation, but as has been well shown in innovation research, sustainable innovation needs a culture, and this cannot be created through a single course offering. The current educational BS and BA models yield students with knowledge, and we could consider adding some innovation theory and process to this curriculum. But how this would produce a culture with experience in the full innovation process is not at all clear.

A few graduate programs and isolated seminars on innovation could be a start, but what is really needed is an approach that develops and sustains an innovation culture wherein we can transform not just a few students, but many, into a next generation of innovators. Further, within a comprehensive innovation curriculum a key issue would remain: how can we expect to develop innovators if we don’t provide them experiences where they see, even once, the innovation process as it happens? The need is self-evident: we need an innovation in the teaching of innovation.

Because innovation is not discipline specific, and is often multi-disciplinary or inter-disciplinary, innovation education needs to cross and combine fields. Because innovation is more than knowledge, learning by doing is a major emphasis.

Innovation, it’s a team thing!

As we discuss our program, one of the most pressing questions is “can we really teach innovation?” The underlying question is really, “Can we teach students who are not necessarily geniuses how to be innovative?”

Our answer has been by analogy, to ask back in response, “Can one really teach another person to ride a bike, play an instrument, or play just about any sport?” And it becomes clear that one can teach people some basic principles, and show them examples, and then their efforts must be based on practice, coaching, practice, coaching, and practice, practice, practice. With a good coach providing useful feedback, most people can improve their abilities and become much more proficient.

Figure 1. The space of natural and possible innovators

We describe the space of natural and possible innovators, shown in Figure 1. For natural or born innovators, innovation seems to come easily, but naturals are few and far between. And even for a natural, living up to their potential takes work.

Our B.I. program is focused on the large body of students with sufficient abilities, skill, and drive, who have the potential to become innovators. There are far more of these potential and untapped innovators than there are “naturals,” and we have demonstrated that when we engage and coach them, we improve their spirit of innovation, as well as their capabilities. With the right experiences, practice, and coaching, untapped innovation talent can indeed be developed.

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In our view, even if members of the larger non-natural or innovation majority do not rise to the pinnacles of innovation leadership, they have an important role to play in overall innovation, for in following Edison’s famed dictum that “Genius is 1 percent inspiration and 99 percent perspiration,” one effective innovator can help lead a team of others who understand the basics of innovation to form an overall “winning” team. By way of analogy, one does not have to be team captain to be a valued team member, to enjoy the game and the victory.

One of our program tag lines is that “innovation is a team sport,” and we refer to classes as team practice. This metaphorical approach also helps in recruiting. While many students are excited by the prospect of the B.I., some potential students lack the interest or confidence to want to “risk” pursuing innovation. We ask how many of them were naturals at the sports or music they now enjoy, and point out that after years of practice and coaching, only now are they good at these activities. However, we have also found that when we explain that people tend to enjoy what they are good at, with the sports/music analogy, they begin to see that maybe with practice they may become good at, and enjoy innovation. Most parents, however, understand the value of the B.I. right away, and we have received a lot of very positive feedback from parents.

For the B.I. program, the team/sports analogy runs deeper. The UCCS B.I. faculty are the innovation coaches, and even in our email aliases we use the coach title, as in “inov201-coaches@uccs.edu”. Most innovation courses are team-taught, bringing together coaches with different skill sets, and allowing for more small-group coaching. We are also raising funds for Innovation Team scholarships, which are not merit or needs-based funding for attending school, but athletic-like scholarships which fund participants for practicing and for playing. It is pay to perform, which in our case, is to perform on real projects for real customers.

The teaming, and the learning by doing, is at the very core of the B.I. model, with a longitudinal sequence of Innovation Teams courses. We need students to see innovation, to experience it, and to do it. The students take 6 terms (3 years) of team classes, with many students working, for pay, on those teams outside of the required class component. These teams are generally working for an external customer. Some customers act more like mentors, working closely with the students on their desired innovation and guiding them through the process. Others act like the paying customers they are, and expect results with little guidance as to how to achieve them.

With multiple startups involved, and a wide range of customers and outcomes, during the 6 terms students experience innovation working and see innovation setbacks, redirection and failure. Managing these teams is the single most challenging part of offering the B.I. program, and it requires faculty with a very broad range of skills and a lot of time and patience. However, there is no substitute for experience, either for the students or for the faculty.

Not only do the B.I. students get to see innovation in action, they gain a wide range of experience in soft skills in dealing with customers and projects. Students are routinely faced with, and must learn to effectively address, ambiguity, uncertainty and customers or other points of interaction, who don’t get back to the team with information or direction the team wants.

Team members have to learn to clearly communicate status and needs to clients, make assumptions with partial information, make suggestions on direction, and still make progress on their projects. They get to learn, first hand, that customers don’t always know what they want, let alone how to do it. Inevitably, most also learn painful lessons about scheduling, management, and dealing with ineffective and non-productive team members.

It’s a surprise the first time they lose points for doing another student’s work, and realize they have to help the other person advance, and not just step over or side-step them. Even the best students get critical life lessons when things happen beyond their control and outside their meticulous plans. For example, we had a customer whose business division, including the direct point-of-contact, was downsized/outsourced. In an instant, the team went from an exemplary, on-track project with a happy customer, to trying figure out how to try to salvage the project. Within hours they were working on one proposal to the original company, and a very different pitch to the point of contact who was now scrambling to form his own company.

One might read about something like that in a “case-study”, but it is quite different when it happens to you or one of your friends, and you have to compose the response/proposal to the different parties involved. Innovation does not always follow one’s plans, and the team classes provide an environment to learn that as well as to hone the skills of adaptation with a bit more support network and mentorship.
The case against teaching critical thinking

A common suggestion raised by faculty as we designed and launched our B.I. at UCCS was a push to include “critical thinking” as part of the program, but we chose instead to focus on creative problem solving and innovation team thinking. Critical thinking has many definitions, with two common ones being similar to “critical thinking is reasonable reflective thinking focused on deciding what to believe or do” and “the art of thinking about your thinking while you are thinking in order to make your thinking better: more clear, more accurate, or more defensible.”

Our view is that “critical thinking” is put forth as an important skill by those in fields that don’t actually address real problems, to suggest their courses have important value. Not surprisingly, a touted Delphi study on critical thinking drew from a majority of philosophers (52%) while only 6% of those involved were from physical sciences.

People in fields that do solve problems (and drive innovation), however, concentrate on creative thinking, problem-solving skills and team work, which may explain why the Accreditation Board for Engineering and Technology (ABET) does not include “critical thinking” as an objective. Undoubtedly, thinking clearly is important, and there are valuable skills espoused by proponents of critical thinking. But we have found that the key skills include “the art of asking essential questions, detecting bias in information sources, ethical and logical reasoning,” and they can more naturally be included as part of problem solving, creative thinking, and innovation team exercises.

Essentially, we do not teach critical thinking, we teach students to learn to value and accept diverse viewpoints, different rationales and arguments, different sets of fundamental values, and we insist that students learn to think creatively to find solutions in context, not in abstraction: this is innovation.

3 THE BACHELOR OF INNOVATION FAMILY STRUCTURE

The Bachelor of Innovation (B.I.) is a family structure, much like a bachelor of science (BS) or a bachelor of arts (BA), in which particular majors are defined. The B.I. is a unique multi-disciplinary undergraduate program initially supported by the College of Engineering and Applied Science (EAS) and College of Business (COB) at the University of Colorado at Colorado Springs (UCCS). The initial majors include (in alphabetical order) B.I. in Business Administration, B.I. in Computer Science, B.I. in Computer Security, B.I. in Electrical Engineering, and the B.I. in Game Design and Development. Each member of the family comprises an emphasis or major, an innovation core, a cross-discipline core, and the general education requirements.

We designed the B.I. family of degrees to be consistent with ABET and AACSB accreditation guidelines. The B.I. in Business Administration is offered by the College of Business, which is AACSB accredited, and we expect to seek formal ABET accreditation after we graduate our first class of students in the engineering-related majors.

Similar to how general education or common requirements are included in the BA or BS, the B.I. does not specify the content of a major. Rather the B.I. specifies the common elements for a family of degrees, where specialization areas define the details of their major. The goal of this family is to define the common cores, leaving the disciplines to define the majors. The B.I. Program has four significant “components” in each degree, as shown in the diagram.

The Innovation Core is 27 Credits, geared toward innovation and entrepreneurship. The program starts with a course in entrepreneurship in which each student pitches twice in the first term. The program also includes an entrepreneurship course in the senior year, building on the 3 years of experience to make it a true capstone experience.

The first course in the B.I., first semester freshman year, is introduction to entrepreneurship. Students work in teams to develop, vet and pitch their ideas. The first pitch is to community members and angels who provide a dose of reality. Based on the pitch, some of the teams (historically 30%-50%) are “defunded” and instructed to form new teams with new ideas. Teams can also defund themselves (and they earn more
credit if their decisions match the external consensus view). The students continue to develop their work, and by the end of the term each team presents a revised new pitch and a 15-25 page formal business plan that includes the idea, the team, the financial projections, and the marketing/sales plan. Community members have repeatedly been astonished at the quality of both ideas and the presentations.

Part of the goal of the class is to get students engaged in multi-disciplinary teaming, where no single student knows enough or has enough time to pull complete the requisite work alone in the given time frame. Part of the goal is for them to see how much more they have to learn, which encourages them to then take appropriate courses and electives, and take them seriously. If this first course is too much work, which it is for some, then it suggests that they are probably not ready to head down the innovation/entrepreneurship path.

At the center of the innovation core are additional multi-disciplinary, long-term team activities during the sophomore, junior and senior years. Teams are expected to include students from all years, possibly including graduate students, occasionally freshman and even high school students, with a long-term goal of virtualized teams with international team members. The teams have dynamic membership and the roles of team members will change on a regular basis.

Examples of these multi-disciplinary projects include development of video games used in teaching science to elementary school students and training for computer security; assistance in the development of a book on the innovation process; and the use of Web-based tools to improve Internet marketing and advertising for small businesses.

In some of these projects, student teams collaborated with entrepreneurs to apply for and win competitive grant funding for their innovations. In these projects, teams were required to understand the business, as well as technical issues associated with the project objectives, and to formally manage the project and interact with the customers, the client companies.

The innovation core also includes a freshman course on innovation processes, covering both theory and practice. We include topics on creativity, ideation, team-building, sustaining or permanent innovation, understanding and managing change. We also conduct multiple self-assessments of the abilities and interests of students, including discussions on the Myers-Briggs Type Inventory (MBTI) personality test, temperament, and other personality traits. One of the challenges here is finding materials that do not presuppose business experience to explain what businesses do, because most freshmen don’t have much business experience.

We supplement the readings with a lot of in-class exercises. For example, consultants from Value Innovations Inc have helped students turn value innovation abstractions into a ten step process they can follow and use, with an in-class exercise where they move it from theory to practice. We have partnered with Value Innovation on multiple dimensions, helping them with a book on innovation and multiple proposals, including a successful NSF award to develop a commercial innovation teaching toolkit.
Along with innovation comes the issue of intellectual property. Typically, schools offer a business law course or two, but with innovation there is a need to teach students how to protect their ideas. It is important for students to understand what intellectual property consists of, and we recognize that all the innovation we teach in the B.I. will come to naught if we negligently exclude comprehensive knowledge on how to write a patent, litigate intellectual property, and settle or formulate licensing processes.

Clearly the basic principles of business law are therefore essential, and so this is exactly what we do; we first teach the principles of court systems, torts, licensing and a little criminal law, as well as corporations, LLCs, C and S corps, and we also introduce intellectual property in the context of formulating business architectures to suit one form of business enterprise compared to another. After the mid-term examination, the students write a patent, write its claims, and then hypothesize various litigation processes and innovative means to prevent litigation. Students also explore how to pursue licensing agreements with adversaries to effectively make them partners. While we do not teach students how to be their own lawyers, we do prepare them to seamlessly interact with lawyers when necessary, and how to have control over a lawyer instead of vice versa.

We also introduce students to typical business budgets, with a focus on how resources should be spent on R&D. We run scenarios where R&D is low and high, and in their exams we require them to empirically formulate for hypothetical businesses the optimum R&D investment.

The remaining required course is a junior level technical writing course in an engineering program, but we put it in the sophomore year so more additional topics can be built on it. We also add a major component focused on team writing, proposal preparation, presentations and most importantly, persuading an audience to view their innovation from their point of view. We train them how to write proposals, such as a Small Business Innovation Research proposal. Additionally, we teach them to deliver an exuberant, animated, beautiful, and provocative monologue explaining why their idea, their innovation is the greatest thing to hit planet Earth since the wheel.

To teach argument and logic, we insist that hunting advocates advocate to a school board why guns should be banned, or ask conservatives to deliver a provocative speech explaining why we should teach Muslim-related courses at schools, or have liberal pacifists convince an audience that corporal punishment should be reinstated. We push students to deliver provocative speeches on issues they do not inherently believe in so that when it comes time to deliver their own innovative presentation, they consider it to be a “no-brainer.”

The course is co-taught by B.I. Faculty that together have 2 PhDs, one JD in Law with years of intellectual property litigation, experience in three startup companies, and dozens of successful proposals that received more than $20 million in funding. Most importantly, these coaches have spent their lives successfully convincing investors, reviewers, funding agency and judges.

Beyond the innovation core, we structured the majority of the remaining electives to further support innovation, giving each student a secondary study area in which they know at least enough to partner effectively with others who are specialized in that area.

Each Cross-discipline core is a coherent collection of 15 credits from a key innovation supporting area other than the students major. The goal is to provide experience and knowledge in a secondary area needed for innovation, providing enough skills and experience to enhance their ability to work

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17In the first 2 years we required 21 credits in the cross disciplinary cores, but reduced it to 15 to better support the issues of transfer students from other schools/majors and to provide more electives for students to explore areas.
with others on an innovation team. Like cross training in sports, we don’t expect students to master this area. Instead, it will strengthen and improve their abilities to work well with others in the secondary field. The initial cross-discipline cores are:

**The Technology Core** (for non-technology degrees) provides a broad coverage of engineering and technology using existing courses in engineering and computing.

**The Business Core** (for non-business degrees) provides a broad coverage of business topics based on the core business courses of accounting, marketing, management, and finance.

**The Globalization Core** (for any B.I. major) provides a selection of courses on international issues. It requires a foreign language at the second year level, and a collection of international business and policy courses. Students must demonstrate at least a three-month residence in a non-English speaking country, and one semester of study abroad will be facilitated and is strongly encouraged. While abroad, involvements in the Innovation team projects will be “virtual,” but will be required.

**The Creative Communication Core** (for any B.I. major) will provide coverage of a variety of communication mechanisms including both traditional (e.g., oral communication) and non-traditional (e.g., visual arts) communication approaches.

When introducing a new degree we must also consider what will happen when graduates approach employers who are not yet familiar with the program. If the degrees were named by modifying the name of the major, rather than the family, e.g. like a BS in Electronic Innovations, the employers, and especially the human resource departments, might have a harder time understanding the capabilities of these students and what they have learned. Human resource offices in companies that advertise for students with, say, a Bachelor in Electrical Engineering, might dismiss them as unqualified without looking deeper. The B.I. designation allows the students, when they apply, to honestly say they have a “Bachelor in Electrical Engineering.” Since the degrees are in general quite comparable to the BS degrees in their related areas, this naming allows companies to see it for what it is, a variation on the underlying background while still retaining the core of the major, which is generally the first consideration when hiring.

In the long term, innovation requires standards, and to ensure the B.I. is recognized as a high quality degree, we are seeking to service mark the name. Protecting an innovation through intellectual property protection, like trademarks, is part of the innovation process, and we use it as an example in our program. As we began advertising and marketing, the uniqueness of the name initially has students, parents and companies asking what it is all about, and the trademark helps assure that it will not be confused with programs from competitors.

Some might ask that if we are trying to transform education in a larger way and address a national need, why we would trademark the name and restrict its use. Our trademark does not mean that no one else can use it; it means we decide who can and cannot use it. Our goal is to ensure the name has a consistent meaning, that all such programs incorporate the core elements and significant learning by doing, and set the appropriate standards of quality. We have already begun discussions with other universities interested in starting their own B.I. programs.

### 4 PROCESS AND CHALLENGES

The barriers to our innovation were the long product cycles in academia, and the ultra-conservative and territorial model of universities, combined with the faculty’s sense of superiority and resistance to change. So how did we successfully achieve the Bachelor of Innovation family of degrees? The answer, not surprisingly, was that we looked at the proven innovation processes we would be teaching, and adapted and applied them to the university.18 In moving the overall B.I. program forward, here were our top dozen concerns and the steps we took, followed by some discussion on adaptability.

1. First, we had to find a place where the culture was partially willing to embrace change and innovation. Innovation needs the culture to grow, and changing academic culture is difficult. Unlike a corporation, where the CEO can champion change and exert some control, academics often resist change. Program leader Dr. Boult moved from the Ivy League where he had an endowed department chair at a top 40 university, to a young aggressive growth university (UCCS), which offered a core quality and talent in engineering and business, and with the potential for accepting change.

2. We began in “stealth mode” to avoid early derailment by detractors. We quietly laid the groundwork for the change, introducing key elements of the B.I. design as small changes, one-off

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courses, and by seeking to prove some of the more controversial program elements, such as undergraduate students work on real projects for companies and work on proposals, so we could prove our students could do such work.

3. We designed a value innovation strategy by identifying elements of performance and the most important customers, and then analyzing their needs and designing to the new performance dimensions to deliver more value to each customer. Part of this included recognizing that different “key stakeholders” had different objectives, and so we developed story lines designed for each different customer segment and major personality types in those groups.

4. We gathered market data, asking hard questions about competitive (dis)advantages. Our market research introduced a new space of possible ideas to the broader community, who in turn put pressure on many otherwise uninterested people in the organization to take change seriously.

5. We formed an initial team that engaged key influencers and administrators in discussions on program elements and implementation issues to ensure high-level management engagement and buy in. We needed administrators to develop ideas on their own (although perhaps by being led somewhat) so they could own ownership of the ideas and champion the process. We expected to change our ideas along the way by integrating different viewpoints, also a key element of innovation.

6. We sought external validation and seed funding. We won grants from the National Collegiate Inventors and Innovators Alliance (NCIIA) and the National Science Foundation (NSF) Partner for Innovation Program. External validation speaks volumes to administrators and legislators, weakens the argument of detractors, and gave our team some room to operate.

7. We designed our innovation to initially co-exist with existing product lines and minimized the number of people impacted by implementing the change. We started in a bootstrap mode with Dr. Boult and Dr. Chamillard teaching more than necessary to get it going, and then after exceeding the revenue in our business plan we brought in new faculty with the necessary interdisciplinary background.

8. We anticipated roadblocks and developed strategies and partners to ensure we could get through or around them. We capitalized on strong external fiscal threats to catalyze open discussions and negotiated with stakeholders, initially asking for an idealized package, but settling on something that was still viable. We partnered with community members to push for change.

9. We didn’t expect to get everyone onboard. Not everyone embraced the innovation process concepts; for example, the mathematics department, which had been in EAS for decades, decided this innovation initiative was not for them and moved their department from EAS to the College of Letter Arts and Science. The Department of Mechanical and Aerospace Engineering (MAE) felt the B.I. was not for them also. If we had tried to get everyone on the train, we’d still be back at the station.

10. We built on market data and the early successes to develop an exciting pitch backed with a detailed business/program plan. We used these to sell the B.I. in the many-stage campus and state approval processes. The pitch was targeted at intuitive individuals motivated by passion and ideas; the detailed 60-page plan addressed the data-driven mindset which seems to dominate academia.

11. We under-promised and over-delivered, marketing hard while aggressively managing growth and resources. The result is that our B.I. Family of degrees is a unique program focused on teaching innovation, and we have received awards from the American Society of Engineering Educators and Innovation India. We have a modern marketing plan, which our university initially opposed funding. We believed that marketing an innovation is critical, and our business plan justified the expense. With it we have attracted out of state and international students well above campus average. Our growth has been more than double the initial plan, with currently 130 students across five majors. Given the growth last year, we reduced our marketing to slow our growth rate. In the first two years, we had more partner companies and innovation team funding than we have had qualified students willing to work, so managing the growth to maintain quality given staffing levels has been important for us.

12. We don’t expect the fight to stop when we got the approval. Once you begin to generate resources, expect administrators to want more of it and to provide less support. For example, while the college collects our student technology fees, the B.I. program had to buy its own computers.
Not everything along the way was clean and executed according to our plan. The details of the approval and implementation process for the B.I. in GDD provide a good example in adaptation for innovation. The initial vision for the GDD degree was as a joint venture between the College of Engineering and Applied Science (EAS) and the College of Letters, Arts, and Sciences (LAS). However, to mitigate the risk associated with the requirement for approval from both colleges for such a venture, Dr. Chamillard also forwarded an EAS-only proposal in parallel. Planning for and pursuing alternate paths is a valuable and necessary activity for any innovative endeavor. As it turned out, LAS rejected the proposal and campus-level feedback suggested that a GDD degree in EAS should be part of the B.I. family.

This B.I. in GDD approach had been discussed earlier but had not been pursued, as neither the B.I. or GDD groups wanted to risk being derailed because the other’s radical vision was killed. With both programs through their first campus hurdles, the merger was swift and mutually beneficial, providing a market differentiation and competitive advantage for the GDD while providing for faster B.I. growth and a more diverse set of students in the innovation program.

It is important for the GDD majors to have the choice to form small independent game development companies in the area, as locally there is little of the more traditional employment in the game development industry. The Innovation Core and other components of the B.I. degree support that goal very well, and they also help students and parents see multiple potential career paths. The adaptation of GDD into B.I. strengthened both programs and the result is much better, even if moderately different from what either team originally envisioned.

As with many innovation efforts, successfully reaching our end goal required acuity to see a path, assiduity to diligently move forward despite adversaries and setbacks, and significant adaptability. It’s an example that has a natural place in our curriculum, an example of not just talking about innovation, not just teaching it, but of us working actual process and how it is impacting the students whom we are teaching.

5 OBSERVATIONS, CONCLUSIONS, AND LESSONS LEARNED

Although many in academia see that the world is changing, and talk about it and write articles about the changes and innovation, and despite rapid external morphing in business and engineering, some of the very people who espouse these facts are reluctant to change themselves. Teaching the B.I., or more accurately coaching in the B.I. program, is not your average faculty interaction. When pitching the concept we knew this would take a special type of faculty: ones with experiences that span multiple dimensions of the innovation spectrum. Check out the faculty/authors bios at www.innovation.uccs.edu and you’ll see what we mean. One cannot realistically support a program with a focus on learning by doing without faculty that are actively doing. You’ll need real innovators in the classroom, and an attitude focused on innovation, not classic research or teaching. Don’t expect too many established faculty to change, but make use of those who do.

The Bachelor of Innovation™ family of degrees represents a new direction for undergraduate education. Getting such a novel program through departments, campus, and eventually state approval was a non-trivial exercise, and along the way we faced and overcame multiple challenges by using innovation processes to drive the change process.

Does the B.I. work? Only time will tell for sure, but the first two and a half years have exceeded almost everyone’s expectations. Our freshman classes for the B.I. are limited by space and resources, and our problem now is managing growth and quality. Our successes are compounding the interest.

In our first term we had one business plan get “defunded” at the first pitch half way though the term, but the team’s second idea/pitch was good enough that we partnered them with a local company to win a $100,000 Navy Small Business Innovative Research (SBIR) contract. The freshman and sophomores produced about 80% of the project’s deliverables, and the company has asked the B.I. to partner on other contracts.

In the second year, student teams have supported over $2M in successful grant/contract proposals, with multiple ongoing funded projects and teams supporting nearly a dozen companies. We have already seen multiple start-up companies emerge from the program, one that already has a product and beta customers, another winning $150,000 in an NSF SBIR. That is not bad for a “startup” program of mostly freshman and sophomores studying at a campus founded after the microchip, word processing, hypertext and the mouse had already been invented.

We define innovation as “transforming ideas in to impact,” and with that definition, the B.I. clearly is an innovation. Its impact on campus has been significant, and its impact on local business is being felt and is growing. We seek broader impacts across the nation. Join us in the next innovation in education.