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## **AC 2012-5179: IDEATION COMPETITION: CREATING LINKAGES BETWEEN BUSINESS AND ENGINEERING**

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## **Ideation Competition:**

### **Creating Linkages between Business and Engineering**

An innovative program at this University has proven to be an excellent vehicle for permitting collaboration between Engineering and Business faculty and students. Students are given the opportunity to develop exciting new products and to pitch their ideas and designs to senior leaders of regional corporations. The Ideation Challenge provides this vehicle. In addition to driving students to perform their best in front of leaders of industry, it is an outlet for innovation and creativity, the first steps in the entrepreneurial mindset. This year, for the first time, the Ideation Challenge will have a second phase. The second phase will be to take one of those innovative ideas to the point where it is a feasible complete design that could actually be fabricated.

The College of Business at this University offers an Entrepreneurship minor that has 9 credit hours of core courses and 9 credit hours of electives. This year, the two phases of the Ideation Challenge roughly correspond with the first two of those core courses: Entrepreneurship Ideation and Innovation and Entrepreneurship Feasibility Analysis. The third Entrepreneurship core course, Small Business and Entrepreneurship, was not addressed in this iteration of the Ideation Challenge.

Entrepreneurial thinking begins with ideation...thinking outside of the box. An entrepreneur must develop a vision for a new product or service, or a new way of delivering an existing product or service, to distinguish themselves from the rest of the crowd in the marketplace. Coming up with that new idea, that thing that sets one's product apart from others can be quite difficult. The Ideation Challenge at our University is designed to give students the tools to tap into their creativity through a fun competition that exposes them to different modules of how to generate those ideas and provides them with the tools they need to express that creativity.

As an idea's potential value is detailed, entrepreneurs must establish the feasibility of the idea. This will be the second phase of the challenge and is being implemented for the first time this year. Two engineering students will establish the feasibility of one of the ideas generated in the ideation phase. They will do this in an outside consultancy role with the assistance of a faculty mentor.

Our ideation challenge design began when one executive recognized the value of entrepreneurial thinking. He encouraged a program where students and professionals of different backgrounds worked together across multiple interactions to create ideas to solve a common problem.

After three years the challenge maintains its focus on ideation. However, with collaboration between the College of Business, the Department of Engineering, and local business, the challenge also includes a feasibility phase. This second phase challenges engineering students to develop their entrepreneurial thinking.

## **Entrepreneurship and Education**

Though scholars and practitioners debate the practical value of teaching entrepreneurship, multiple approaches to instilling entrepreneurship through education exist. Educators can present entrepreneurship to students as a collection of personal traits, a set of processes, a way of thinking, and as a set of skills and techniques that require ongoing work<sup>1</sup>. Since the turn of the century ABET and the ASEE have encouraged greater attention to entrepreneurship in engineering education<sup>2</sup>. In response, higher-education institutions continue to implement innovative programs to teach engineering entrepreneurship<sup>2</sup>.

Entrepreneurship involves finding solutions to problems that may be complex and not well defined. Several researcher studies suggest that interdisciplinary collaboration is an effective way for engineering students and faculty to address such contexts<sup>3</sup>. Some institutions, such as Penn State University's E-SHIP minor, have effective ways of institutionalizing collaboration among engineering and other disciplines, such as business<sup>4</sup>. However, many higher-education institutions, particularly mid-sized ones, face difficulty creating a culture of interdisciplinary, entrepreneurial experiences for engineering students.

Our University has found a unique way to incorporate an interdisciplinary, entrepreneurial education experience for students. This paper sets out the historical development of this program, the factors that lead to a natural collaboration between engineering and business faculty and students, and details of how the most recent iteration of program was managed. The paper concludes with lessons that we learned.

### **Ideation Challenge (2009): history and evolution**

Prior to 2009, the Executive-in-Residence (EIR) program at the College of Business (COB) consisted primarily of a one-day interaction between an area Executive and College of Business students and faculty. The COB established this tradition, which involved a series of talks and small group discussions. In the 2009 – 2010 academic year a Chief Executive Officer of a global company initiated the ideation contest as part of his tenure as the College of Business Executive-in-Residence. He challenged the College to organize an experience requiring students to have extensive contact with his organization. The individual desired an EIR program that was more than a one-time, passive interaction between a CEO and students. The Executive perceived breaking the status-quo as critical to success in business, and he spread that belief to the EIR program. The Executives that co-sponsored the ideation challenge in the following 2 years were equally committed to this belief.

As with the planning of every ideation challenge since, the key criterion for selecting the object of the challenge is that it is relevant to college students. The inaugural ideation challenge forced students to create an alternative design for the cardboard pizza box. The Executive never intended to pursue the idea. It was merely a coincidence that his organization's resources provided the opportunity to do so. In fact, the pizza box challenge was one of three ideation challenge concepts that were considered, and the other two ideas had no relation to the Executive's organization's capabilities. Intentionally tying the ideation challenge to potentially marketable products only became part of the program in its second iteration.

Selecting an object that is salient to college students is critical because doing so builds internal motivation to persevere in the face of new challenges. The ideation challenge requires students to think and behave entrepreneurially, and for many of them this is a new way of thinking. It forces them to seek out and utilize multiple approaches to problem solving, many of which are completely new to the students. It requires them to put in hours of work outside of classes, paying jobs, and social lives to pursue a goal with no guaranteed payoff. It causes students to acquire skills that they do not currently have, or at least gain access to other individuals who have and are willing to share such skills.

Identifying and attaining necessary skills and resources is a common challenge for entrepreneurs, and the inaugural ideation challenge sought to support students in doing this through regular training sessions. In 2009, student teams met with a team of three Business faculty members once a week for relevant training sessions. The meetings were standardized. The lead faculty member gave a short presentation, followed by a group question-and-answer session, and capped off with private team meetings with one of the three faculty members. Near the end of the challenge a team of students needed a way to create a 3-dimensional electronic prototype of their pizza container idea.

The team of management, marketing, and accounting students sought help from the COB team, and who then then sought help from the engineering faculty. An engineering faculty member agreed to incorporate the design challenge as part of a class project. The business students detailed their idea to the engineering students, and the engineering students produced a quality prototype that fit the description. This experience regarding the acquisition of new skills is what initially led to collaboration between the COB and the Department of Engineering in 2009.

### **Ideation Challenge (2009 – 2010): increased collaboration**

The 2009 challenge was evidence that increasing interactions among individuals from diverse backgrounds and skills sets should be built into an ideation program. Thus, in 2010 the COB and the Department of Engineering sought ways to increase the level of collaboration. The 2010 challenge involved creating a new outdoor sports game, and we tried two new methods to enhance the diversity of faculty and student participants.

Since the event is part of the COB Executive-in-Residence program, we thought that students from other Colleges may have assumed they were not invited. So the first change was to schedule members from the corporate partner's executive team to visit engineering classes and invite students to participate. This did not result in engineering students participating in 2010, but the overt invitation signaled to engineering students and faculty that the corporate partners of the COB were not exclusively partners of the COB. Rather, they were partners with all of the University, through a COB program. We believe this gesture sowed the seeds for further collaboration in 2011.

A second change was to explicitly encourage student participants to engage with engineering faculty on the design of their game ideas. Two engineering faculty members agreed to offer time to students throughout the competition. With this change, the training sessions were no longer constrained to interactions with Business faculty. The impact of these two adjustments was meaningful beyond the competition.

In 2010 The COB and the Department of Engineering had just began sharing a building. These adjustments to the ideation program built social ties between Business and Engineering administrators, faculty, and students. The distance across the hallways seemed shorter. As we now discuss, these changes led to much greater collaboration the following year.

### **Ideation Challenge (2011): integration and expansion**

The 2011 challenge centered on students creating a better party tent. The co-sponsoring corporate partner was a global tent manufacturing firm. The CEO was actively recruited to be the Executive in Residence and co-sponsor the event by the CEO of the firm co-sponsoring the 2010 game design ideation challenge. The fact that one year's corporate sponsor voluntarily recruited the following year's corporate sponsor speaks to the positive impact that this program has on the corporate partners. We highlight more about this in the conclusions of the paper.

Due to the recent collocation of the Department of Engineering with the College of Business, there has been substantial University interest in developing and reinforcing synergies between the two entities. The Ideation Challenge provided an easy way to jump start those relationships between both students and faculty. Several adjustments led to a successful integration and expansion. One adjustment was the introduction of a two-phase approach to the program. Phase I would be carried out in the fall semester and consist of an ideation challenge similar to the previous two years. Phase II would consist of a design and feasibility analysis among engineering students in the spring semester. Phase II is discussed in greater detail later in the paper.

A second adjustment in 2011 was that the Engineering Department chair was involved in the Challenge from the initial planning stages with the CEO of the tent manufacturing firm thru to the selection of the winners at the final presentations. To build on an adjustment from 2010, engineering faculty were further encouraged to participate in the workshops for students involved in the competitions. As we highlight in Table 1 and in the next section, one of the training sessions was completely led by an engineering faculty member using engineering facilities. Also, engineering students were actively recruited and encouraged to participate in the challenge, and this year students accepted the invitation. Some students used their entries into the Ideation Challenge as projects for their engineering classes. The engineering students who participated in the Phase I challenge were sophomores and juniors. Two engineering seniors followed the teams in Phase I of the program to be better prepared for Phase II of the program. They monitored Phase I of the challenge from the beginning to better understand what the stakeholder is looking for and to be familiar with all of the designs that were entered into the competition.

Several externally visible features of the 2011 competition further highlighted the collaboration on campus. The combined Business and Engineering Center served as the focal point for the competition, and the corporate partner erected one of their tent structures adjacent to the main entrance of the building. Posters on the structure highlighted the competition and the manufacturer. Workshops were held in multiple locations throughout the building. For example student teams did CAD drawings in the engineering computer labs and students, faculty, and

corporate participants would commonly meet in the College of Business board room and in shared classroom spaces.

Not only did the business and engineering groups expand and formalize their collaboration, but students from the College of Liberal Arts also participated for the first time this year. We are hopeful that the persistent attention to collaboration will expand participation across campus in future years. The next section and Table 1 outline the entrepreneurial-focused training series that the COB and the Department of Engineering members established for the competition.

### **Ideation Challenge (2011): Execution**

Over three iterations of this program, we have identified a general series of sessions that reflect the “best practices” for executing a collaborative, entrepreneurial-focused ideation challenge. Table 1 lists sessions we now implement, the order in which they occur, and a brief description of their purpose. Some additional details are provided, here.

Pre-planning is essential. We had 2-weeks to plan for the first event, and do not recommend trying that. We have had pre-planning meetings begin up to six months ahead of time, but two months is more than enough time. These meetings help identify leadership roles, develop expectations for everyone involved, and set a timeline for future events. Moreover, these meetings develop social capital and enhance networks between the University and the corporate partner.

At least two sessions are required to orient students to the ideation challenge. One session should announce the event to students and the community and provide a formal invitation to participate. Promoting the ideation challenge and this kick-off event is helpful, but such promotions, by themselves, will not drive participation. We find that personal invitations and encouragements to participate are helpful. Our experience is that approximately 50 students express interest in attending the first information session, about 70% of them show up, and about 70% of those will join a team and continue.

It is important to encourage students to form teams of 3-4 people, with as much diversity in backgrounds and skills among them as possible. We required this the first year by selecting teams based on personal surveys we administered. The following two iterations we allowed students to self-select teams after encouraging diversity. Each year, the top ideas tend to come from the most diverse teams.

Hold the initial orientation meetings close to each other, within the same week, so as not to lose the attention of interested students. Then, hold one training session (see Table 1) each week thereafter. Using the training sessions we outline in Table 1, we are able to start the ideation challenge in September and finish before Thanksgiving.

The training sessions need to expose students to diverse perspectives on the specific challenge and encourage students to think creatively. As outlined in Table 1, we begin with the end user or customer. We encourage students to think about the “fuzzy problem” they are addressing, and to utilize perspectives from their personal experiences, customers’ experiences, and the experiences of the corporate partner to create a clear definition of the problem they are trying to solve. In our experience, this leads to teams often identifying different portrayals of the critical elements of the problem they are trying to solve with their idea. This leads to diversity in final ideas.

As mentioned previously, building social capital and increasing personal and institutional networks is a key bi-product of this ideation challenge format. Designing training sessions that are hosted by different partners (i.e., business faculty, engineering faculty, and the corporate partner) facilitates the development of social capital and strengthens networks. Additionally, sharing the responsibility for training students reduces the burden on any one of the partners.

Up to now we have focused on the training sessions as they relate to the students. However, our corporate partners have indicated that the interactions between students and members within the corporate organization train the entrepreneurial thinking of the organizational members. The students' questions and thoughts, even the students' mere presence inside the corporation challenges the accepted norms of the people within the organization. Diversity in thinking is naturally infused in the organization. Because the CEO's who volunteer their organizations to participate are generally looking for changes and new direction, this diversity energizes the organization. We have been told that this energy is as valuable as any of the ideas that are generated from the challenged. Faculty involved in Phase I of this program received no incentives (load or pay) for their participation. Involvement in Phase I can be creditable in the dossiers of tenure-track faculty for teaching, scholarship, and/or service depending upon the extent of their participation.

### **Phase I (2011): final presentations and judging**

After the training sessions, the final presentations are made. In some cases it is necessary to have a semi-final presentation session where all teams record their presentations so that a group of finalists can be chosen. This can be a logistic necessity. If five teams present at the finals and each team gives a 10-12 minute presentation with a 3-5 minute Q&A, then the program lasts for at least 75 minutes (5 teams X 15 minutes each). Now, add in a 15 minute introduction for leaders from the University and firm to talk and judges to be introduced. Then account for 5 minutes between the presentations, at least 10 minutes for judges to select the winner(s), and 10 minutes to thank the participants and award the prizes. In this format, even if nothing gets off schedule, the final ceremony is over 2 hours, not counting pictures and news interviews and time for the audience to socialize. Our goal is to have a final ceremony that is over in less than 3 hours. This is why we always plan for the pre-recording of final presentations.

There are a few general notes in preparing the final ceremony. First, select a diverse set of judges. We have had professional engineers, local media personnel, marketing professionals, sales professionals, and customers on our panels. Second, reduce bias in the judging by not having members close to the teams be official judges. Third, make judging criteria clear and simple. The judging criteria should match the idea criteria given to students in the beginning. This information is finalized in the pre-planning sessions for the ideation challenge.

Aside from the logistical details and judging of the final ideas, it is important to pre-plan the promotion of the ceremony and the winning ideas. Pre-plan who is responsible for contacting which paper and television station for media coverage. Have your desired press release details already written. We recommend focusing on the collaborative nature of the event and the benefit to the students. Also, each partner should pre-plan how to promote for their own purposes. The specific audiences for the business group, engineering group, and corporate group will likely be different.

## **Phase I: Lessons learned**

Table 2 identifies general lessons we learned after three iterations of Phase I, the ideation challenge. Based on our experiences, we believe the impact on developing an entrepreneurial mindset among participants is noteworthy. We also strongly assert that the rewards to students are greater than the publicized award to the winning team. In 2009 top prize was the opportunity for an internship. In 2010 top prize was an opportunity for an internship, \$1,000 for the winning team, and the chance to have your name on a patent if the idea was patentable. In 2011 there was a \$2,500 prize for the first place team, a \$1,500 prize for second, and the internship and patent opportunities. But the rewards were much more.

For example, we have seen a “C” student become leader of the winning team and go on to internships and careers with the corporate partner. We have seen lasting friendships form among previous strangers, both for students, corporate team members, and faculty team members. In general, students tend to leave the challenge with greater passion for defining and pursuing their future careers. They gain confidence, they are exposed to new ways of thinking, and they develop new relationships. It is amazing that by the end of the competition a freshmen student can stand up in front of the CEO of a global organization, a panel of professionals, and a live audience, present a unique idea, field challenging questions, and not even look at the experience as unique. After weeks of interacting with professors of different disciplines and with senior professionals the experience truly is not unique to that student.

The companies also benefit. In our first competition, the CEO was so impressed with the quality of ideas and presentations he added 4 additional awards at the last minute, including letters of recommendation for every student who participated. In our second competition, the CEO was so impressed with the changes he saw inside his company after the challenge that he personally recruited the next year’s CEO. This format energizes companies.

The payoff at the University is also notable. The format highlights and nurtures the synergistic potential of cross-discipline collaboration. Students, faculty, and administrators see new opportunities in the University community. Social ties are strengthened, and this allows for new lines of research to grow and methods of teaching to be shared.

## **Phase II: Feasibility**

All engineering graduates at this University must complete a capstone senior design project. The proposals for these design projects are normally vetted and taken to the proposal phase during the students’ next to the last semester in the program. The project itself is completed during their final semester. Students either work as individuals or in groups of 2 or 3. We have taken pride in that we are normally able to place students with external clients for these projects. The goal is to involve the student in the solution of a real world engineering problem that will actually be implemented following their recommendations. The students accomplish their work under the tutelage of a faculty advisor. They are required to involve their stakeholders periodically throughout their design process to ensure that they will be delivering a solution that meets the client’s needs. In many cases the students take on the role of independent consultants, developing an engineering solution to a stakeholder problem that will be presented to the stakeholder at the close of the semester.



This model serves as a win-win for both the students and the stakeholders involved. The stakeholders are provided with an engineering solution to a problem they may not have had the resources to solve. As a prime example of this, some of our recent civil engineering emphasis students recently helped a non-profit group to develop a preliminary design and cost estimate for a new greenway in our city. This non-profit group is now working with some of our business students to develop a marketing plan for the greenway. The students involved in this project will have a major design document that is part of their portfolio to show potential employers. The experience on the project can be a major point in their resumes.

Early in the fall semester, before the Ideation Challenge even kicked off, we began talking up the event to our first semester engineering seniors. We wanted to get two students on board for Phase II of the project as early as possible in process. One of our mechanical engineering emphasis students was the first to sign on. This student was paired with a civil engineering emphasis student. The problem at hand will require the knowledge of lightweight materials and dynamic analysis possessed by the mechanical engineer and the ability to quantify the loading, especially the wind loading, that the civil engineer will bring to the table. These students are both in their capstone design course and are on track to graduate this spring.

Although these students could have participated as competitors in Phase I of the Ideation Challenge, it worked out better that they did not because they did not have a stake in any of the designs that rose to the top of the competition. Throughout Phase II, they will work not only with the tent manufacturer, but with the students from other majors who came up with the conceptual designs.

The criteria for this feasibility stage are more restrictive than those used for the ideation phase. The ideation criteria were:

- Aesthetic appeal, WOW factor
- Ease of installation and maintenance
- Ability to increase brand awareness
- Simplicity for storage and transport
- Durability
- Sustainability
- Adaptability

Although the ideation teams were aware of the design criteria for the final product, they were most concerned with the ideation criteria. The design criteria for the feasibility stage:

- Width: 40' expandable to 60'
- Area: 4,000 – 5000 s.f.
- Eave height 8' extendable to 10'
- Maximize unobstructed floor area
- Transportable in 20' trailer

Additionally, the final design must take into account affordability. The students must consider not only the first cost of the product, but the rental income that can be achieved over the lifetime of the structure. Over the course of the spring semester, these two students will help the stakeholders develop a design that could revolutionize the tent industry. The firm has agreed that

the students involved with the project will share in any patents developed as a result of the project. The faculty mentor for this team is given an academic load of 1.5 hours (out of 12 required in a given semester) for serving as the design mentor.

Expectations for the project are that the two students involved will learn more about the entrepreneurial process than their peers who are focused primarily on solving specific problems for their stakeholders instead of bringing a new product to the marketplace. We plan to involve not only engineering faculty mentors, but business faculty mentors throughout the design process. The students will provide design documentation throughout the semester, but will also give three major briefings to faculty members throughout the semester. These are the preliminary design review, the dry run of their final presentation, and the final presentation. The dry run is more formal than its name may imply. The dry run occurs at least one week prior to the final presentation and is the venue where faculty members dig fairly deeply into the design. The formal final presentation is given in front of not only faculty, but the general public. Invitees include all stakeholders and family members of the students involved.

The corporate stakeholder chose the second place Phase I design to move forward to Phase II instead of the first place Phase I design. The first place design, although innovative, would have presented some major challenges to the end users in terms of equipment needed to erect the structure. To date in Phase II the engineering students have coordinated with the stakeholders to select appropriate dimensions and materials for the tent. They have created a 3D model of the tent framework in CAD software to facilitate analysis and design. The students have also identified and analyzed the loads on the tent to calculate the greatest forces expected in the structure. The students are now in the process of designing the framework and connections to allow rapid erection of the tent while also providing adequate strength to support the expected loads. They will also perform a cost estimation of the design. Finally the students will communicate their design to the stakeholders through detailed drawings and a practiced presentation.

Although we are not able to report lessons learned from Phase II in this paper, Phase II will be complete prior to the conference and results/findings will be made part of the presentation that will be given there.

### **Program Assessment**

We are currently developing formal assessment tools to measure the entrepreneurial and business outcomes of this program. The process we present here forces students to be immersed in a team-oriented (often with interdisciplinary teams), problem-rich, and ambiguous experience. Furthermore, faculty and corporate partner members experience the interdisciplinary immersion of the program.

Assessment of Phase II of the program is currently ongoing. The Phase II team is composed of senior engineers in their capstone design course. They have completed their preliminary design review milestone. The preliminary design review was on par with peer design projects not associated with this competition. Further assessment will be conducted on the written design report and final design presentation. The final design presentation will be a public event with all stakeholders in attendance. Exit interviews will be conducted with all graduating seniors to

determine if the understanding of the entrepreneurial aspects of engineering is greater in the team that participated in this competition.

The Phase II engineering team had more of an academic stake in the competition than any of the Phase I teams. For the Phase II team, 80% of the grade in their capstone design course is directly attributable to their performance on this project. For the Phase I teams, there was less of an academic stake, but more of a financial incentive. For the Phase I engineering teams, less than 10% of their grade in a course was related to the project. But, all Phase I teams had the chance of sharing a stake in cash prizes and a potential internship. We will attempt to assess the outcomes related to these differing incentives in future competitions.

## **Conclusions and Recommendations**

Although the Ideation Challenge has been a very positive competition for business students over the past three years, the third iteration of the contest has already had a positive impact on engineering students. All of the students involved learn and experience the first phase of entrepreneurship, ideation. They learn how to work on multidisciplinary teams and how to work with a wide variety of stakeholders. For many of the engineers involved, especially the freshmen, this contest provided them with their first glimpse into entrepreneurship and the College of Business. For many of the business and liberal arts students who were in the competition, this was their first exposure to engineering design and the tools that can help

There is some anecdotal evidence gathered over the past semester that indicates the students who take the majority of their courses in this building are showing interest in majors besides their own. Some business students have enquired into what the requirements would be to major in Engineering, but to keep a minor in Business. Some engineering students have looked into the requirements for the entrepreneurship minor that is offered by our College of Business. There are engineers in the marketing club. Two engineering freshmen have asked for a clear-cut pathway for entrance into our University's MBA program and have made changes to their schedules to accommodate this.

The Ideation Challenge has directly addressed our University's goal of achieving more synergies between Business and Engineering. Faculty members from both groups were involved throughout the Ideation Challenge, from the initial planning meeting up until the final judging and lessons learned. We also have faculty from both groups involved with the engineering students completing Phase II. Business students participating in the competition learned about engineering design. Engineering students learned about business considerations in design. All students learned about entrepreneurship. Even though Phase II of the competition is not complete, we are already considering how to make Phase I an even more effective learning experience for the students involved next fall.

## **References**

1. Neck, Heidi M. and Patricia G. Greene, "Entrepreneurship Education: Known Worlds and New Frontiers," *Journal of Small Business Management*, VOL 49, No. 1, 2011, pp. 55-70.
2. Dabbagh, Nada and Daniel A. Mease, "Student Perceptions of Engineering Entrepreneurship: An Exploratory Study," *Journal of Engineering Education*, Vol. 95, No. 2, 2006, 153-164.

3. Richter, David M., and Marie C. Paretti, "Identifying Barriers to and Outcomes of Interdisciplinarity in the Engineering Classroom," *European Journal of Engineering Education*, Vol. 34, No. 1, 2009, pp. 29-45.
4. Bilén, Sven G., Elizabeth C. Kisenwether, Sarah E. Rzasa, and John C. Wise, "Developing and Assessing Students' Entrepreneurial Skills and Mind-Set," *Journal of Engineering Education*, Vol. 94, No. 2, 2005, pp. 233-243.

**Table 1: Suggested Session Schedule for Ideation Challenges**

<b>Session</b>	<b>Purpose</b>
<b>Pre-Planning Sessions</b>	<ul style="list-style-type: none"> <li>• Leadership from the University and corporate partners meet to agree on the focus of the challenge</li> <li>• Agree on a timeline that places dates and locations to the program’s main sessions (below).</li> <li>• Identify communication procedures and develop promotional items, prizes, and common goals.</li> </ul>
<b>Orientation</b>	
1. Kick-off event	<ul style="list-style-type: none"> <li>• CEO’s Presentation on topic of choice. Attempt to raise awareness and motivation among students and faculty.</li> </ul>
2. Information session	<ul style="list-style-type: none"> <li>• Students with initial interest meet faculty and corporate team members for additional explanations and Q&amp;A.</li> </ul>
<b>Training</b>	
3. Q&A with the end user	<ul style="list-style-type: none"> <li>• Students meet with the customer or end user of object around which the challenge centers. Students get “primary data” and begin to define the “fuzzy problem” they must address.</li> </ul>
4. Creative thinking and ideation training	<ul style="list-style-type: none"> <li>• Exercises on creative thinking and an ideation process. Encourage corporate team members to attend and participate.</li> </ul>
5. Visit to corporate partner facilities	<ul style="list-style-type: none"> <li>• Students and faculty team members visit the corporate partner to see existing products, interact with representatives from various functions, and ask questions. Identify previous ideas that already exist or have already been considered.</li> </ul>
6. Team & faculty private meetings	<ul style="list-style-type: none"> <li>• Teams receive faculty guidance to help them move forward with their ideas and to begin to select a final idea.</li> </ul>
7. Relevant technology and tools training for prototypes (e.g., CAD)	<ul style="list-style-type: none"> <li>• Faculty members assist students on tools necessary to create prototypes to communicate key features of ideas. Semi-structured meeting with time to experiment with tools.</li> </ul>
8. How to make and effective “Pitch”	<ul style="list-style-type: none"> <li>• Tips on how to make the most of a 10 minute pitch and to prepare for questions from judges.</li> </ul>
<b>Presenting</b>	
9. Pre-recording final presentations	<ul style="list-style-type: none"> <li>• Time constraints may require that not every team presents its idea at the final ceremony. If this is the case, recording everyone’s presentation ahead of time insures that the corporate partner gets to hear all ideas and facilitates selecting the finalists.</li> </ul>
10. Final presentation ceremony	<ul style="list-style-type: none"> <li>• Teams present (live – this may be in addition to a previous recorded presentation), community members are invited, final judging occurs, winners are selected, prizes are awarded. Have media coverage planned for local TV, newspaper, and other relevant outlets. Potential corporate partners for the next challenge should be invited to watch.</li> </ul>

**Table 2: Key Factors for Effective Partnering University-Corporate Partnering in Extra-Curricular Entrepreneurial Student Challenges**

<b>Program Iteration</b>	<b>Lessons Learned</b>
1 <sup>st</sup> year (2009)	<ul style="list-style-type: none"> <li>• Maximize interactions among individuals from diverse backgrounds</li> <li>• Offer entrepreneurial training based on problem-solving processes</li> <li>• Build the program around a salient challenge</li> <li>• Plan for promoting and archiving program experiences from the beginning</li> <li>• Design a finale event that is a fitting celebration for the time and hard work that everyone puts into the program</li> </ul>
2 <sup>nd</sup> year (2010)	<ul style="list-style-type: none"> <li>• Make expectations about the creativity–feasibility relationship clear</li> <li>• Offer diverse student training and support opportunities led by different people</li> <li>• Have a clear explanation as to why ideas are not guaranteed royalty payments if they are created and marketed</li> <li>• Establish a strong connection between the lead coordinators of on the University and Corporate sides.</li> </ul>
3 <sup>rd</sup> year (2011)	<ul style="list-style-type: none"> <li>• Place no limits your expectations of students</li> <li>• Separate the ideation phase of entrepreneurial thinking and the feasibility phase.</li> <li>• Maximize collaboration among University silos and corporate silos from throughout the planning and implementation process</li> </ul>

