International Experiential Learning in Engineering: a Case Study of Junior Enterprise in the United States

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Currently, large research-based engineering schools, such as the University of Illinois at Urbana-Champaign (UIUC), are trying to incorporate more project-based learning (PBL) into engineering curricula. However, integrating PBL proves to be a challenge, especially in large lecture classes typically required for freshmen and sophomore engineers. Junior Enterprise (JE), a student-led non-profit consulting organization comprised of undergraduate and graduate students, provides a solution to this problem. Students work on projects together to provide services to companies and institutions, enhancing students' business and entrepreneurial skills through practical application of classroom learning. In 2012, the first United States Junior Enterprise was founded at UIUC to provide experiential and entrepreneurial education for engineering students through consulting projects with local start-up companies, non-profit organizations and UIUC. This paper summarizes the history of Junior Enterprise abroad and details a single case study of the implementation and integration of JE at UIUC, including the current state and the future plans of the Junior Enterprise movement in the United States, and offers best practices and recommendations for other institutions.

The Junior Enterprise movement originated in 1967 in France. It has fostered experiential education in over 20 countries for almost 50 years. Currently, JE is active in 14 European countries with over 280 Junior Enterprises represented and promoted by the international organization Junior Association for Development in Europe (JADE), established in 1992. According to the 2012 European Commission study of 2,500 recent college graduates, JE students obtain full-time employment after graduation more quickly than their peers due to their better developed skills in adaptability, creativity, networking, and analysis.[4] Junior Enterprise students are intrinsically motivated to take an active role in their education as engineers through project-based learning.

At UIUC, Junior Enterprise gives students an opportunity to hone their skills outside of theoretical instruction with experiential learning. The founders of UIUC's Junior Enterprise believe that engineering students need more exposure to practical engineering applications. The Illinois Foundry of Innovation in Engineering Education (iFoundry) supports this endeavor to improve experiential learning at the University of Illinois by assisting in the funding of JE. Junior Enterprise offers a student-driven solution and experiential learning to students by providing the following skills: leadership, interfacing with clients, project management, and technological literacy.

Junior Enterprise develops entrepreneurial skills in students while promoting both 21st century skills and technical abilities. Projects prepare students for full-time employment by requiring teamwork and analytical thinking to solve problems. JE is a student led organization that increases the quality of engineering education by preparing students for their future careers. This paper demonstrates student development through the international experience of Junior Enterprise and makes a case for the expansion of Junior Enterprise in the United States. The conclusion of this paper includes the core benefits of involvement in Junior Enterprise for American engineering students and recommendations for universities interested in starting their own Junior Enterprise.

Method

The primary research question of this study, *How has Junior Enterprise impacted students?*, was conducted through the network of international Junior Enterprise students from Europe, Brazil, and the United States using social media and email. This paper focuses on a single case study with embedded units of Junior Enterprise in multiple countries. The authors founded the first Junior Enterprise in the United States and will, for readability, write this paper in third person.

A case study is an empirical inquiry that inspects an experience within its real life context, particularly when the experience and its context are not mutually exclusive, according to Yin.[8] In the case of Junior Enterprise, the authors sought to conduct an in-depth investigation as a descriptive case study which allowed them to gather data from a variety of sources and determine its convergence.[1] For this qualitative research, a case study was used because it had the potential to gain insight into a complex case spanning multiple countries and varying forms of education.[1] In this paper, a single case study with embedded units was conducted of Junior Enterprise students in the United States, Europe and Brazil. Looking at these three countries as sub-units in studying the JE concept allows the authors to draw global connections about JE.

Data was collected from the authors' personal experiences as well as statements provided by international and domestic Junior Enterprise students. The data was analyzed using pattern matching across the authors' and Junior Entrepreneurs' experiences. The authors utilized their experiences as the founder of Junior Enterprise in the United States and the American JE Ambassador in Europe for global benefit analysis and recommendations to universities.

Study Context

This section describes the study in the context of Junior Enterprise, University of Illinois engineering students, and Champaign-Urbana Business & Engineering (CUBE) Consulting.

Junior Enterprise. JE is an international network of student-led consulting organizations present throughout Europe and Brazil with recent expansions into Tunisia, Argentina, Asia and the United States. Junior Enterprise encompasses approximately 50,000 students worldwide governed by two umbrella organizations: the European JADE and Brasil Junior. Undergraduate and graduate students involved in JE work as business and/or technical consultants for companies. Consulting projects apply students' academic knowledge to the real world in the creation of an innovative solution tailored to the business's needs. Both nonprofit organizations of JADE and Brasil Junior work to promote "learning by doing", connecting university education with the business world and enhancing entrepreneurial skills.[5] The executives of the JADE organization, which represents 14 European countries, are frequently invited to European Union business events such as European Development Days. JE has expanded to Tunisia and parts of Asia due to the advocacy of former Junior Entrepreneurs and the assistance of JADE and Brasil Junior. However, no Junior Enterprises have been started within the United States in the past fifty years. JADE and Brasil Junior planned to learn more about American college culture before advocating for the creation of a Junior Enterprise within the United States.

University of Illinois engineering students. The University of Illinois is the fifth best university for engineering in the country.[2] UIUC is a strong research university responsible for innovations such as the transistor and the light-emitting diode. Over $236 million per year is spent on research within the College of Engineering at the University of Illinois.[3] With such a strong research presence on campus, engineering education at UIUC is slanted toward research with the biased expectation that many students plan on attending graduate school. The College of Engineering at Illinois is comprised of 8,400 undergraduate engineers, of which over 1,200 students attend the Engineering Career Services (ECS) career fair each semester. In addition to the ECS career fair, Engineering Council, a governing student organization which oversees all engineering organizations and events, also hosts two career fairs attended by approximately 2,400 students each fall and 1,500 students each spring. Students interested in industry find it difficult to recognize the connection between the classroom and their future jobs. The largest engineering organizations on campus are those which provide students with professional development and networking opportunities. This is a strong indicator of student interest in industry. The University of Illinois is a widely international university with a strong focus on global education opportunities such as study abroad. The International Programs in Engineering (iPeng) is an office specifically focused on the creation and operation of study abroad programs for engineers. Civil engineers are ranked fifth as the major of students who study abroad the most. For these reasons, Junior Enterprise is a good opportunity to incorporate experiential learning into students' education while connecting with university students around the world.

CUBE Consulting. During the fall semester of 2012, engineering students at the UIUC founded the first Junior Enterprise in the United States. The students chose the name Champaign-Urbana Business & Engineering Consulting (abbreviated as CUBE Consulting) for their new Junior Enterprise. CUBE Consulting was founded as a technical, student-run consulting organization focused on providing non-profit organizations, start-up companies, and businesses throughout the Urbana-Champaign community with engineering solutions. The mission of CUBE Consulting is to provide consulting services which allow consultants to apply academic knowledge to real-world business situations. Over the past two years, CUBE Consulting has grown to encompass more than 25 engineering and business undergraduate and graduate students, representing all engineering majors offered at the University of Illinois. These students are recruited using informational sessions, newsletter postings, and word of mouth. They are selected via an application and interview process. Consultants are assigned to projects through a skills assessment to ensure each student is properly matched for each project. Project managers lead each project group while constantly communicating with both their client and the executive board. The executive board of CUBE Consulting maintains all necessary functions in order to advance CUBE Consulting within the University of Illinois, the United States, and the world. These functions include, but are not limited to: seeking new clients, maintaining international relationships, providing entrepreneurial development through speakers and activities, and team building. CUBE Consulting works to provide University of Illinois engineering and business students with the opportunity to develop technical skills in a global setting.

International Junior Enterprise

In 1967, the first Junior Enterprise was started in France. French universities, in comparison to higher education in the United States, do not offer a wide variety of student organizations for

student involvement. Junior Enterprise was different because it offered students the opportunity to learn actively through projects while working with companies present within their local communities. The Junior Enterprise concept spread quickly as French universities formed their own Junior Enterprises and the movement spread to other European countries. In the 1980s, France formed the first confederation, *Confederation nationale des Junior-Enterprises*, which governed all Junior Enterprises in France. The purpose of a European country's confederation is to standardize the operation of all Junior Enterprises within the country. Junior Enterprise spread throughout Europe, and a continental confederation, Junior Association for Development in Europe (JADE), was formed in 1992. JADE currently governs over 180 Junior Enterprises comprised of over 20,000 students. JADE focuses on promoting the Junior Enterprise concept throughout Europe to universities, companies, and governments while actively seeking to expand Junior Enterprise worldwide.

Junior Enterprise spread to Brazil in 1988. Within one year, it is estimated that 10 Junior Enterprises were started throughout the country, reflecting the enthusiasm Brazilian college students exhibit towards entrepreneurship. An umbrella organization to oversee Brazil, similar to that of JADE in Europe, was founded in 2003 and named Brasil Junior. Brasil Junior now governs approximately 28,000 students. A relationship between Brasil Junior and JADE was established almost immediately in 2003 to further the entrepreneurial activities of both organizations and its constituents while actively promoting Junior Enterprise to countries such as Tunisia, Canada, and the United States. Currently, there are three Brazilian ambassadors in Brussels working with JADE to further align the goals of both JADE and Brasil Junior in the expansion of Junior Enterprise worldwide. Both Brasil Junior and JADE offer opportunities to network internationally through biannual meetings and biennial Junior Enterprise World Conferences. These conferences focus heavily on networking and provide professional development through workshops, competitions, and Q&A panels.

Junior Enterprise has had a significant impact within Junior Entrepreneurs' own countries and throughout the world. The European Commission conducted a study on Junior Enterprise in 2012 on behalf of the European Union. The results of this study, which compared Junior Enterprise students to typical university students, demonstrated the benefits of Junior Enterprise in the development of entrepreneurial attitude, skills, and knowledge. The European Commission discovered that Junior Entrepreneurs exhibit more self-efficacy, risk propensity, adaptability, and motivation than traditional students. Jose Manuel Barroso, the president of the European Commission, commented, "Students who participated in Junior Enterprises are more self-confident, more innovative, more likely to seek new solutions and new technologies".[4] The Junior Enterprise concept continues to garner worldwide recognition. In a report by McKinsey & Company concerning employment after higher education, Junior Enterprise was hailed as an opportunity to enhance employability due to JE's ability to connect classroom learning and the business world through working with small and medium-sized enterprises.[7] Junior Enterprise has significantly affected communities around the world. In the *Huffington Post*, Michele Hunt wrote of her impressions after the Junior Enterprise World Conference 2012 where she was a closing speaker: "[Junior Enterprise students] are co-creating the future: collaboration, cooperation and innovation...They understand on a very deep level that we are all connected and they are committed to put their vision of what the world can be, to work for the benefit of all."[6] Junior Enterprise has positively impacted students and citizens throughout the world.

As a result of international Junior Enterprise success, JADE and Brasil Junior turned their focus outside their own countries to look for expansion opportunities. Junior Enterprise offers a wide variety of experiential learning opportunities through PBL as well as the opportunity to network internationally, which makes it appealing to other countries. The United States was deemed an ideal country in which to expand by both JADE and Brasil Junior, but both organizations were hesitant about United States expansion plans due to unfamiliarity with American college culture.

Founding of CUBE Consulting

In August 2012, Dr. David Goldberg spoke at the Junior Enterprise World Conference in Rio de Janeiro. He was greeted by 2,000 students impassioned by project-based learning. He found these Brazilian and European students were among the most talented and promising professionals their countries had to offer. When talking to these students during the conference, they repeatedly asked him the same question: "Where is the United States chapter of Junior Enterprise?" After returning to the University of Illinois, Dr. Goldberg introduced undergraduate engineering student, Karen Lamb, to the Junior Enterprise concept. He urged her to begin the movement in the United States. Lamb recognized the university's need for more global and educational opportunities. With fellow students, Stephanie Nemec and Stephanie Chou, Lamb formed the executive board of the first United States Junior Enterprise.

In November 2012, the executive board began recruiting students to join their new consulting organization. Students were instantly captivated by the JE concept of crossing geographical boundaries and connect with students globally. They found the idea of applying their engineering skills to work with local companies intrinsically motivating. After only a few weeks of recruiting, the first United States chapter of JE had gained 20 new members and adopted the name CUBE Consulting. During the first months of CUBE's founding, more than 15 Junior Entrepreneurs from four continents and 10 countries reached out to assist CUBE Consulting with phone calls, video conferences, emails, and numerous requests to collaborate on projects and educational initiatives. Several Junior Entrepreneurs from Brazil and Europe requested to study abroad at the University of Illinois solely to participate in and aid CUBE's founding. In a single day, the 'likes' on CUBE Consulting's Facebook page went from 5 to over 100; almost all of the profile owners came from outside the United States. Junior Entrepreneurs from all over the world reached across geographical and cultural boundaries to form new, strong international connections. As a result, the first CUBE members were exposed to a new dimension of networking: international connectivity, an invaluable experience in the modern global workplace.

CUBE Consulting also received unwavering support from the University of Illinois's iFoundry. The department provided CUBE with initial funding, beneficial university connections, and sound advice. Recognizing the opportunities CUBE Consulting would create for engineering students, iFoundry made a significant effort to help the organization succeed. At the same time, CUBE's founders gained counsel from countless professors and university administrators. As a whole, the university played a critical role in the founding and shaping of CUBE Consulting.

Within six months of its founding, CUBE Consulting developed a consulting base of 20 students, completed three consulting projects, and connected with Junior Entrepreneurs in over 20

countries. During this time, CUBE member Morgan Bakies was traveling to Junior Enterprise chapters across Europe. Bakies visited Westminster Business Consultants in London, Europe Etudes in Strasbourg, and the JADE headquarters in Brussels. While staying with these JEs, she also received visitors from Junior Enterprises: ESCadrille (Toulouse, France), N-Hitec (Liege, Belgium), and LSM Conseil (Louvain-la-Neuve, Belgium). While observing international Junior Enterprises, Bakies learned more about international JE's common procedures: day-to-day JE operation, partnership negotiations, consultant interviews, exchange of powers, and overarching European operations. During personal interviews with presidents and other executive members of international JEs, she asked questions concerning recruitment, client seeking, and project management in order to learn which best practices could be applied to CUBE Consulting.

At the end of their first semester, CUBE's consultants elected Bakies as the new President, recognizing her leadership skills and international experiences were a perfect fit for the role. Over the next year, CUBE Consulting expanded both their student body and international connections. They established three new, technically demanding consulting projects to support the local community. In the fall of 2013, student consultants worked with a local sustainable technology start-up, research professors making an "agri-pulp" paper product, and website and content development for an iFoundry project. These projects exposed students to an array of practical challenges they had not previously faced in their coursework. Practical experience, in addition to the international networking opportunities, makes CUBE Consulting an attractive and enriching option for engineering students.

Benefits of Junior Enterprise

The primary question of this case study: *How has Junior Enterprise impacted students?* The authors' experiences and statements provided by international Junior Entrepreneurs and domestic CUBE consultants followed a general theme: students feel that Junior Enterprise has provided them with valuable practical experience in their field, an expansive international network, and strong interpersonal skills.

A large subset of the responses stated that Junior Enterprise provided them with advantageous practical experience they would not have gained otherwise. Especially for engineering students, career opportunities such as internships and co-ops are difficult to attain without some prior practical experience. Junior Enterprise allows students to supplement their academic coursework with corresponding practical engineering experience. Internationally, students pointed out this benefit as integral in affecting their college experiences and careers. A Brazilian Junior Entrepreneur said the following about his experience: "JEs teach what is not in the books, what you can only learn by experience and by making mistakes." A Belgian engineering student and Junior Entrepreneur had similar things to say: "We don't have so much the occasion to 'touch' things, and to get practical. Being part of a Junior Enterprise definitely gave me more occasions to test my practical skills." University students desire opportunities to work on projects outside of standard textbook learning and apply their knowledge which Junior Enterprise provides.

Another benefit that recurred throughout many of the responses was the professional and international networks students were able to build as a result of participating in Junior Enterprise. Not all students have the opportunity to study abroad but still desire a global experience during

college to acquire the skills necessary for the global workplace. Junior Enterprise allows students to have this experience and connect with students in countries around the world. In their responses, students reiterated that this experience has been valuable to them professionally. Understanding different socio-cultural patterns in professional environments is valuable knowledge in today's global workplace. A Junior Entrepreneur from the United Kingdom epitomized the international JE network, saying: "The Junior Enterprise concept opens up a world to students that isn't readily available." In addition to this international network, Junior Enterprise also provides students with a valuable professional network. According to the study done by the European Commission, Junior Enterprise students develop stronger networking skills than the typical European college student.[4] The JE model gives students the opportunity to work with several different companies and organizations during their time as a consultant. CUBE Consulting provides these opportunities and also regularly schedules entrepreneurs from the local community to speak at meetings and connect with the consultants. CUBE Consulting members and international Junior Entrepreneurs alike have said these connections were essential in securing internship and job opportunities.

In their responses, almost all Junior Entrepreneurs cited interpersonal development as a benefit of being involved with Junior Enterprise. Although academic work provides a strong base of knowledge for engineers, these courses often do not stress leadership, management, and teamwork skills. In industry, an engineer must constantly work with or lead a diverse group of people, but this skill is not readily attainable within most engineering curricula. Junior Entrepreneurs emphasize their personal development in public speaking, ability to synthesize and analyze information, understanding of group dynamics and leadership techniques, and developing positive client relationships. The European Commission study also concluded that Junior Enterprise develops strong analysis skills of its members when compared to other European students.[4] These are skills engineers must develop because universities do not provide adequate instruction. A CUBE Consulting member said the following on interpersonal development: "For me, CUBE has helped me to develop my leadership and critical thinking that are really important to be a consultant." Almost all members of CUBE Consulting that were polled indicated that these skills set them apart from other candidates in job applications and interviews. When talking about their experience with CUBE Consulting, they found that recruiters became more interested because their experiences reflected the atmosphere of an engineer in industry. This follows the trend observed in Europe in which 79% of Junior Entrepreneurs found work immediately after graduation compared to the average of 59%.[7] Junior Enterprise offers university students both in the United States and internationally the opportunity for personal development, which enhances employability.

Recommendations to Universities Interested in Junior Enterprise

Junior Enterprise allows engineers to engage a unique, critical skill set. This combination of international connectivity, practical engineering experience, and interpersonal/professional development is not attainable through academics alone and is not offered by most student organizations.

Contact international and domestic JEs. Before starting a new Junior Enterprise, interested parties must network with existing JEs to determine the value of implementing JE at their

university. Well-established JEs founded over 10 years ago have standard operating procedures which can serve as invaluable models. JADE and Brasil Junior have standard documents on how to start and establish a new Junior Enterprise at your university. College culture varies from country to country, so it is also important to contact JEs within one's home country (if such a JE exists) in order to learn more about Junior Enterprise domestically.

Student buy-in. Because Junior Enterprise chapters are completely student-driven, finding students who are especially passionate about improving their engineering education is critical. Although JE offers many benefits to students, the underlying primary benefit is pedagogical. Students who recognize this will have more intrinsic motivation to dedicate their time and resources to developing a new JE. A determined group of students will make a major difference in founding and establishing a Junior Enterprise chapter. This group of students will have to recruit other students, work closely with faculty, and seek clients for consulting projects. Having the right combination of passion and determination is important during this process.

Faculty support. Students looking to start a chapter of Junior Enterprise will undoubtedly need faculty support to be successful. Students do not have the same experience consulting, project managing, client garnering, or creating a new entrepreneurship venture as compared to academic professionals. Faculty must provide students with wisdom, professional connections, and potentially some funding. They must also provide advice regarding questions and concerns the founders may have while starting a new Junior Enterprise. Willingness to answer student questions and providing feedback when it is needed will benefit the founders immensely.

Recruitment. With the right combination of student leaders and faculty advisors, member recruitment can begin. This initial group of students needs to have an interest in international relations, practical engineering experience, and professional development. Each chapter of Junior Enterprise is unique, and the first group of students will shape the chapter's mission and tone. A strong consultant base is important in initial projects and future success of the organization.

Investigate potential projects. Before looking for projects, students and faculty members must assess the skill set of Junior Entrepreneurs in their organization. Next, the projects available within the university and local community must be assessed. The ideal project will require some level of technical skill without being extensive. The goal is to give students a valuable challenge to encourage PBL without overloading them. Potential projects must be as defined as possible with concrete, feasible deliverables within the scope of an undergraduate student's training. To look for potential projects, interested parties should search for potential clients from start-up companies and non-profit organizations. These businesses typically have several tangible, incomplete projects, due to lack of resources, which could be modified to appeal to students.

Launch Junior Enterprise. After projects are determined, recruited students are assigned to a project team headed by a student project manager. Once contact is established between the project manager and his/her client, a Junior Enterprise has moved out of the "initiative" phase and is officially launched. The founding members typically serve as the executive board to further the JE. It is suggested that a website, Facebook page, and other social media outlets be utilized for a new Junior Enterprise to best network with international JEs and attract new clients.

New JEs must focus on building a reputation within their university, community, and internationally in order for it to succeed.

Conclusion

To bridge classroom learning and real-world business applications, Junior Enterprise offers university students technical consulting projects with international networking and professional development opportunities. Junior Enterprise advances university students' ability to compete in a global job market due to their increased intercultural competencies and entrepreneurial skills. Universities interested in starting a Junior Enterprise are encouraged to use this case study as a basis, with particular focus on the recommendations provided.

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