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INNOVATIVE EDUCATION IN A GLOBAL ECONOMY

An Interactive Qualifying Project Report

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by

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## Abstract

It was the goal of this project to identify different forms of innovative education that exist in the changing global marketplace. These different practices were then compared to the current educational tools in place by the WPI China Project Center. In this way it could show the strengths of the China Project Center and its position in innovative education around the world. With the globalization of the economy and evolution of markets it is important to be at the forefront of global educational tools.

## Chapter 1: Introduction

As employers look for new talent in the every year from new graduates it is important to not only have a solid education but one that has features that stand out from the rest of the graduating class. With the economy being more globalized than ever it is important to have a background and a skill set that allows graduates to become immersed in the global economy right from graduation. This does not apply only to business majors but engineering majors as well. It is important for these graduates to have skills in innovation, globalization, and entrepreneurship to be ready to tackle the global market place that today's economy depends on.

The ways in which different universities teach these different skills varies immensely. There are universities that teach it through classes, projects, projects with international students, projects with international companies, and a combination. There are many universities who seek out a partner university and only deal with them while other universities seek out a number of partnerships with different companies and other universities.

Another major focus of engineering education is the focus on holistic teaching and learning, not just the technical information. There has to be a development of personal and social competences to deal with the global marketplace. The majority of engineering jobs call for a cross cultural acceptance and understanding. It is important for an international education to be able to have students realize the impact of different cultures on the marketplace.

The goal of this project is to identify different innovative ways that education in the engineering field has grown and evolved in an international stage. In order for this to happen we must take a look at what engineering students around the world are doing and compare this to what Worcester Polytechnic Institute does as grounds to base different approaches off of.

Blended learning as a combination of multiple approaches in learning has the reputation to have a high impact on education of future engineers. (Eisenberg, 2008) It is important for students to have an innovative, international background in order for them to succeed in today's marketplace.

## Chapter 2: Literature Review

There is a wide variety of different ways that engineering is taught to students in the US. Most systems use a progressive class by class learning system to teach technical skills to students. There are also a number of project oriented programs, such as senior projects, that many schools either require or give the option of completing. A less number of schools give the option to study internationally in a pure engineering sense. This may be something that puts other schools ahead of the curve as universities try to add innovative curriculum to attract students.

There are some current international techniques which are innovative to the field of education. The first of these are classes that are taught by three different schools in conjunction in a course called Global Project Development. This project oriented course brings together the Technische Universität Berlin, Berlin, Germany, the Seoul National University, Seoul, Korea, and the University of Michigan, Ann Arbor, USA. These schools interact using small international groups that collaborate over the internet on projects. These projects move through every stage of a normal project development from creative generation all the way to creating a prototype. This is an example of both blended learning, intercultural and project oriented learning.

One technique that's coming into use are the different accreditation techniques. It is important to the quality of the engineering society that accreditation systems are compared on the criteria they use. One area of the world that's moving to step up the value of their accreditation system is that of Latin America where countries like Argentina, Brazil, Chile, Columbia, Mexico etc. so that the skills and characteristics taught here can be compared with those taught in other

areas of the world. This is innovative because mutual recognition is an important step in the growth of engineering at a worldwide level.

Another interesting revolution in education is when institutions collaborate to bring education to more people. In one instance faculty from Massachusetts Institute of Technology and Cambridge University combined to create the Alfaisal Engineering Program Committee which helped design programs for Alfaisal University which is located in Riyadh, South Arabia. This university will offer programs in engineering, science, medicine, and business with the goal to help serve the global community. This high quality education and research oriented facility was not available to the national community or Middle Eastern industry before this time.

Partnerships between the students and the industry can also come up with rewarding results. This gives the students a chance to solve real world problems and boosts enthusiasm. In one example the students at Ohio State worked with officials the Village of New Albany and Jefferson Township, Ohio to redirect floodwaters from a residential neighborhood. This type of partnership rewards both the academics and the industry.

There are a few programs that are focused on China in particular. Kettering University has created The China Business Tour sponsored by its Department of Business in order to learn more about China. The professor, Dr. Norman Irish, took seven students to China on a business trip in order for them to learn more about the country and its people. This trip helped the students to become aware of the highly influential country that contains 1.3 billion people. The president of Kettering University, James E.A. John, has also signed an Academic Cooperative Agreement between Kettering University and Jilin University in China. This agreement allows the universities to begin setting a framework for the production of an Undergraduate Mechanical



Engineering program. After students whom are proficient in English complete two years of study in Jilin University they can transfer to Kettering University where they complete their full degrees alternating 15 months of coursework and 15 months of actual cooperative work experience.

Georgia Tech also has a focus on the importance of Business and Technology in China. Georgia Tech runs different programs that relate directly to the business world in China. The first of these is within the Georgia Tech Ivan Allen College. This is a language for business and technology in China for 6 weeks with the host university Shanghai Jiaotong University. This program lets the students learn Chinese in a Chinese environment which gives them skills to enhance their job competitiveness, learn the culture and get a feel for the business that exists in China.

The second program is the China summer program at Georgia Tech that exists between two cities, Tianjin and Shanghai. This is an opportunity for students to earn credits in seven different courses consisting of science, engineering, humanities, and social sciences. Chinese language courses are included, but there are no credits awarded. This program is in partnership with Tianjin University and Shanghai Jiaotong University.

Georgia Tech's Supply Chain and Logistics Institute also have a Center for China Logistics. This research center is currently "developing an in-depth knowledge of transportation and logistics infrastructure in China, warehousing and distribution practices in China, the role of micro wholesalers and distributors on last mile delivery in China, and challenges for multinational corporations to operate long haul road transportation in China."(<http://www.scl.gatech.edu/research/china/chinalogistics.pdf>) The process of understanding of

the logistics and supply chain complications and developing an effective management strategy will impact the economies of both China and the United States.

The current techniques that are practiced give students an advantage over their peers in the marketplace. Students who complete these innovative international projects or classes have unique skill sets that make them more desirable to employers. This gives these students the advantage straight out of college.

### Chapter 3: Methodology

It is the goal of this project to identify and learn from the different forms of engineering education that exist and compare them to what WPI's China Project Center currently has in use. The identification of this goal was the first step towards completing this project.

The next step in this project is to research what other types of innovative engineering education systems exist and how they compare to what WPI currently does. This is done through the literature review section of this project and gives us a basis on how to gauge the current practices at WPI.

The next step is to identify and study what WPI's current center is doing and has in place. Giving a definition and overview of what the WPI China Project Center is currently doing will give us a better understanding on how they compare to other education systems we have researched. This is not only done by taking the definition of the center but also by analysis such as interviews and surveys.

The final step is to identify what innovative educational techniques are effective at this moment and how they compare to what the WPI China Project Center is currently doing. In this way we can easily see how advanced the center is. Overall we should be able to use this step by step process to identify the strengths and or weaknesses of the current practices in use.

# Going about the Project

Define goals and Ideas for the project

Research what other types of innovative education systems exist

Study What WPI does in international education

Identify the best or different ways to be innovative in international education

Figure 1: Methodology

## Chapter 4: Current Practices and Differences

The current project system at Worcester Polytechnic Institute differs from other innovative forms of learning in a few different ways. Every single student at WPI must participate in a project within their major in order to complete their degree requirements. “The Major Qualifying Project, or MQP, this project should focus on the synthesis of all previous study to solve problems or perform tasks in the major field with confidence, and communicate the results effectively.” (<http://www.wpi.edu/academics/Projects/index.html>)

The specific project that this report is centered on is the China Project Center with Co-Directors Professor Yiming (Kevin) Rong and Professor Amy Z. Zeng. First established in 2005, the mission of this project center is laid out clearly in a mission statement:

The mission of the Center is committed to providing education and project opportunities that focus on:

- Applying technical knowledge to solving real-world problems;
- Developing capabilities to work effectively in multi-cultural teams; and
- Creating new ideas and identifying new alternatives based on technology.

We emphasize:

- Working/living in a multi-cultural environment
- Partnering with multi-national companies
- Identifying projects with a strong technical focus
- Understanding cultural impacts

The China project center has been able to establish partnerships with five different technological universities in China: Huazhong Univ. of Science & Technology, Southeast University, Beijing Jiaotong University, Shanghai Jiaotong University, and Shanghai University.

Each project that is done by the China Project Center is done through a two phase process. The first phase of this project is the preparation time that is given before the project is actually started in China. This seven week, part-time, preparation period is completed on campus. There are weekly written reports with online communication between the WPI students and the partner students in China. There are two objectives that are to be completed during this time. The first deals with the project itself, understand both the sponsor and the problem at hand and study literature in order to develop a project plan for the upcoming time spent in China working on the project. The second objective is to start communications and build a sense of camaraderie between the different members of the teams.

The second phase of this project is the time spent in China working on the project itself. This is seven weeks spent full-time working on the project. There are weekly meetings and reports. There are not only the technical aspects to overcome but the unfamiliar environment. There is also the challenge of managing a team whose culture can be unfamiliar and dynamic. The final goal is to produce final presentations to both the sponsors and the partner universities.

There is a systematic and integrated defined 10-step cycle that is followed throughout the project. There are revisals that happen however the project must move through every step in order to be successful. They are as follows, 1. Problem Identification, 2. Problem Statement, 3. Project Goals and Objectives, 4. Project Methodology, 5. Literature Review, 6. Information and Data Collection, 7. Data Collection, 8. Recommendations, 9. Pilot Study or Implementation Plan, and 10. Presentation and Report. This process is very similar to the Six Sigma DMAIC framework. The project is Defined, there is problem identification and the problem statement is built with the help of goals, methodology, and literature review. There is a Measurement portion while data and information is collected. The data is then Analyzed before any conclusions can be

made. Then Improvements are put forward as recommendations and through implementations plans. The Control portions of DMAIC can be found in the documentation of the report and the presentations.

In this project there was a survey conducted to poll the student's reaction to the projects that they participated in. Each question was formulated to get an overall feel for their experience as a whole. The specific group that was polled was those that participated in their MQP during the summer of 2008 working with Chinese students in China on Industrial Engineering and Manufacturing Projects. The survey and its results from the eight students are as follows:

On a scale of 1-5, 1 = strongly disagree, 5 = strongly agree: Answer the following 8 questions.

1. Do you feel that you have had a unique learning experience?

5:8    4:0    3:0    2:0    1:0

This question talks about the experience that all eight of the students shared. In my case I answered a strongly agree and felt that it was very unique. My peers agreed with me and felt that the experience we had was one that was unlike something we could have received somewhere else.

2. Will you discuss this experience at interviews or with other peers?

5:6    4:2    3:0    2:0    1:0

I answered this question with a strongly agree as well. I already have discussed it with peers and I for see discussing it with future employers. The project is something that I will not forget easily and I believe this is shadowed in the answers of my classmates.

3. Was this experience an example of something that you would expect to do during your career?

5:2    4:3    3:2    2:1    1:0

This question I answered with an agree. I did agree that the work that I did would have fallen in with what I would like to do; however, I would not be disappointed if my career didn't reflect what I did in my project. This question's average answer was 3.75 with students who felt that the experience directly reflected the career they would like and some who disagreed that it would be part of their career.

4. Do you value this experience more than you would class work?

5:7    4:1    3:0    2:0    1:0

This question was very close to unanimous with seven out of eight students answering that they strongly agree. This experience was not only more educational and more of a life experience than class work but it is something that can be used later on. I foresee being able to use this experience during interviews and on resumes in a way that class work does not compare.

5. Would you recommend this project center to other students?

5:8    4:0    3:0    2:0    1:0



Every single person would recommend this project center. Each person took something away from it that they would like another student to have the chance to experience for themselves. In my case it was not only the culture and location that would make me recommend it but the interaction with both other students and a company while doing something that I hope my career will be centered on.

6. Do you feel this experience was different from what other college students experience?

5:8 4:0 3:0 2:0 1:0

This question was also answered with everyone answering that they strongly agree. The WPI project system is unique in the first place; however, this center takes it to the next level by not only partnering with international students but companies working out of another country.

7. Are you proud of your work at this project center?

5:7 4:1 3:0 2:0 1:0

Seven strongly agrees and one agree shows that the work done while at the project center is something that everyone was proud of. This is reflected upon the advisors from both the schools and the companies that made this project not only a unique experience but a success in the eyes of the students.

8. If you knew how it would turn out would you do it again?

5:6 4:2 3:0 2:0 1:0

Everyone agreed that they would do it again with six of eight of the students strongly agreeing. This experience is something that I would not hesitate to do again knowing the outcome.

9. Are there any other comments that you would like to make about this project center?

The results from this survey are very informative. The most striking result is that all eight students strongly agree that they had both a unique learning experience and that they would recommend the project center to other students. The only question that had any disagreement from a student was the question of whether or not the experience was something that they would expect during their career. Some projects that were centered on the major of a student but not specifically the career path that the student may have wanted this can be accounted for. Each question can be looked at in a different way; however, it is very telling that the project center is both innovative and educational in the fact that all these students felt strongly about their experiences.

There are other schools that do similar things to WPI. If we take a look at Rensselaer Polytechnic Institute they also have projects for some of their majors. These projects are bound by the type of major or school that the student is in and is not affected by the rest of the student body. These projects must be approved by the school or major they're in; however, they do not always count for three classes worth of credits. These projects also have no requirement to be carried out with teams or companies. In comparison to the China Project Center these projects lack the focus of a real world problem brought on by the companies themselves. In an interview conducted with a RPI graduate there was almost no mention or emphasis on the projects that take

place compared with the experiences of WPI students. There are projects at RPI that deal with partner schools or companies, however these are rare and the combination of the two is almost never seen. This is just another reason why the experience at the China Project Center at WPI is so unique.

## Chapter 5: My Own Experience

I'm adding this chapter because of the unique experience that I was able to have while I was abroad doing my MQP with the China Project Center. In this project it was our goal to identify ways in which Nypro China could reduce its impact on the environment while producing a cost savings. While observing the company's green initiative we took a number of steps to identify waste streams within Nypro China. Each of these waste streams: Resin, Water, and Electricity all yielded a cost savings through short-term and long-term goals with the company. These goals were realized with the use of the Six Sigma: DMAIC process to help Nypro China reduce its impact on the environment and produce a considerable cost savings.

The project itself wasn't the only thing that was interesting it was the experience I had there while I did the project. There are experiences in life that live on in memory and will not be forgotten. My time in China cannot be categorized as just one memory but a string of memories that I will always carry with me. I remember landing in the international airport in Shanghai watching a worker in a traditional straw hat sweeping around the edges of the runway. At that moment when my partner and I were taking our first glimpses of the Chinese culture that there would be a lot more experiences to come. I can also say that when my flight to the United States was taxiing towards the runway I took one last glimpse at another identical worker trying to contain all the memories I had accumulated over 7 weeks. These are some of my most memorable thoughts while in the Peoples Republic of China.

There are about 1.4 billion people in China. I can say that I didn't see .1% of the population; however, I have a great respect about how so many people can live in unison. At first I was slightly put off by the fact that there were so many people and it seemed as though

someone was always within sight or bumping past you. Although as I observed everyone and watched more closely I began to have a deep respect for how so many people could live such a small space. If America ever became so saturated with a population I don't know if everyone could live in such a peaceful existence. I was amazed that everyone had adapted to being squeezed together, something that would cause many people to become agitated by having their personal space invaded. I was also amazed at how China has adapted the workforce so that more people have jobs by creating jobs that would not exist other places in the world. China has a lot of people; however the people know how to live in conjunction with one another.

The simple act of eating is different in so many cultures. As an American, eating out is something that is done on a somewhat regular basis. When you're with a group of people everyone usually has their own meal and in large groups it's hard to talk to everyone at the same time. I believe that China has made the act of going out as a large group a lot more unified. First of all going out in a larger group usually means you have your own room. Second everyone doesn't order their own meal but dishes are selected for the group as a whole. The circular tables all have a "Lazy Susan" (a glass rotating platform that all the food is placed on). This not only helps distribute the food which is shared between the entire group, which is taken piece by piece, but stimulates conversation incorporating the entire group. Small side conversations still happen but overall it seems easier to hold a conversation as a larger group. Through the act of sharing an entire meal and always facing everyone at the table I believe that groups are more easily brought together while dining in a Chinese restaurant.

When people think about communicating they usually think about language. I expected to meet people who couldn't speak English in China. I'm in their country; I don't expect them to know my language. What did amaze me was how people manage to communicate even when

the common language they know is very little. While simple words of Chinese and English were always exchanged it extended past that with gestures and some imagination. Drawing pictures or spelling out a word was not uncommon. Problem solving was a major asset; in one instance, combining two types of goods, a plastic cap and a tea cup let someone know I wanted a plastic cup. I also found myself intrigued by how I could read what people were saying. Being the only American in my group my partners would talk in Chinese about things all the time. A good amount of the time I would have an idea of what they were talking about and they seemed amazed when I would ask a question about that idea before they had explained their conversation. I believe that the communication between people extends far further than just language.

Overall my time in China was not just a senior project, it was memories that I will carry with me forever. I hope that one day I have the chance, whether it is business or pleasure, to return to China. I'm very thankful for the opportunity that I had to visit a place that differs in so many different ways from my home. I don't just see this as an experience either but a tool that I can use moving forward in my career. This sort of holistic learning is valuable in its own way.

## Chapter 6: Conclusion

In conclusion this project defined different types of innovative education that exists today in the field of engineering education. Working with other students at different colleges, in teams, with different companies, and learning to experience different cultures. These innovative ideas have helped evolve engineering education and push it out of the classroom.

While there are a number of universities working to use some of these ideas in their learning it is rare to find one that does all of them. The China Project Center at WPI has successfully integrated all of these innovative ideas into one project that is fundamental in helping boost a student's career. This combination of real world experience and holistic learning has shown to be very innovative in the category of engineering education. Employers will be attracted to these qualities and will have an edge over students whom only have class room knowledge.

It will be interesting to see how long it takes before the majority of other universities adopt similar innovative ideas. When or if these ideas become the norm, what will the next generation of new ideas look like? Hopefully it will be the engineering students of today coming up with the innovative ideas that will push engineering education into the next generation.

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