

# Globalization of Engineering Design Projects

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**ABSTRACT:** *A Capstone Design Project is an important component in engineering education. Students pursue this project during the last semester of their undergraduate studies. Through the Capstone Design Project, engineering students are exposed to the process of developing new products. They are guided through each phase of the creation process including designing, building, and testing as well as marketing. The purpose of this project is to give the students hands-on experience in solving "real world" engineering problems. Those projects are normally done by individual students or a team of students addressing a problem for local industry.*

*The authors of this presentation have developed a website allowing engineering students from the entire world to create multinational teams and work together on engineering design projects or any other undergraduate research project. The website will enable engineering students to cooperate on international teams during the completion of the Capstone Design Project. This concept will allow the students to be exposed to the global aspect of the engineering profession through experiencing different work methods and being involved with foreign industry. Future engineers working on multinational teams will develop the appreciation and skills for multicultural communication. Students will be able to compare their preparedness for the engineering profession with team members in another part of the world. This project will also familiarize the students with the technical problems and challenges in the world. After experiencing successful cooperation in cross-cultural teams, students will continue to pursue international projects and further their involvement with foreign industry.*

## 1 INTRODUCTION

The world is becoming a smaller place because of the ongoing process of globalization. People are exchanging information in a matter of seconds between countries thousands of miles apart. The Internet has enabled people from around the world to communicate efficiently and exchange large amounts of data almost instantly. Improvements in transportation have made worldwide travel affordable for many people. Many companies have decided to reach out for new customers abroad. This process has also taken place in the field of engineering. In order to become competitive in a multinational environment, engineering companies need people familiar with foreign languages and cultures. As a consequence of this demand, more students need to become educated at the international level. A great way to learn to interact on multinational teams is by being exposed to people from other countries. Through international cooperation, students gain a different perspective on their field of study and refine their ideas.

During the last semester of engineering undergraduate studies, students pursue the Capstone Design Project. They are exposed to every step of the process of creating a new product. Future engineers gain hands-on experiences in their field through solving "real world" problems for the local industry. This program has become even more beneficial by placing students in multinational teams with members located in different countries. It is an opportunity for students to become involved in international teamwork and broaden their horizons through experiencing foreign languages and cultures. Team members are able to share their academic experiences and knowledge with students from different backgrounds. While pursuing the project students have the opportunity to address problems encountered by the foreign industry.

To successfully complete the project and solve the problems that come about during the process, students need to communicate, exchange information and ideas. The most appropriate medium to enable that interaction is the Internet. It allows students to exchange ideas and have real-time group discussions online. Students are able to communicate efficiently without having to pay long-distance phone bills. Working on every-day group projects in class, engineering students often choose the convenient method

of communicating through the Internet. Thanks to that powerful medium, students thousands of miles apart can easily interact, and exchange ideas with each other.

## **2 ADMINISTRATION AND FUNDING**

Penn State Hazleton by being one of the branch campuses of a major university offers freshman and sophomore years of an engineering program, as well as, three associate degree engineering technology programs. Those programs are:

- Mechanical Engineering Technology
- Electrical Engineering Technology
- Nanotechnology

The engineering technology curriculum at Penn State Hazleton is in the process of being reinvented with futuristic goals for achieving the following attributes

- Industry driven flexible curriculum which reflects the current needs of industry.
- Industrial “real world” experiences which will be incorporated into the engineering technology curriculum.
- A “real world” capstone design project which will be part of the curriculum.
- The international aspect of engineering technology which will be included in the curriculum.
- An international team building concept which will be included in the curriculum, that is, a capstone design project which can be done by Penn State students working as a team with engineering technology students from different countries.
- Some courses in the engineering technology curriculum which could be delivered by using a web-based delivery mode.

The hardest objective to achieve has proven to be a student introduction to an international team building concept. In order to address this issue, the concept of an international design project has been developed. An appropriate website was also developed and attached to the Penn State Hazleton website.

The “real world” design projects are not a new concept for Penn State Hazleton. Industry sponsored design projects were initiated ten years ago. Very positive outcomes from those initial projects have increased the commitment of local manufacturing companies to do additional projects with Penn State Hazleton. Some companies started to financially sponsor those projects. At the same time state sponsored funding agencies have been identified. The procedure for initiating each project has been very similar. After Penn State Hazleton was contacted by a prospective client, a preliminary meeting was arranged with an engineering faculty member and the company. Those meetings were usually held at the company’s site. During those preliminary meetings, the degree of involvement of Penn State Hazleton was discussed, and a tentative budget was also developed. After the cost of the project was determined, the appropriate funding agency was contacted. Depending on the nature of the project, those agencies were either the Ben Franklin Partnership or the Northeastern Pennsylvania Industrial Resource Center.

Once a funding source was identified, the formal funding proposal was submitted. The funding proposal was prepared and submitted by Penn State Hazleton in conjunction with the manufacturing company. Most state funding agencies expected the company to provide at least a 50% matching (cash) contribution for the total project. An in-kind contribution was also expected. After the funds were approved, the funding agency prepared a three-way contract between Penn State Hazleton, the funding agency, and the client (manufacturing company involved). After the contract was signed by all parties, the project was announced to the students. The state sponsored funding agencies required a confidentiality agreement to be included in each contract. This confidentiality agreement was to be signed by the faculty involved as well as the students. The students received financial compensation for their work on a biweekly basis. Upon completion of the project, Penn State Hazleton invoiced the funding agency and the company for the cost of the entire project. The cost of the project included 8.6% for fringe benefits. In addition to these costs, materials, supplies, cost of building and testing prototypes were added to the cost of the project. The money in the budget was spent to cover the direct cost of the project.

This is the first year that the concept of an international design project is being explored. Funding is not being considered because of the confidentiality and government related issues. During this academic year the concept of the international design project was created and a website was also developed. There were a couple of students from Poland who took advantage of this opportunity. During the next academic

year we are expecting students from India, China, and France to become involved. Personal contact between the Penn State Hazleton engineering faculty and the engineering faculty from other countries is expected to be an effective way to encourage students to get involved. The website will be helpful after the initial contact is established and students from different countries become aware of its existence. During the summer months, May through August, the topics for the international design projects are being identified. A number of manufacturing companies in the area are contacted to identify “real world” technical problem to be used for the international student projects. The company has to agree in writing to have the project posted on the web. In September the proposed projects are posted on the web. Students from different countries can view them and make a commitment to become part of the team. The drawings are to be done on AutoCAD which was found to be the most commonly used CAD software. Free hand sketches can also be scanned and sent electronically. All discussions between students are done in email form. Engineering faculty members who mentor the projects receive a copy of the correspondence and act as facilitators. If needed the company who initiates the project (client) can be contacted. Most of the time the company is asked to review the different versions of the design and select the one that they feel would suit their needs. The project is to be finalized and technical documentation is to be submitted by the end of the Fall Semester. Some projects may last for the entire academic year.

### 3 CONCLUSIONS

International design projects are a rewarding experience for engineering and engineering technology students. Engineering faculty who are mentoring the project may need to intervene and act as a facilitator. This concept can be time consuming. Based on our short experience with international design projects, the following recommendations are being offered:

- A personal contact between engineering faculties from different countries can be an effective way to increase student awareness of the opportunities.
- Engineering faculty mentoring the projects must be involved in email discussions between students on an ongoing basis.
- There will be opportunities for companies outside the United States to post projects on the web.
- Not all the projects may produce satisfactory results for the company. The company should be made aware of that and sign a liability release statement.
- Nobody gets paid for their work, neither students nor faculty.

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