Developing Design Skills in a Global Learning Environment

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1. Introduction

Engineering design has undergone drastic changes over the years, including improvements in design visualization, design methods, and instrumentation. In this competitive, global economy, a product may be designed by engineers from several countries around the globe. Differences in cultural background and work attitudes must be understood by all parties involved in order to develop an effective design. For example, the various parts of an automobile can now be designed in different parts of the world. Since the product parts are being designed and manufactured at different locations, it is necessary to coordinate multiple design requirements. When local companies begin their conversations regarding a part to be designed and manufactured, they need to have a strong mutual understanding of each other's personal and professional manners to have a better working relationship. Moreover, if they are from different parts of the world, they also need to understand each other's cultures, work ethic, and working under those companies limited available resources. This paper describes efforts and ongoing research in developing design skills in future engineers, preparing them to be successful in a global learning environment.

Today's world is competitive; globalization of business activities blends different languages, customs, engineering knowledge and marketing skills [1]. Many companies are now launching products in foreign markets to be accredited worldwide. The products launched are tailor made to suit the customer's society and culture. The companies are now expanding locally and globally as well which can require international partnerships in design and development. Consequently, these companies are on a look out to collaborate with international companies who can help design and manufacture products that are reliable and cost effective. At each company, normally there are talented people such as engineers, businesspersons, managers, executives all with different perspectives who have excellent communication skills and skilled in their area of expertise. Such companies are able to prosper when colleagues can communicate effectively and efficiently. For international partnerships, it is possible to collaborate properly when they understand each other's culture and background. One may question the reason for a part being designed or manufactured at different locality. The answer is simple; companies now look for other companies anywhere in the world to help them develop products, which are profitable, reliable, and of good quality.

The best way to learn one's culture is by sharing the principals of that respective culture, and in doing so, develop a sense of professional closeness. As Fairleigh Dickinson University President Michael Adams emphasize, "One cannot truly understand the subtleties of another culture without first having been a part of it." It is this vicarious immersion in culture through discussion that allows engineers to understand, respect and develop a feeling for different cultures, and thereby develop an effective working relationship. This global learning as applied to design skill and development is a continuous evolving process that is being implemented into present educational curriculum [2]. Integration of global learning into the senior design course is a stepping-stone for the mechanical engineering (ME) students at Wichita State University (WSU). This will create an international awareness within the students and thereby help them to compete in a global economy.

A method to understand these cultural differences and global perception is based on a communication metaphor of "cage painting". It involves sharing of personal experiences, values (trust, relationships, interpersonal space, and including punctuality,) and ethics (behavior, moral duties, and virtues) [3, 4]. Figure 1 shows a virtual form of cage painting. It is an invisible cage [5] where communication takes place between people of different origin. The bars of the cage represent the personal attributes; for example, one such bar characterizes punctuality, which in one culture is important and not so important in another culture [2]. Cage painting simulation [4] was developed to help students understand the essence of global learning. The software simulation program has a series of situation-based questions with different answers; the student has to choose the best answer that is agreeable with a person of different culture

on the other end. In this simulation, successful communication is represented by the invisible bars of the cage becoming visible.

2. **Implementation of Global Learning Approach**

Global Learning was implemented in the senior design course (ME662) in Fall 2004 under Dr. Kurt Soschinske, ME department, Dr. Glyn Rimmington, Boeing Distinguished Professor of Global Learning and Dr. Mara. Alagic, Curriculum and Instruction department. The plan was to amend the curriculum by introducing global learning concepts systematically. The initial step was to establish the need for global learning within the engineering arena. A presentation was given by a globally-involved aerospace company executive explaining the importance of global learning [2]. The next step in demonstrating global learning was introducing students to the "cage painting" metaphor as it applies to global learning environment [4]. It was demonstrated through sessions conducted by Dr. Rimmington. Cage painting simulations were conducted in the College of Education technology lab in Corbin Hall,

Figure 1: Demonstration of Cage Painting [6]
PE - Personal Experience, V-Values, and E-Ethics

WSU. The next experience was provided using Polycom videoconferencing equipment and laptops provided by the Global Learning grant resources [7] for "mock" live connections between ME662 and WSU international students. Finally, cage painting simulations would be conducted through live connections with international schools.
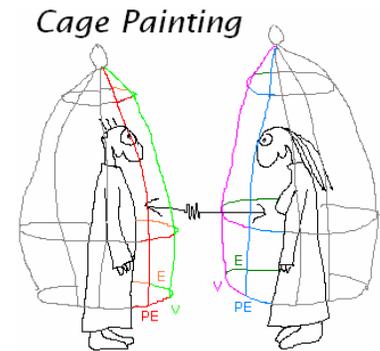
In the year 2004-2005, most of the technical groundwork was laid. Discussions on global learning and cage painting were introduced. Mock practice sessions were arranged; topics such as personal background, hobbies, and work ethics were discussed. However, technical difficulties occurred such as voice breakup, and other visual disturbances. It was found that computer memory (RAM) had to be upgraded for smooth operation of audio and video. The Polycom software was also installed in the newly developed ME global design lab. The lab is equipped with the desktop PC containing high-end hardware configuration and clocks showing time of different parts of the world. Later in 2005, the senior design class students also experienced cage painting simulations at Corbin Hall WSU under Dr. Rimmington and Dr. Mara Alagic. A first international connection was conducted between WSU and Indian students with one of the engineering academic institution in India. Some of the questions put forth were "What are your technical passions?", "What kind of research work is done?", "Which software are you familiar with?", "What kind of games do you play?", and "What do you do in your leisure time?" During this interaction, other technical difficulties such as freezing of the video, unclear voice were experienced due to low network bandwidth in India. This work led the basis for students understanding communication skills involved with people of diverse culture.

In 2006, the entire group of ME662 students will have the opportunity to interact with group of international students. The connection with Indian institution will be expanded for multiple sessions with students. Currently one of the groups are working on a project sponsored by a Russian aerospace company. Students are again prepared for this experience by participating in cage painting simulation. As a result, this approach is a continuously changing process to help train WSU mechanical engineering undergraduate students to compete in a global economy.

3. **Conclusion**
- The world is getting connected and in order to broaden this connection it is necessary to create international awareness through internet-based videoconferencing.
- The motivation for global learning was to provide the students a taste of the cultural backgrounds, work attitudes with students and faculty living in different countries having different cultures.
- Ongoing research is carried through in order to inform researchers and revise the approach to developing engineering design skills for today's technologically savvy and globally connected world.

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