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ESTRATEGIAS PARA EL DESARROLLO DE PROGRAMAS DE TECNOLOGÍA COLABORATIVOS INTERNACIONALES

STRATEGIES FOR THE DEVELOPMENT OF COLLABORATIVE INTERNATIONAL TECHNOLOGY PROGRAMS

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RESUMEN

La era actual de la globalización se caracteriza por un flujo sin precedentes de información, ideas y valores a través de fronteras y culturas nacionales. Aunque se espera que el efecto neto de la globalización aumente la estabilidad política en todo el mundo, el descontento resultante del aumento de las disparidades económicas regionales resultará en una mayor volatilidad de aquellas no elevadas por la marea creciente. Se necesitará un liderazgo global para abordar estas regiones con desafíos de desarrollo, muchas de las cuales también son desafiadas por los recursos y pueden ser susceptibles a los efectos del cambio clima en el futuro. La influencia de las ONG internacionales y de las corporaciones, que ahora constituyen 13 de las 50 economías más grandes del mundo, destaca el papel de los actores no estatales en el liderazgo global en el siglo XXI. Este artículo presenta las experiencias pasadas del autor en el desarrollo de programas internacionales en la Universidad Estatal de Penn en la preparación de los estudiantes para liderar en la nueva economía global con un sentido agudo de la conciencia global y la fuerza de carácter moral. Además recientes experiencias en Cuba en la escuela de diseño y construcción de botes adopta similares enfoques que son introducidos.

Palabras clave:

Liderazgo, cultura, marina, tecnología.

ABSTRACT

The current era of globalization is characterized by an unprecedented flow of information, ideas and values across national boundaries and cultures. Although the net effect of globalization is expected to increase political stability worldwide, discontent resulting from widening regional economic disparities will result in increased volatility from those not elevated by the rising tide. It will take global leadership to approach these developmentally-challenged regions, many of which are also resource challenged and may be susceptible to the effects of climate change in the future. The influence of international NGOs as well as that from corporations, who now constitute 13 of the world's 50 largest economies, highlights the role of non-state actors in global leadership in the 21st century. This paper presents the author's past experiences developing international programs at Penn State University in preparing students to lead in the new global economy with a keen sense of global awareness and strength of moral character. In addition, recent experiences in Cuba of the Landing School of Boatbuilding and Design, adopting a similar approach, are introduced.

Keywords:

Leadership, culture, marine, technology.

INTRODUCTION

Globalization has quickly flattened barriers to enterprise and collaboration. Technology projects are now carried out collaboratively 24:7 across time zones and continents and technology graduates must possess skills not present in 20th century curriculum (NAE, 2008). The effect of globalization on flattening cultures is less clear. Preparing technology students to lead and be led across cultures requires introspection to identify and remove existing misperceptions and an empathic engagement to promote understanding of others and the development of a more hygienic worldview.

Some of the most desirable technology career paths now have global trajectories, and global awareness alone will not provide students with the critical skills necessary to enter and succeed in the highly competitive global playing field. Although graduates from the best schools in the United States (US) are still highly prized by international organizations in the private and public sectors, the relatively weak foreign language skills of US students places them at a disadvantage with respect to, say, graduates from top programs in the European Union (EU). In addition, EU graduates frequently leverage programs like Erasmus and joint international degree programs to gain significant cross-cultural experience prior to graduation. It is against this cross-cultural competition that in 2005 Penn State's program began to strategically focus on providing students with the critical international collaborative skills to enhance their already strong technical skill sets and prepare them for global careers.

Curricular Approaches

- Cross cultural teaming, either virtual teaming supported by technology or collocated teaming during international travel requires significant preparation. Literature regarding student service learning indicates that students who are insufficiently prepared for cross-cultural experiences whether international or domestic may reach incorrect and sometimes racist conclusions about the people and communities with whom they work (Hondagneu-Sotelo & Raskoff, 1994).
- Beginning in 2005, the author developed two opportunities within the engineering leadership development program at Penn State for US students to directly engage with students from other cultures: (1) Leadership Innovation and Global Challenges (LIGC); (2) International Leadership of Enterprise and Development (ILEAD). Both courses required a Global Engineering Teams (GET seminar) seminar in the previous semester as preparation.

GET seminar

- The GET seminar uses cognitive approaches to the development of global knowledge to help students forge a solid foundation in their understanding of the dimensions of culture and communication. The course focuses on developing a keen understanding of the dimensions of culture and communication; students are trained to think like cultural anthropologists, becoming aware of cultural elements around them and observing communication styles. Although most students at Penn State are from the mid-Atlantic region of the United States, and demographically the University is located in what may at first appear to be a mono-culture (i.e. predominantly Caucasian, middle class, etc.), students become keenly aware of regional cultural differences even between the Pittsburgh region in the west and the Philadelphia region in the east through critical observation, discussion and analysis. Communication levels and styles are explored and the course ends with a module on negotiation

LIGC

- LIGC students would begin the spring semester (following the GET seminar) with a 6-week venue-specific preparation for their visit to North Africa to collaborate with students at a partner university, L' École Mohammadia d' ingénieurs. This preparation included the pragmatic learning of spoken colloquial Arabic to promote confidence and display respect as well as exploring cultural, religious, geopolitical and social justice issues.



Figure 1. LIGC program featured in the 2010 Penn State College of Engineering magazine.

DEVELOPMENT

During their time in North Africa, students would live with host families in the old city, many of whom spoke no English, and study leadership and innovation in the context of resource management and engineering with their North African engineering peers. Approximately half the academic day was spent in lectures, the other half on field trips or field challenges (students working in multicultural teams to solve challenging engineering-related tasks).

The course sequence focused on promoting intercultural understanding, raising global awareness, and developing leadership skills and innovative thinking with respect to engineering design in order to better meet the challenges of the 21st century.

ILEAD

- ILEAD pairs Penn State engineering students in virtual teams with business students at Corvinus University in Budapest, Hungary, and more recently with students from Taibah University in Medina, Saudi Arabia. Students collaborate during formal scheduled in-class meetings using classroom Polycom™ videoconferencing, and outside of class using personal Skype™ accounts. Projects are real-world and clients on past projects have been located in the Central Europe, Africa, the Middle East, Central Asia, South America and the Caribbean. The Hungarian-Saudi-American student teams deliver their final presentations in Budapest. Students report increasing value from this international sequence, and significant enhancement to their global skill set (Schuhmann & Zappe 2008).



Figure 2. ILEAD program featured in the 2011 Penn State College of Engineering magazine

As an example, projects in the 2007-2008 academic year included: (i) engineering design and return on investment analysis of a rainwater catchment system to serve a community of mentally and physically handicapped young adults in Jamaica, West Indies; (ii) engineering design and fabrication of finger protectors for a women's agricultural cooperative in Tioute, Morocco, as well as a supply chain analysis for exporting the product – Argan Oil – to buyers in the the EU and USA; (iii) engineering design, fabrication and testing of methods for Baobab pulp separation and seed decortication, and a market analysis for the sale of pulp in the EU and USA, for clients in Benin, West Africa.

These projects result in physical objects and/or detailed engineering design, as well as emotive experiences; the teams hone their engineering and business skills, learn new cross-cultural methods, and experience the feeling

that accompanies having made a difference. Placing engineering within this type of human context is especially significant if programs wish to promote racial and gender diversity in the class (Malcom, 2008).

Some projects from the ILEAD course evolved into stand-alone projects. The publicity from the 2007-2008 baobab project resulted in a small women's cooperative in the northern Benin town of Natitingou reaching out to request support in developing a mechanized solution to the separation of baobab pulp and seeds. Over a two-year period, student teams prototyped and tested solutions on-the ground in Natitingou.



Figure 3. Natitingou baobab project featured in the 2012 Penn State College of Engineering magazine

The Penn State students who worked on the baobab project were afforded a remarkable learning experience while valuable technology was transferred to the cooperative. Through mechanization, workers at the cooperative were able to dedicate time to refining and packaging commercial quantity and quality product appropriate for the EU market. Combined with their biologique certification, the cooperative was transformed in to a thriving global enterprise, and in 2016 received global recognition for their evolution.



Figure 4. Natitingou baobab cooperative receiving an award from French President François Hollande in 2016 for "l'innovation alimentaire grâce à la pulpe de baobab biologique".

International collaboration that benefits all participating parties is possible if objectives and outcomes are clearly

defined, faculty have strong relationships, students are rigorously prepared, and the program carefully executed.

Commonality of educational objectives and outcomes

The broad educational objectives and outcomes for these international courses appear in the table below (Schuhmann, 2010).

<p>Ethical awareness and conduct <i>Students will be able to recognize and address ethical challenges, and seek, understand, and resolve differences among stakeholders in decision-making processes.</i></p>
<p>Self-knowledge and awareness - Character <i>Students will understand personality and temperament, recognize common global character traits, understand the value of introspection and reflection in leadership, and demonstrate high standards of behavior.</i></p>
<p>Enhanced global awareness/world view <i>Students will have a an informed and contemporaneous view of the world, be aware that diverse talents and expertise reside in all parts of the world and that its peoples and nations are strongly interconnected, and be able to prognosticate based upon their knowledge of history and current events. Students should understand the roles the United States plays in the world and how diverse peoples view the United States and why.</i></p>
<p>Enhanced appreciation of cultural diversity <i>Students will understand the achievements of diverse peoples, be sensitive to cultural differences, and comfortable with alternative world views and diverse ethical principles. They should display inclusive behavior and a commitment to an equitable world.</i></p>
<p>Understanding of public policy issues <i>Students will be able to think broadly, seeing issues in a rich context of various alternatives, probabilities, and trade-offs, see engineering as applicable to problem solving in general, and understand the role of public policy in science, technology, and business.</i></p>
<p>Understanding of the role of sustainability in engineering <i>Students will understand that environmental protection does not preclude economic development and that economic development must be ecologically and socially viable now and in the long run.</i></p>

At the heart of these courses, and embedded with the above objectives and outcomes, was the intent to help students develop a deeper knowledge of the world, enhanced skills in cross-cultural communication, and direct experience in participating in positive change processes in other countries. The critical vehicle for this cultural development is promoting confrontations with student prejudices and developing their empathic abilities.

In engineering, the role of empathy has gained significant traction in the last several decades. In early empathic design literature, engineering designers, formerly encouraged to interview customers or users to determine needs, were directed to watch users interact with technology in their own environment (Leonhard & Rayport, 1997). Positive reports have arrived from industry on the effects of empathic design (Burns, Barrett & Evans, 1999). Empathic design is now being studied as a graduate engineering research topic (Saunders, 2010). The role of empathy in leadership theory can also be found in transformational

leadership (Bass, 1985), authentic leadership (Walumbwa et al, 2008) and emotional intelligence.

Pedagogical techniques

At the core of empathic pedagogy is the need to metaphorically remove students from their shoes and insert them in those of another. This removal process is also paralleled in cognitive loading. Cross-cultural preparation is often as much about removing material as it is about loading in new perspectives - like the Zen master who received a visit from a university professor and filled his tea cup to overflowing to show him he was already too full of his own opinions and dogma for any enlightenment to occur.

Students who travel to North Africa shine a light on the roots of poverty by excavating how the relationships between imperialism, globalization and climate events in the late 19th century resulted in famine and mega-death by starvation, leaving the shaken foundations of much of today's developing world. In a post-9/11 world, the misperceptions regarding Islam afford rich opportunities for challenging student worldviews. Students are confronted with the reality of extremism in the US, both religious and violent. A travel through time to see the rich history of science and engineering in Islam provides students with a new perspective on its importance to western civilization. Regional geopolitics are also visited and viewed through the dominant paradigm of the region, a lens often at odds with that of the students.

Finally, the need for post-travel reflection is as critical as pre-travel preparation. As with the physics of light, reflection provides a means by which to observe oneself and the system within which one functions. Thinking back on one's actions and thoughts, untangling paradoxes, and forensically investigating how to improve future performance, is an essential life capability and critically important for international experiences. Educators who neglect to schedule and facilitate student reflection miss valuable opportunities for student self-improvement. Consider "20%" programs implemented by innovative companies that allow employees individual reflective time to develop new ideas (e.g. Google, Microsoft, Apple) that have yielded remarkable products, and then consider how much innovation comes from knowledge workers whose every minute at work is scheduled (by non-reflective managers) in back-to-back meetings and responding to urgent initiatives.

Building A Collaborative Educational Network In Cuba

The Landing School of Boatbuilding and Design is a small technology school focused on developing in its students a deep theoretical foundation in applied technology as well

as practical manufacturing skills for the marine industry. In spring 2017, faculty and students from the School traveled to Cienfuegos, Cuba to work collaboratively in a prototype international program with faculty and students from the Remo's Academy. As can be seen in a recent video documenting achievements and difficulties (Cubanet, 2017), the Academia faces significant challenges with the state of disrepair of its boats, while at the same time developing world class athletes with the resources they have.

There is clear synergy between the needs of these two schools. The Landing School seeks to develop a broader and deeper understanding of the world in its students, and provide real-world experiences with which the students can demonstrate their skills. The Academia seeks to develop world-class athletes with a fleet of reliable high-performance boats that can be repaired by faculty and students at the Academia.

Set within the context of the vision of the University of Cienfuegos to build a paradigm of sustainable internationalization, this nascent program satisfies the pragmatic needs of both institutions while developing relationships and understanding between faculty and students of both institutions.

The 2017 program focused on building understanding between the students of these two schools, effecting necessary repairs to the racing shells, and transferring the knowledge and technology necessary to help develop the capacity of the Academia to effect repairs of their boats in the future. The Landing School faculty and students spent 1-week at the Academia, working full days with faculty and students and sharing meals.

After quickly adapting to the Cuban heat and humidity, the small group of 4 boat builders quickly engaged with the coaches and young rowers. Because the eight-man rowing shell is quite large (15 meters), multiple sets of hands were required to prepare and effect the necessary repairs. Removing old paint and wood required communication and teamwork between the US and Cuban instructors and students; a project of this scale would not have been possible to complete in a one-week span if it were not for effective collaboration.

While the primary technical focus of the project was to improve the structural integrity of the largest boat of the fleet, the eight-man rowing shell, many other valuable non-technical learning objectives were achieved. The Landing School desires to instill a culture of sustainable boat building, using locally sourced natural materials and reducing the amount of waste. The faculty and students from both schools were challenged to creatively solve problems and accomplish tasks while using the limited

available resources. The Landing School students learned valuable lessons from their Cuban experience given the resourcefulness and ingenuity for repair that one finds on the island. In exchange, the US faculty and students were able to share new techniques of boat repair, using recycled pieces of copper wire and other fiberglass material removed from boats no longer in use. The coaches at the Academia were attentive to the repair process and toward the end of the week the coaches were teaching others the techniques they had just learned. After the week there was a great sense of accomplishment at having restored the integrity of the Academia's boats. There was also opportunity for informal social exchange and for the US students to see the important and historic city of Cienfuegos.

Students of the Academia subsequently won the national championship in these boats. While credit must be given to the superior athletic abilities and skills of the team, perhaps in some small way the enhanced strength and integrity of the boats as a result of this project contributed in part to their success.

This 2017 program was very much a prototype pilot-program for what is hoped to be a long-term approach to collaboration between the Landing School and Cuban institutions in general. The Landing School and the Academia plan to run this collaborative program once again in 2018. The Landing School will use the GET seminar approach prior to the visit to help its students forge a solid foundation in their understanding of the dimensions of culture and communication and better understand the language, culture, and history of Cuba. It would be of interest to consider moving forward how technology students from Cuban universities (e.g. University of Cienfuegos) might become involved in this program, and also what a Cuban analog to this GET seminar might look like.

Finally, the salience of a marine technology program such as this for the island nation of Cuba is best expressed in the words of Fidel Castro Ruz:

"En el mar hay un porvenir para los jóvenes. ¡Tenemos que despertar ese porvenir! Somos una isla rodeada de agua por todas partes, no podemos estar de espaldas al mar, tenemos que darle el frente al mar, y avanzaren el mar, y crear esa conciencia en nuestros jóvenes".

"At sea there is a future for the young. We must awaken that future! We are an island surrounded by water everywhere, we cannot be with our backs to the sea, we must face the sea, and advance in the sea, and create that awareness in our young people". (Castro Ruz, 1963)

CONCLUSIONS

Technical and social challenges are becoming increasingly linked, as are nations and cultures, and to effect constructive change in the 21st century these challenges cannot be treated as separate and distinct (Sheppard, 2008). Because of this, technology programs must continue to refocus the engineering curricula from content to skills, broaden students' worldviews, and hone their judgment (Adams, 2008). Collaborative global programs with a focus on socially relevant projects represent a viable pathway by which to respond to a rapidly changing world and realize these goals.

International programs have the ability to expand the intellectual and cultural horizons of participants. This is predicated upon thoughtful and rigorous pre-visit preparation, and opportunity for post-project reflection. Clearly defined educational objectives and outcomes allow for continued focus throughout the international experience and can serve as metrics for program assessment; however, in the end, "making universities and engineering schools exciting, creative, adventurous, rigorous, demanding, and empowering milieus is more important than specifying curricular details" (Vest, 2008). International educational projects can also effect positive physical and economic change; however, faculty and institutions must be prepared for a multi-year investment in time and resources.

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