



Dialogue of Innovation: Did you come to See or did you come to Stay?

Mr. Richard Harris, Northeastern University

Richard Harris College of Engineering Assistant Dean for Academic Scholarship, Mentoring & Outreach Director, NUPRIME

Ms. Lauren Machunis, Northeastern University

Lauren Machunis is an undergraduate Academic Advisor in the College of Engineering at Northeastern University, where she advises first year students, as well as upper class students majoring in Chemical Engineering. Additionally, she is an adjunct instructor in Liberal Studies within Northeastern's College of Professional Studies. Lauren received her BS in Communications Studies, as well as a Master of Science in Applied Educational Psychology, from Northeastern University. In addition to her interests in the area of college student development, she has also been involved in college access programming. Lauren served as Director of Linking Education and Diversity (LEAD), a college access mentoring program serving students in the Boston Public School system.

Dr. William Tiga Tita, D'Amore-McKim Business School, Northeastern University

Dr. William Tiga Tita, Ph.D., MBA, BSME, Chairman and CEO of the Global Management Center, Trade Information Network of the G77 Chamber Ltd (GMC-TIN). GMC-TIN created and operates <http://www.tradeinfont.net.org>, recognized as the electronic commerce portal of the G77's 133 member states and the World Chamber Network, <http://www.worldchambers.com>. He is on the faculty of the D'Amore-Kim School of Business at Northeastern University, and is a visiting faculty member at the Graduate School of Business, Stellenbosch University in South Africa. Dr. Tita has been Program Manager and Chief Technical Adviser in the Private Sector Development Program of the U.N. Development Program and founder of IOCS-African Informatics, S.A., a Cameroonian software engineering firm and software reseller. He serves on several high-tech company boards. Dr. Tita has been recognized by the International Development Agencies, notably, the World Bank, as a pioneer and expert in distance learning and eCommerce. He is also a Kent Fellow on Social Ethics from University of Southern California where he completed his post-doctoral studies. Dr. Tita's research interests are in exploring the role of the Web in trade development and education and training, in general, for the emerging economies. Other primary teaching and research interests are professional ethics, e-commerce, entrepreneurship, social entrepreneurship, and strategy in the global economy.

Address: D'Amore-Kim School of Business, Northeastern University 360 Huntington Avenue, Rm.219A, HA Boston, MA 02115 Email: w.tita@neu.edu; wtigatita@yahoo.com Phone: 1-617-373-7259 Mobile: 1-508-735-7945

A Dialogue of Innovation: Did you come to See or did you come to Stay?

The inaugural Dialogue of Innovation and Civilization (DOIC) was established and launched by the College of Engineering of Northeastern University during Summer 2013 in Cameroon, Africa. The idea of the DOIC grew out of established summer semesters offered as Dialogues of Civilization (DOC) at Northeastern University. As stated, the DOIC experience was designed on the framework of the Dialogue of Civilization (DOC) model currently in place through the Office of Institutional Study Program (OISP). However, it was developed to go beyond the traditional DOC model by providing students (engineering and non-engineering) with the opportunity to understand the historical, cultural, social and political context of the technological challenges of the community they are immersed within and how these challenges may be addressed through: (1) technological innovation (engineering problem-solving solutions), (2) entrepreneurship (business development) and (3) social innovation (making a positive difference in the world) in an effort to meet societal needs globally.

The traditional DOC courses were primarily focused on the immersive observational experiences of students, but did not engage students in the observation, development and implementation of culturally relevant solutions within the countries they were visiting. However, in the case of the DOIC, this culturally immersive experience allowed Northeastern University students to experience daily life in a traditional African village setting of Cameroon while creating sustainable solutions to real life challenges in this developing country.

It should be noted, that the Dialogue of Innovation and Civilization course was also implemented using a model established by JolaVenture, a social enterprise backed by IDEA, the Northeastern University student-run venture accelerator, that seeks to empower farmers in Cameroon's agricultural market through technology and entrepreneurship. JolaVenture's first product was the SolPod, a solar-powered food dryer developed by a Northeastern University engineering capstone team, to help address the possible repurposing of compromised crops.

Fourteen Northeastern University students enrolled in the DOIC initiative, with 85% identified as members of underrepresented populations (African American, Hispanic, Native Hawaiian, Female, First-Generation). They consisted of majors from across the university including: Chemical Engineering, Civil Engineering, Mechanical Engineering, Computer Engineering, International Affairs, Human Services, Pre-Law, Entrepreneurship and Management Information Systems. Students participated in two academic courses, *Engineering Discovery & Innovation* and *Business in Modern African Economy* taught by Northeastern University lecturers and advisors who traveled to Cameroon with the students.

Course overview

The classroom seminars and experiential activity undertaken, enabled students to engage in both a theoretical analysis and practical examination of the field of engineering, technology and entrepreneurship. Students participated in this engineering discovery and innovation experience through active engagement in the local community, which included fieldwork and interaction with community members and other stakeholders. Students worked to help identify technical

problems based on societal needs and the challenges to implementing technological solutions through innovation and social entrepreneurship.

An essential component of this DOIC program was incorporating Kolb's Experiential Learning Model into the curriculum. Students visited different sites to conduct fieldwork in area villages and cities. Project fieldwork consisted of local university peer-to-peer partnerships, site visits with local families, businesses, and agricultural areas, interviews with field experts, and previously launched engineering projects being implemented through engineering capstone developed products. Additionally, students participated on local excursions to expose them to a diversity of different areas within the country of Cameroon, including: Bali, Bamenda, Douala, Kribi, Limbe, Yaounde. Traveling in country allowed the students to understand both the challenges and the opportunities for innovation throughout the various regions.

Finally, students applied engineering design principles to identify societal needs in the community and propose real-life solutions that can be used to work with the local citizens to help improve the quality of lives for the people of these communities. This effort provided students with the opportunity to innovate and develop culturally relevant problem-solving ideas that may improve the quality of life in unique communities in an effort to make a positive difference through an entrepreneurial spirit.

Course goals

There were several goals that were identified at the inception of the DOIC. It was essential that the students would be able to engage in a continuous dialogue of what innovation may mean in a developing country, where there is little infrastructure or platform, when compared to a developed country. Likewise, students would be able to understand how an adaptive society, such as a developing country, may be able to benefit from the knowledge and application of an inventive society.

Furthermore, students would be able to identify societal and cultural needs, as well as propose the design of culturally appropriate solutions to real life problems. Student engagement would bring about an awareness of local, national, and international projects that may be used to promote advances in technology and innovation.

Course objectives

1. To understand how the engineering design process can be used to identify technological needs and proposed solutions
2. To present important information regarding the engineering design process in an interesting, active and participatory manner
3. Discuss how the practice of innovation through engineering and technology may be affected by policy-making in a developing country
4. To be actively engaged in the host community
5. Create an in-depth understanding of the constraints and limitations that affect the lives of the people of these communities
6. Be participants in culturally relevant technical solutions that can be implemented in the community

7. Exposure to the academic and campus experience of peers in a Cameroon university
8. To develop a global perspective of innovation through engineering and technology and how it relates to the student's own experience
9. To utilize the Human Centered Design (HCD) Toolkit in the development of proposed culturally relevant solutions as future culturally competent professionals and engineers (CCPE)
10. Begin to consider student's future identity and the role engineering may play in their possible contributions within a global context

Course expectations

- A hands-on experience engaging students with the culture, civilization, and history of the people of the country studied and visited
- To be challenged to think of engineering and innovation from a global perspective
- A robust cultural experience that comes from immersion into the local community
- An opportunity to innovate and develop problem-solving ideas, using the engineering design process, in an effort to make a positive difference through an entrepreneurial spirit
- A place where students are respectful of the cultures, beliefs, and views of others
- The opportunity to learn about the possible societal impacts resulting from introducing new innovations into a community of a developing country
- An increased understanding of the global opportunities awaiting students as they pursue their undergraduate degree at Northeastern University
- Begin to consider student's future identity and the role engineering may play in their possible contributions within a global society

Theoretical Framework

A central component of the Northeastern University education is based on experiential learning using a co-operative education model. Similarly, the concept of experiential learning was the cornerstone of this DOIC program's development. This program used David Kolb's Experiential Learning Theory as the framework for the coursework. Experiential Learning Theory (ELT) provides a holistic model of the learning process and a multi-linear model of adult development, both of which are consistent with what we know about how people learn, grow, and develop. The theory is called "Experiential Learning" to emphasize the central role that experience plays in the learning process, an emphasis that distinguishes ELT from other learning theories.¹

According to Kolb, students must complete four learning stages in order for learning to take place. Learners, if they are to be effective, need four different kinds of abilities- *concrete experience* abilities (CE), *reflective observation* abilities (RO), *abstract conceptualization* abilities (AC), and *active experimentation* (AE) abilities. That is they must be able to involve themselves fully, openly, and without bias in new experiences (CE). They must be able to reflect on and observe their experiences from many perspectives (RO). They must be able to create concepts that integrate their observations into logically sound theories (AC), and they must be able to use these theories to make decisions and solve problems (AE).²

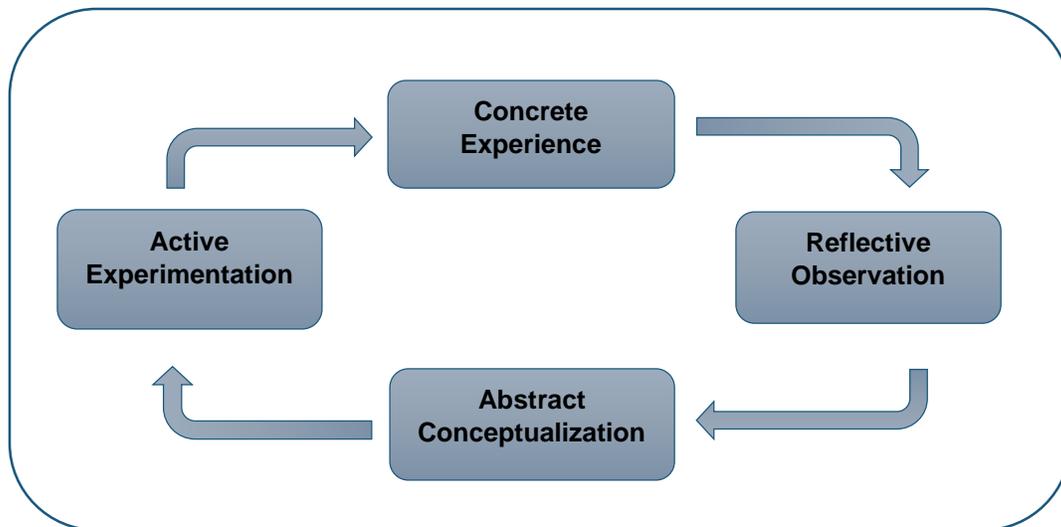


Figure 1: Kolb Experimental Learning Theory, 1984

Concrete experience (CE) abilities were at the core of this international experience. Students were taken out of their known environments and placed into a setting that required them to do away with their known biases and experience a different cultural setting with different social norms.

Reflective observations (RO) were integrated into the classroom experience through the use of the Human Centered Design model. The students were guided through the use of the Human Centered Design (HCD) Toolkit made available through an on-line resource developed and provided by IDEO.

Upon arrival in country, students were given a few days to adjust to the cultural differences and observe their surrounds before classroom meetings began. Once they were in the classroom, students were asked to reflect on their initial experiences and observations in country. Students noted not only what they saw, but also what they were experiencing, such as: lack of consistent running water and electrical outages, experiences as passengers on roadways, absence of trash receptacles, interactions with locals, biomass waste, etc. This initial process allowed the students to consider different perspectives and ask questions to gain a better understanding of what they were experiencing.

An important factor to developing the abstract conceptualization (AC) abilities was to incorporate interaction with the local students and stakeholders. This allowed the Northeastern students to share and reason their own observations and experiences with their Cameroonian counterparts. By gaining a better understanding from a local perspective they were able to build the logically sound theories that are critical to this learning theory.

Finally, the active experimentation (AE) abilities were incorporated with a final project. The project was the culmination of the knowledge abilities that students had mastered. They had to take the abstract conceptualizations and develop them into concrete ideas that showed evidence of understanding the problem in its cultural context, as well as providing concrete solutions to these problems.

Creativity leads to innovation

Students were challenged to reflect on whether they had “come to see or come to stay”, to underscore the perception generally held by the local stakeholders that students in the past had come mostly to observe, but rarely engaged in innovative solution development as true change agents. Using the “come to stay” perspective resulted in the opportunity for students to adopt an empathic design approach, by walking in the shoes of others, as opposed to just a sympathetic approach.

This empathic approach was further grounded as their local counterparts worked alongside in generating creative solutions at the same time vetting them through local champions within the stakeholder community. One Northeastern University student reflected on the experience by saying, “...At some point, I realized that implementing a solution which would have a positive impact would be less like dropping a bomb and more like planting a seed. Thankfully, our student counterpart, who was very passionate about our initiative, was also committed to nurturing the seed we planted while we continue to collaborate from 8000 miles away!”

Peer collaboration allowed the students to understand local perspectives and involved the local stakeholders in the innovative solution development. In six weeks, students worked to identify areas for development, and used the Human Centered Design (HCD) model that defined three requisite criteria for recommendations: (1) desirability, (2) feasibility and, (3) viability/sustainability.

Northeastern University students worked with and collaborated with 25 student counterparts from Bali’s Christian Cameroon University (CCU). At the very beginning of the class meetings, Northeastern University and Christian Cameroon University students were initially divided into two teams, separated out by university, to work in identifying their observed challenges within Cameroon. After the two teams of Northeastern University and Christian Cameroon University students stated their respective thematic problem areas, they were then brought together to come up with a mutually agreed set of domain challenges to begin working on.

Thematic problem areas identified independently by respective student group participants:

CCU Students Only:

1. H₂O Problems
2. Waste Disposal Management
3. Alternative Energy/Resources
4. Transportation
5. Agriculture
6. Education
 - a. Experiential Learning
 - b. Practical/Applied

NU Students Only:

1. H₂O Resources/Health
2. Waste Disposal/Health
3. Alternative Energy/Electricity Generation
4. Transportation Safety
5. Agriculture
6. Youth & Education (Academics)
7. Community/Empowerment/Outreach
8. Governance

Upon completion of the thematic areas, we proposed to combine the Cameroon students and Northeastern University students into seven groups. It was further decided that there should be

student representation from both institutions in each of the seven groups. Students decided on combining their respective themes to consolidate their efforts, with the following result:

Reformed Student Challenge Domain Formation

1. Youth + Education (Formal)
2. Governance Team
3. Alternative Energy
4. Transportation
5. Waste Disposal
6. Water Resources/Health
7. Community Engagement

Creating dialogue among equals

Kolb's research incorporated the previous work done by Paulo Freire's concept of praxis which is defined as, "reflection and action upon the world in order to transform it" (as cited in Kolb). Kolb further developed this idea to say, "Central to the concept of praxis is the process of "naming the world," which is both active- in the sense that naming something transforms it- and reflective- in that our choice of words give meaning to the world around us. This process of naming the world is accomplished through dialogue among equals, a joint process of inquiry and learning.³ As the students moved from the first initial reflective stage of the course, they transitioned to incorporating field work into their regular class work. Student groups that consisted of both the CCU students and NU students would visit local sites and meet with stakeholders to have a dialogue about the current state of affairs in relation to their chosen topic. This process of inquiry not only allowed the students to collect data, but to understand the needs and desires of the people that would be the most affected.

The following is an example summary of a meeting that was held with a group of Cameroon stakeholders and the seven student domain challenge groups. The summary includes a brief overview of the current government materials loan program that is facilitated through the local Bali Farmers' Cooperative.

Attendance included the Executive Assistant to the Mayor, who also serves as the President of the Bali Farmers' Cooperative, along with three members of the Bali Farmers' Cooperative. The Secretary General, Vice President and Counsel Regional President for the Northwest Region, also joined the meeting. This meeting was held at the Bali Council with Christian Cameroon University and Northeastern University students in attendance.

Meeting summary: Sunday, 05/19/13 – 3:00PM

More than 85% of Cameroon is nourished by Bali farmers and is the sustenance for the economy whereas only 5% of the United States is nourished by American farmers. The Cameroon government provides a payment scheme of two-year contracts to support farmers purchase of materials. Each farmer is allocated 100,000 French Cameroon Francs (FCF) for fertilizer thru the loan scheme. More specifically, this loan scheme offers material loan support in place of cash.

The Bali Farmers' Cooperative is a confederation of producers, transformers and marketing organization. The Cooperative receives about 8,000,000 FCF to provide support to the farmers, on behalf of the government. Currently there is no insurance or relief funds to address unforeseen challenges that result in loss of funds due to environmental disasters. When farmer loans are not repaid, then legal action is taken. This results in farmers abandoning their farms to avoid legal action, which can lead to incarceration. For example, it was noted that Bali farmers were facing a real-time natural disaster during our stay. Flooding destroyed all of the crops in a low valley area due to a catastrophic overabundance of rain in early 2013. As a result, farmers were unable to yield crops and unable to harvest and repay their loans.

It was further explained that Bali follows a traditional 8 day week, which is used by local villages to determine the market day calendar. Only one of the 8-days is used for the Bali farmers to sell their crops. Wholesale buyers come in to purchase at bulk to re-sell in the local city of Bamenda, Cameroon. If Bali farmers are unable to sell their products (perishables) on the target day, then they must wait 8-days later, for the next "traditional" market day.

Unfortunately, no transformation units are available. For example, there are no resources available to turn pineapples into pineapple juice, or into dehydrated pineapple, to transform the crop so that it is not lost. The introduction of the SolPod (solar dehydrator) is one of the transformational initiatives to help re-purpose the use, sale and storage of the crops.

Transportation to market is another problem of the Bali farmers. Capacity building is a fundamental factor. This involves training farmers to minimize cost and maximize profits. Water also presents another challenge and opportunity for the farmers. Water is often connected to health-related mosquito-borne illnesses such as malaria as well as a lack of consistent water quality. However, the farmers are also seeing longer rainy seasons in recent years, which affect their seasonal crop rotation, as well as conditions for growing food.

Additionally, governance is a challenge due to the government structure (French-Civil Law, British-Common Law, and Cameroon-Customary Law) in place as well as the method of communicating these three equally existing legal frameworks which may appear to come into conflict from time to time. However, that is not as directly related to the technological challenges encountered, although it further explained what would appear to an outsider the fragmentation of the legal system(s), which sometimes affected efforts undertaken to address some of the issues identified by the students.

As a result of this meeting, many of the students groups identified direct and indirect consequences of the farming problems. Concerns highlighted from the students relative to the seven domains:

- Transportation: Farm to Market roads are part of the Bali Council to try and develop easier access to transport. Farmers are the highest users of the roads.
- Agriculture and Waste: Current structure of market day results in a high volume of lost harvest, but has strong cultural significance and long line of tradition.

- Alternative Energy Sources: Farmers are using petrol for the pumps. Cost is high for farmers.
- Child Welfare/Community Empowerment: Due to lack of means, the farmers' children may not be able to afford to go to school, thus leading to child workers and hawkers.
- Governance: Farmers who could not afford to repay loans often would flee the village in fear of incarceration; many of them leaving behind their family.

Meetings, such as this, were conducted throughout the DOIC program to supplement the field work that students were doing. During the first four weeks of the program, students had focused their efforts on understanding the local perspective in Bali. However, in the final two weeks of the program were spent traveling in country throughout five different cities to gain a better understanding of Cameroon's national perspective on these domain areas. Students' level of understanding progressed from a micro level to a macro level, including how Cameroon's opportunities for development mirrored much of the larger global efforts charged by leading world organizations.

While traveling to the capital city of Cameroon, Yaounde, students had the opportunity to meet with the Director and other leaders of the United Nations Information Centre. Students were briefed on the United Nations Millennium Development Goals (MDGs) and how these efforts are impacting countries around the world, including Cameroon. The MDGs are a result of world leaders working in partnership to identify specific areas of global concern and to call for global improvements to meet the needs of the world's impoverished by the year 2015.

The United Nations Millennium Development Goals include:

1. Eradicating extreme poverty and hunger
2. Achieving universal primary education
3. Promoting gender equality and empowering women
4. Reducing child mortality
5. Improving maternal health
6. Combating AIDS/HIV, malaria and other diseases
7. Ensuring environmental sustainability
8. Global partnership for development

Many of the MDGs coincidentally correlated with the project areas identified by the students. Students were able to make direct connections with what they were observing in-country with the similar concerns that world organizations and Non-Government Organizations (NGOs) had identified. Students were required to include MDGs in their final projects to exhibit how their recommendations could meet one or more of the United Nations Millennium Development Goals. This provided local government officials with blueprints on how they can specifically engage in the Millennium Development Project.

The projects researched and presented by the students have not only addressed the United Nations Millennium Development Goals, but also resulted in an opportunity for the Bali village council and area government authorities to engage in securing a possible largesse of \$1,000,000 USD from a WorldBank community-driven project fund to implement many of the innovative solutions to address the areas of: water resources/health, renewable energy, waste management,

agricultural transformation, governance, community empowerment and engagement, education, and transportation.

Thinking globally and acting locally

This Dialogue of Innovation and Civilization offered an opportunity for undergraduate engineering and non-engineering students to understand engineering problem-solving from a social and culturally relevant context for further entrepreneurial growth. Moreover, students were able to make direct connections between global initiatives, such as the United Nations Millennium Development Goals and the WorldBank strategic plans, to the work that they were doing at the local level. Effectively, students were challenged to understand what it truly meant to think globally, and act locally.

Therefore, the students' work, if taken into consideration by local authorities, could lead to sustainable community development and an improved standard of living there.

Student engagement involved stakeholders at all levels of the Cameroon community including: farmers, entrepreneurs, educators, vice mayors, district officers, senators, as well as the United Nations Information Centre.

As stated earlier, students were challenged to reflect on whether they “came to see or came to stay”, to underscore the perception generally held by the local stakeholders that other students in the past had come mostly to observe, but rarely engaged in innovative solution development as true change agents. Using the “came to stay” perspective resulted in the opportunity for students to adopt an empathetic design approach, by walking in the shoes of others, as opposed to just a sympathetic approach of just “coming to see.”

Northeastern University students were able to leave a lasting impact in Cameroon. As a Cameroonian constituent (Vice Chancellor of Christian Cameroon University) stated, “The local community of Bali (Northwest Province) has gained a lot from this program through impressive and feasible solutions that were brought forward by the students. These solutions, if taken into consideration by the local authorities in Bali, will lead to the sustainable development of the community and improvements in the standards of living of the people. The research spirit that has been initiated at Christian Cameroon University will lead to the discovery of new technologies and sustainable solutions to some of the pressing societal problems.”

Experiential learning effects on student development

Dr. Nancy Diekelmann, a professor of nursing, developed a Narrative Pedagogy model of analyzing common lived experiences of students, teachers, and clinicians. She explains, “in the conventional pedagogies, experiences are pre-specified in terms of objectives, and evaluation of learning is linked to outcomes. Within the alternative, interpretive pedagogies, there is a shift to critiquing, examining, exploring, and deconstructing the experiences experienced by students for their meanings and learning.⁴ The Narrative Pedagogy attempts to reform conventional learning pedagogies to alternative interpretive pedagogies. In the former, concerns center on selecting and sequencing knowledge to achieve the specified outcomes and learning experiences preplanned by the teacher. In the latter, the concerns focus on presenting multiple

epistemologies (knowledge), exploring ways of knowing and practices of thinking, and interpreting as central to understanding the nature of experiences.⁵

In evaluating the DOIC course, it was important to evaluate the student's narratives on their entire experience, both academically and culturally. What we found was that student's learned outcomes were reflective of their experience as a whole; not separated out by what they learned in the classroom versus outside of the classroom. Likewise, it echoes Kolb's Experiential Learning Theory which defines learning as the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience.⁶

Upon returning to the US, one Northeastern University student stated, "My fellow 'dialoguers' have acquired cultural lessons that will be with us forever, whether or not relevant to a specific problem at hand. Understanding others' viewpoints is an invaluable skill set that will improve the way in which I approach most situations for the rest of my life. Northeastern University's espoused mission to cultivate world and local stewardship among its students may be well served by this kind of experiences that leads to developing cultural professional competency."

The student narratives also reflected that the experiential learning experience gave them both breadth and depth of knowledge in understanding the problems facing this under developed country, as well as how these students identified with being change agents. "Having gone to the farm to do fieldwork and interview the farmers really opened my eyes to the agricultural challenges they face and the pressing need for improvement and change. These were challenges that I was aware of after the initial meeting with the cooperative, but didn't completely understand until I saw them with my own eyes and made a connection with the farmers. To be honest as I walked through the fields I felt more and more discouraged, I realized that I had no idea on how to solve some of these problems. Ideas came into my head, but were quickly discarded as I evaluated them for viability and feasibility. What made me feel even worst was when Mr. Gilbert explained to us that we were the third group of students that came to him with plans of coming up with a solution, he said that the previous two had gone back to the States and he hadn't heard from since. This put some pressure on us because we didn't want to be the third group to the same and definitely didn't want to let Mr. Gilbert and the farmers down. Ultimately, it was that feeling of empathy and responsibility that led us to our solution and our plans to stay in contact after we left Cameroon."

Effects on future engineers

Previous qualitative research on international immersion programs for US students has tracked the personal and professional development of participant students after they have entered into their professions. The research has found that these educational experiences radically and profoundly changed the personal and professional lives of participants and thus were highly significant for the students.⁷ The DOIC students' personal qualitative remarks echo the significance of this dialogue experience in shaping their future professional cultural competencies.

"Working within developing nations presents a unique set of challenges and opportunities this Dialogue of Innovation in Cameroon has illustrated to me the need to be a culturally competent

engineer. In order to successfully identify a solution to an issue in places such as Cameroon the *true* problem must first be identified, and in a developing nation this may not be immediately evident. It will take culturally competent professionals to unravel the problem with understanding and insight in order to be successful. It is my hope that this experience has been the first stepping stone along the way to becoming a culturally competent engineer.”

Another student commented, “The trip to Cameroon has forever shaped my perception of engineering and development. The developing world offers an environment which challenges young engineers and entrepreneurs while also rewarding them greatly. The opportunity to make a difference, to build, to grow and to be a part of something substantial will stay with me as I navigate the path ahead of me.”

In the months following the Dialogue, we began to see how the experience in Cameroon influenced the academic choices of some of the students. For example, one student returned to do research on campus with a new found goal of addressing malaria drug delivery methods. Previously, she had planned on conducting research relating to contact lens use, but her experience and exposure to the effects of malaria influenced her follow this new path. Additionally, another student studying civil engineering, who participated in the Water Resources domain group, decided to do an international co-op experience to further learn about hydro-engineering.

Further DOIC development

The next phase of our Dialogue of Innovation and Civilization is to develop beta-testing, in under-developed countries like Cameroon, of culturally designed products/solutions, from engineering senior capstone projects or with products launched thru “Engineers for the Greater Good (EGG)” entrepreneurship competitions.

Additionally, we are looking to recruit and expand this opportunity by inviting students from the Northeast LSAMP Alliance to participate. This will bring students from University of Connecticut, University of Rhode Island, Worcester Polytechnic Institute, University of Massachusetts Amherst and Northeastern University, all members of the NELSAMP, to provide this global experience to a larger number of underrepresented minorities across the three-state alliance.

In conclusion, this culturally immersive experience allowed students to create a dialogue around their experience in the daily life of a traditional African village setting, while creating sustainable solutions to real life challenges. They have been challenged to consider their future identity as engineers, global citizens, innovators, and social change agents.

As C. Wright Mills wrote, “The most admirable thinkers within the scholarly community...do not split their work from their lives. They seem to take both too seriously to allow such dissociation, and they want to use each for the enrichment of the other...what this means is that you must learn to use your life experience in your intellectual work.”⁸

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