

CULTURAL ANTHROPOLOGY
AND ENGINEERING DESIGN
DO THEY MIX?

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Abstract – *This presentation relates the cultural of St. Kitts to the engineering design projects implemented by second-year students as part of their Design (EPICS) experience. Imagine an opportunity to practice engineering skills on a culturally diverse island as part of your undergraduate experience. St Kitts/Nevis is a Caribbean island inhabited mostly by descendants of Africans brought to the island to work on the plantations. Teams have mapped boundaries of the Wingfield wilderness area, have examined water and wastewater issue, and have studied soil stability and water erosion. The experience exposes students to a diverse and different culture. The combination of engineering and a culturally diverse setting challenges our second year students and broadens the scope of their engineering skills.*

Imagine an opportunity to practice engineering skills on a culturally diverse island as part of your undergraduate experience. The Design-Engineering Practices Introductory Course Sequence (EPICS) program at the Colorado School of Mines (CSM) offers students a three-week excursion to the Caribbean Island of St Kitts/Nevis complete with a challenge to map boundaries and trails for the National Park, to reduce erosion, or to improve water quality; all critical issues to the infrastructure of the Island. Contracting by the Department of Environment and Tourism, teams from the International (EPICS) course practice engineering design in a culturally diverse environment.

The Design (EPICS) program at CSM introduces multi-disciplinary teams of first and second year engineering students to design, technical communications, and teamwork through an open-ended, client-based project. The program emphasizes an authentic engineering environment in which students explore a complex suite of skills, depicted in Figure 1, through coaching and mentoring from an experienced staff. Students learn through practice how to use a variety of processes critical to decision making associated with engineering design. We take our international course to the island of St. Kitts/Nevis to add a cultural dimension to the program.

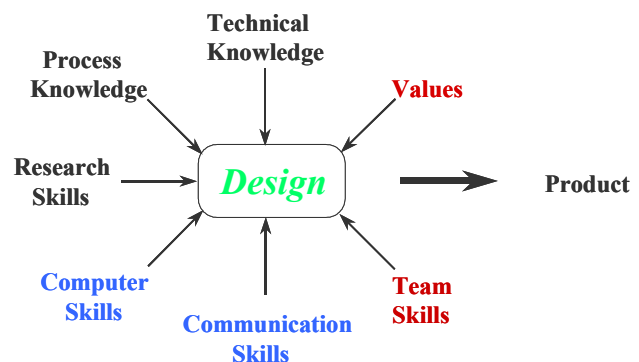


Figure 1: Graphical Representation of Mission for Design (EPICS) Program

The Department of Environment and Tourism from St Kitts/Nevis engages EPICS teams to implement projects stressing tourism and improving the environment. The staff assumes responsibility for protecting and enhancing the environment and attracting tourism to the island. Sugar, once the largest industry on the island, has been replaced by the tourist industry. Without the “magazine” beaches that attract tourists to the Caribbean, the people of St Kitts/Nevis rely on the history and natural resources of the island. EPICS teams map the boundaries and trails of the National Park, address erosion issues created by the hurricane that frequent the island, and explore innovative water treatment processes.

The hypothesis of this paper is that the combination of an engineering experience and a culturally diverse environment creates a unique experience to practice skills required to successfully engineer solutions to societal problems. The story of engineering design on St Kitts/Nevis is a story filled with both culture and design. The story should be told to illustrate the advantages and challenges created when students take on an engineering project in another culture.

The International (EPICS) Program

The International (EPICS) course is a 3-week, project-based session corresponding to the conventional 15-week semester course. The client contracts for engineering services equivalent to approximately 4-person months of effort from each design team. Activities for one day correspond to the theme for one week during the semester. As an example, Day 3 focuses on brainstorming activities including sessions, workshops and visualizations activities that generate alternative solutions (options) to the design problem. Students spend 8 hours per day focused exclusively on the project compared to 5 hours per week interrupted by as many as 15 hours of classes.

Teams prepare each week for oral presentations with the client, which take place every Friday. The first presentation defines the project plan with the client negotiating the actual scope of work. The second presentation reviews the research and testing by each individual member of the team with client feedback on the strengths and weaknesses of the evidence. The third presentation to the Director of the Environment and Tourism and her staff summarizes the evidence gathered by the team leading to their recommendations for implementation. Our students defend their project with the same rigor as any commercial company interested in business on the island.

Students participating in the International (EPICS) program assume an additional cost to participate in the program. In comparison to taking the conventional 3-week course on the CSM campus, the only additional expense students incur correspond to travel and some board. In most cases, parents willingly pay the additional costs to provide their children a cultural experience in a recreational environment. We are currently exploring Foundation support to establish an endowment for scholarships to cover costs for those students who would enjoy the experience but cannot afford the additional expense.

The Impact of Culture

Culture plays an important role to both the design project and the skills of our students. As an engineering coordinator for the Cultural Anthropology course in the McBride Honors Program at CSM, I observe that culture centers on the site, language, and rituals of a people. The

site (or map) also sets specifications for the engineering projects. In St Kitts/Nevis, the language of the people betrays their past but also influences the decision-making processes that impact implementation of projects. A person's word is far more sacred to these people who have not been jaded with the need for written contracts. That is changing rapidly as they have been taught to mistrust the promises of commercial designers. Students become frustrated with the laid-back attitude of these people until they learn to read the non-verbal language as well. The rituals sometimes tell us a great deal about how these people perform in various situations. As an example, students, exposed to the islanders' tales of the medicinal use of various plants, quickly distinguish between ritual and habit. These observations help them to work on a daily basis with these people as well as to develop presentation style that sell their products.

The Site Map



Figure 2: Map of St Kitts/Nevis

The Island of St Kitts/Nevis sets many of the physical boundaries or specifications for the engineering problems. St Kitts is an island of about 70 mi² and is the larger island of the two-island nation of St. Kitts and Nevis, illustrated in Figure 2. The Island is small but diversified.

The population is approximately 45,000 people, most of which are descendants of Africans brought to the island to work on the plantations. Per capita income at around \$6000 modest compared to U.S. standards limits access to material and supplies and experienced technicians. Our students come from a culture in which materials are a “phone call away.” The obstacles of cost and availability of resources seriously change the dimensions of the projects and the solutions. As an example, it took a team of students

designing a solar oven four days to acquire a pane of glass suitable for the dimensions of the oven. The glass company had never encountered the need to cut a specialized piece of glass, and the exercise was a learning experience for both students and islanders.

In 1999, the Government of St Kitts/Nevis declared the Wingfield Watershed a National Forest and Park. In order to complete the designation, teams of CSM students over the last four years collected GPS data along the east, west, and south boundaries of the forest. The final boundary will require a much more intense effort as the team will need to collect data along a boundary that has not been previously explored. We will continue to negotiate the importance and need to map the fourth boundary with people who assume that the park will be certified by drawing the fourth line on a surface map.

The rain forest offers a variety of challenging climbs that expose almost prehistoric landscapes from which you expect dinosaurs to raise their grazing heads. Opening the forest to tourist requires mapping of several trails within the National Park. Our teams have mapped a couple of trails. The Peter Manning trail, a gentle one hour hike takes the tourist to the interior of the forest filled with sun rays, beautiful flower, tiny spiders creating colorful webs and clusters of butterflies that magically escort tourists down the trails. The hike ends at a picturesque outlook over the Wingfield River. The climb to Dos' Dane pond takes the hiker

through an Elfin Forest where even engineers can dream of the “ring” or of conquests to save Middle Earth.

The beauty of the island forests offers so much more than the beaches could ever offer. Mapping the boundary and trails of this unique forest provide the novice engineer an opportunity to explore the wonders as they plot the future of tourism to the Island. The rain forest, however, relies on maintaining a very fragile environment that requires respect. The teams learn from the Rastafarians that respect must be built into their mapping solutions. They must also confront the potential displacement of squatters living within the boundaries of the park – a way of life that has existed for centuries. As teams map the forest, they capture a piece of the culture dictating the lives of the St Kittians both in the past and into the future.

Although site mapping may not characterize the culture, it does place the culture and the engineering into perspective in terms of time and position. An island historically used for sugar production now sees its future in tourism. A people with a history of slavery now share the fruits of their labor and their culture with tourists interested in more than their beaches.

The Language

In 1983, the Island gained its independence from Great Britain but remains a member of the Commonwealth. The spoken language is a formal English spoken very quickly with words often slurred together leaving most students believing the language is foreign. The inhabitants use their language to maintaining their identity. Understanding the language forces teams to focus their attention on what the people are saying, reading both language and body language.



Figure 3: An Assembly of School Children in St Kitts.

To experience the children is to experience an important component of the language of the culture. British influence and educational systems form the basis of their language. Children learn early to speak rapidly as part of the cultural-innovation, which has allowed these people to survive their past. The culture adapts the rigor of the British school system, illustrated in Figure 3, and effectively bestows upon the children a respect for their education. Yet, their poverty excludes them from taking advantage of the opportunity for higher education. A critical activity for our students includes exposing the children to the opportunity of financial aid and athletic scholarships

to pursue their dreams. Our students learn that they have a responsibility to pay back to the community for the benefits they have received from their education – respect.

The body language of the people reveals a culture impacted by slavery. The rich and fertile soil creates a healthy environment for the agricultural industry but unprotected suffers severe damage during the hurricane season. Because of their past, the majority of males refuse to work the fields although they possess great knowledge of the agriculture. As a result, many problems have developed with respect to erosion of the land, primarily along the ghauts that lead to the harbor. Our teams have explored water erosion and soil stability and the damage caused by

hurricanes and storm activity. These issues, indirectly related to the culture of these people, challenge the engineering interests of the students.

Determining the impact of flooding associated with storms, students gain an appreciation for how fragile the ecology can be and how technology can support the island at a time when the culture gets in the way. Since the land offers such great potential, it is essential that the government reduces the damage caused by the hurricanes. Teams propose using recycled tires in the form of tire bales as a means to reduce soil erosion. They recommend building bale walls, schematically represented in Figure 4, to form dams that capture and slow the flow of water. Sediment settles from the water restoring the soil in the ghauts. Their reports have been included in proposals to the World Bank to mitigate these issues in the future

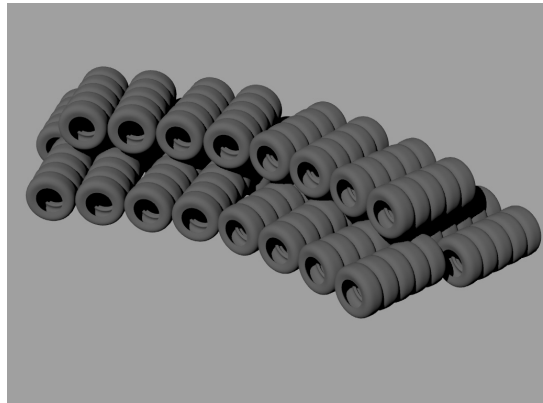


Figure 4: Tire Bale Wall Proposed to Reduce Erosion and Collect Sedimentation.

The Rituals

Rites of deference dominate many of the behaviors of the people of St Kitts/Nevis. We meet children who have not encountered people with white skin or soft hair. My curled mustache intrigues them and captures their attention for hours. When I allowed one student to touch my mustache, I was inundated with other students wanting to touch. As part of the ritual of growing up, the young learn to respect the elderly and often wait, even hours, for permission to enter into a conversation. Our students are frequently left to wait in vehicles as an older government official meets and talks with another elder sometimes for hours. Not accustomed to this rite of deference, teams initially perceive this situation as a waste of their time and a lack of commitment from their client. Eventually, they come to expect the delay and also use the time to discuss team procedures and analysis of the design problem.

Many rituals exist around the natural medicinal powers of island plants and their ability to heal almost any affliction. The people take great pride in the multitude of plants that grow on the island. They place a great deal of value on the availability and quality of their water, and yet they throw their garbage into waters that flow to the harbor. They believe, as their ancestors did, that the ocean takes care of the garbage and cleans itself. Our teams observe the need to remove pathogens, phosphates, and garbage, shown in Figure 5, from waters discharged to the harbor in order to make the waters safe for swimmers and attractive to tourists. Since most tourists first see the harbor as the cruise ships approach the island, it influences their decisions to visit Basseterre. Our teams explore water issues that threaten the natural resources, the health of the people and the needs of the tourist industry.



Figure 5: Contaminated Water Entering the Basseterre Harbor.



Figure 6: A CSM Student Presenting His Results to a Panel of Officials from St Kitts.

The formality of professional presentations reflects British rituals of intensification. Students present their work to members of government and local industry, illustrated in Figure 6, indicative of the value these people put on oral communications between client and consultant. Students learn through practice how to use their communications skills to market their solutions. Dress that includes shoes for men and no bare shoulders or midriffs for women attests to the formality but also to the value of the presentation. Presentation rituals emphasize appearance to highlight the importance of the content.

Summarizing the Value

Although most of the data currently collected to assess the program is qualitative, valuable evidence suggests that the program offers an effective, healthy, and challenging alternative to practice engineering design skills.

St Kitts has several attributes that make it an ideal site for our International (EPICS) program. Students observe wilderness, agriculture, industry, and tourism within the boundaries of a small site. They experience the language of the people and become a part of the local community of Basseterre (Figure 7), which influence their decision-making processes with respect to their design projects. Rituals, both local and international, influence the changes proposed through their design efforts. A combination of engineering design and a culturally diverse setting challenges our second year students and broadens the scope of their engineering skills.



Figure 7: The Multi-cultural Influence Characteristic of Basseterre.

Team members have developed strong bonds from the excursion to St Kitts/Nevis. Most of the teams get together frequently and celebrate the trips. The majority of students who have participated in the program have participated in other study abroad programs through countries like Australia, Germany, and England. Several of our early cohorts have proposed or conducted senior-design projects for the Department of Environment and Tourism. One of the participants even returned to be married on the Island. This year, we are employing two former participants as peer mentors for the design teams.

How often do we experience a situation where we can learn so much about why we study engineering while we work and live with people whose cultural background challenges our own experiences?

Biographical Information

ROBERT KNECHT

Robert Knecht's 23 years of experience in the industry focuses on technical and management support for minerals, energy and waste projects. He currently directs an engineering design program based on a curriculum that focuses on projects from industry. His projects require students to implement a design methodology in teams to resolve open-ended problems and to communicate both in written and verbal forms the results of their work.