



Preparing Students to Work on Multi-Cultural Teams

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Abstract:

As industries continue to expand globally there is an increased need for individuals who can work in both inter-disciplinary and multi-cultural teams. These skills can be fostered in the classroom but it is better if they are imparted in a contextual learning environment. Using a team project approach allows these skills to be acquired and improved quickly. This type of learning environment was created during a field research project supported by a National Science Foundation, Pan-American Advanced Studies Institute (PASI) grant, where multi-disciplinary researchers and students traveled to the highlands of Perú to reverse engineer the Inka Road. Project teams included members from six different countries. The project required the team members to work cooperatively with unfamiliar people speaking various languages and utilizing discipline specific terminology. A brief description of the project development and lessons from this multi-cultural teamwork experience are offered. Comments, covering factors that foster multicultural team development and the quality of such experiences are also offered.

Key Words: Multi-cultural teams, Engineering Field Work, Education

INTRODUCTION

As industries continue to expand globally there is an increased demand for individuals who possess the skills necessary to work in multi-cultural teams. These skills can be fostered in the classroom environment but a contextual learning environment is more effective. Using a constructivist approach allows these skills to be acquired and improved rapidly. This type of learning environment was created during a field research project supported by a National Science Foundation, Pan-American Advanced Studies Institute (PASI) grant, where two teams of multi-disciplinary researchers, from different countries traveled to Perú to reverse engineer the Inka Road with the objective of identifying sustainable engineering practices.

The work undertaken required documentation of engineering practices use by Inka engineers some 600 years ago. The research teams studied structures, hydraulic channels, terraces, retaining walls, storage areas, and ritual sites. While in the field the outcomes of their daily work were shared with audiences at the Smithsonian's National Museum of the American Indian (NMAI) via live interactive satellite broadcasts. The broadcast were also available over the internet. This work and broadcasts supported a major exhibit about the Qhapaq ñan or Inka Road that the NAMI is preparing to produce.

OVERVIEW OF THE PROJECT

The Qhapaq ñan (the Royal road) in scale alone is one of man's monumental engineering achievements. It united the four regions of the Inka Empire that encompassed present-day Ecuador in the north, Perú, Bolivia, central Argentina, and Chile⁶. While the primary focus of the research was to explore the Inka's knowledge of the forces of nature, expose students to the

Inka's engineering and construction achievements, and challenge them to explain how the Inka executed such grand infrastructure. However, the concepts of collaborative learning across cultures and disciplines were underlying themes of the research project. Specifically, the experience was designed to:

- Provide a collaborative learning experience in partnership with South American colleagues and the Smithsonian researchers – scholars from outside pure engineering science,
- Introduce the students to the field work associated with conducting this type of research through site visits and presentations from engineer and non-engineer experts, and
- Afford students the opportunity to participate in a unique international research experience.

A brief description of project development and the lessons identified are presented here. In addition observations and explanations of factors that foster the work of multicultural teams are offered.

INTER-DISCIPLINARY-MULTI-CULTURAL TEAMS

For this paper, an inter-disciplinary team is defined as a group of people from different academic specialties working together to achieve a common objective. The incorporation of many disciplines was critical for the success of the research that was undertaken. The initial combination of archeologists, anthropologists, and civil engineers was augmented by architects, constructors, historians, a music culturist, and a high school student, creating a team with many dissimilar perspectives and specialized knowledge of the Inka culture and road.

The term multi-cultural team is defined as a community comprised of different cultural groups working together on an activity that spans national borders⁹. Since the seminal book by Geert Hofstede on culture's consequences⁵ most of the research on culture has focused on identifying the core cultural values that differentiate cultures^{5, 8} and their implications for work behavior. There have been numerous studies on how to lead in other cultures, how to negotiate⁴, and how to motivate¹. A research program plan and a workshop were used to bring the team together and account for the obvious social differences from an engineering perspective, such as language and units of measure; however, no definitive measures were taken to accommodate culture differences.

INTERNATIONAL RESEARCH EXPERIENCE

The success of this program was the result of careful planning and team leader orientation sessions prior to conducting the workshop and field research with a large team. As a result of the orientation sessions the leaders of the project coordinated a planning and reconnaissance trip to the mountains of Perú in the summer of 2010 to complete a trial run of the experience planned for the summer of 2011. The lessons learned from this trip were incorporated into the plans for the final workshop⁷. The most notable lessons included:

- A partnership with a local university. The Universidad de Piura in Perú provided the team with meeting space, experts, and critical assistance with equipment transportation in and out of the country. This also gave the Universidad faculty the opportunity to be involved in better understanding the history of their country.

- Field logistics handled by a local outfitter. This included transportation of people and equipment as well as coordination of lodging and food.
- Local guides/experts. Knowledgeable guides enabled the team to proceed directly to Inka structures of interest. Without the assistance of local experts, many of the Inka structures would have gone unnoticed by the team and valuable data would not have been collected.
- Selection/composition of team members. Appropriate engineering skill sets, physical fitness, and attitude are crucial for a successful project; this was especially true in the extreme conditions presented by the high Andes.
- Time to adjust to a location. Altitude and climate adjustment must be built into the schedules.

Based upon the lessons learned during the trial trek, the team leaders began preparations for the second year's workshop and field work. The first step was to select a team that would be able to conduct the necessary research and represent a diversity of disciplines and cultures.

THE TEAM

To ensure a diverse assemblage of participants, the organizing committee sought individuals whose research areas were focused in one or more of the major themes of the project. These included hydraulics, hydrology, geotechnical engineering, construction, earthquake engineering, archeology, anthropology, and history. The committee also sought participants in various stages of their academic careers, to include undergraduate, graduate students, post-doctoral students, and junior faculty.

The recruitment in South America was targeted to universities with which the researchers had previous relationships. These included universities in Perú, Ecuador, Argentina, and Chile. These countries also represent areas through which the Inka road network extended.

Dr. Ramiro Matos, NMAI Director, Office for Latin America and an archaeologist is directing the Smithsonian Inka Road research and is NMAI's primary investigator in the field. Dr. Matos helped the team leaders identify archeologists, anthropologists, and historians who could join the team. He was instrumental in identifying local experts and he personally joined the team for a few days. Dr. Jose Barreiro, NMAI's Assistant Director for Research was also instrumental in helping the team leaders assemble qualified researchers.

Table 1 details the overall diversity of the final team that participated in the workshop and field research. The team members were from three different continents representing six different countries and was a mix of eight university faculty one high school teacher, and two industry professionals plus five graduate students, four undergraduate students, one high school student.

The organizers split the participants into two groups for the field work. The composition of each group was determined based upon expertise, physical capabilities, language, with some consideration of personal preferences. One group worked in the Ancash region of Perú and the other group was located in Cusco, the capital of the ancient Inka Empire. The Ancash group camped in the field for nine days with all of their meals cooked onsite and worked in very harsh and cold, conditions. The Cusco group was based in a hostel and was transported by bus to

different research locations each day. Their hiking distance to sites of interest was minimal. However, once drop from the bus they had to pack all of their equipment, while the Ancash group had burros to carry everything to the sites of interest. Having two group enabled individuals who may have had trouble hiking at extreme altitudes (14,000-15,000 ft) the opportunity to still participate in the research. The altitude experienced by the Cusco group never exceeded 13,000 feet. Each participant knew which group they would be working with, prior to arriving in Perú, as the physical and equipment requirements for each group were very different.

Table 1.0 – Inka Road Research Team

Position	Affiliation	Country	Specialty Area
Senior Faculty	Virginia Tech	USA	Geotechnical; Construction
Senior Faculty	North Carolina State University	USA	Construction; Tele-engineering
Senior Faculty	Universidad de Piura	Perú	Construction; Transportation
Senior Faculty	UCLA	USA	Archeology
Junior Faculty	Iowa State University	USA	Construction; Transportation
Junior Faculty	Universidad de Piura	Perú	Architecture
Junior Faculty	Universidad de Piura	Perú	Hydraulics; Hydrology
Junior Faculty	Chiang Mai University	Thailand	3-D Modeling; Construction
Industry Professional	Smithsonian	USA	Historian; Anthropology
Industry Professional	Universidad Nacional de Cordoba	Argentina	Architecture
Graduate Student	UCLA	USA	Archeology
Graduate Student	Virginia Tech	USA	Construction; Engineering Education
Graduate Student	Iowa State University	USA	Construction; Tele-engineering
Graduate Student	University of Colorado at Boulder	USA	Construction; Transportation
Graduate Student	National Taiwan University	China	Tele-Engineering
Undergraduate Student	Universidad Católica de Chile	Chile	Transportation; Surveying
Undergraduate Student	Universidad Católica de Chile	Chile	Transportation; Earthquake
Undergraduate Student	Universidad de Piura	Perú	Structures; Construction
Undergraduate Student	Universidad de Piura	Perú	Hydraulics, Hydrology
High School Student	Chilean High School Student	Chile	K-12 perspective
High School Teacher	Chilean High School Teacher	Chile	Music Culturalist

Once the participants were selected the team leaders began to develop the research agenda for both the workshop and field component. This included determining the content of the workshop, the locations in which to conduct the field research and the data that should be collected.

WORKSHOP

The research experience began with a two-day workshop prior to entering the field. Following the workshop the two groups spent eleven intense days in the field. To conclude the experience there was a one-day workshop upon returning to Lima from the field. The pre-field workshop was held in Lima, Perú at a small hotel and at the Universidad de Piura's Lima campus. The goal of the workshop was to educate the groups about the field research methods, the type of data they would be collecting, the tele-engineering concept that would be used to conduct satellite broadcasts to the Smithsonian, and the various ways to identify Inka construction and engineering practices. Presentations were made about the sections of the Inka road the groups would be investigating by the archeologists who had scouted the areas.

In addition to the technical goals of the workshop, the organizers understood the importance of developing unified teams. At the hotel the participants met one another for the first time. For many it was the first time they had ever interacted closely with someone of another culture. Additionally, a number of team members only spoke one language, making communication a little challenging. Team building exercises and informal networking time were built into the workshop to enable the participants to bond.

Prior to arriving in Perú, each group leader had the responsibility of assigning duties to the individual group members. During the workshop the groups worked together to establish the roles and responsibilities of their members and to ensure that each person understood their roles and were comfortable with assigned tasks. Each group was not only responsible for collecting data about the road and associated structures but they had to prepare daily presentations about the research work that would be broadcast to the Smithsonian from their field locations.

All team members, regardless of their expertise and responsibilities, learned in Lima how to set up the mechanical components of the broadcast equipment which included the satellite base, satellite dish, the generator, and various communications tents and shelters. The training ensured that all group members could participate in the set-up if the need arose in the field to set the system up quickly. The assembly of the mechanical components is a true test of team work and communication and was a quick way for the organizers to ensure that each participant had the appropriate attitude necessary to work effectively as a member of their assigned group.

The pre-field workshop enabled the participants to get to know each other, test the equipment, and develop protocols for collecting field data. It enabled the groups to engage while in an environment that was not threatening and helped them to learn each other's preferred methods of communication and levels of comfort with data collection, equipment use, and presentation building. While the workshop cut the field work short by two days, the organizers knew that this time was critical to building cohesive groups. To ensure success the leaders understood that these participants from various backgrounds, cultures, disciplines and levels of education must meet face-to-face, have time to interact, become aware of their limitations, and gain a respect and

understanding for each other's viewpoints. These actions are critical for inter-disciplinary, multi-cultural teams³. Figure 1 is a photo of the entire team at the workshop.



Fig. 1 –Researchers at the workshop in Lima, Perú

FIELD WORK

The presence of the archeologists helped the team members comprehend what types of Inka structures they were viewing and helped the team to identify the path of the roadway and its associated structures. The historians and guides helped the groups understand local traditions and the history of the road as well as the importance of the various structures along the way.

Broadcasts to the Smithsonian included information about findings and an overview of the location in Perú from where the signals originated. These broadcasts forced group members to coordinate daily to ensure that the presented information was clear, concise, and accurate, as well as visually and intellectually stimulating. Team work was critical, as well as diverse viewpoints to ensure that the broadcasts were appropriated for the broad audience at the Smithsonian. The groups were able to create presentations that incorporated research data, 3-dimensional models, plots of terrain, cultural information, historical perspectives, and explained the religious significance about the road and associated structures. The combination of information engaged the Smithsonian audience and served to explain the essence of how the Inka built their structures in harmony with natural forces and the terrain which was the primary objective of the research.

FINDINGS

The team quickly came to realize that the engineers of the Inka Empire had a unique consciousness of nature and lessons learned from careful observation of nature were the basis of their design and construction skills. Their engineering performance rested on careful attention to: 1) the power of water, 2) the energy expended by the users of the road (man and llama), and 3) the energy required to construct the road.

The Inka engineers understood the power of flowing water and engineered the road to control that energy. Considerable effort was exerted to protect the road from water. The shortest distance between two points is a straight line and this also conserves the energy of the user. The Ancash group quickly came to appreciate this fact. The Inka engineers, understanding this, always employed “directional straightness” – between two points the road ran unerringly straight and had a uniform grade. Only, when forced to by the terrain would the Inka expend human construction energy to build multiple steps.

LESSONS

Learning from individuals that do not speak your language, practice your traditions or have the same academic background is something that engineers will face as they enter a global market. Engineering students must learn how to communicate well through various modes, with our global workplace co-workers are no longer in the same location. Educators must prepare students to be successful in dealing with the challenges of multi-cultural teams. The first conclusion from this project was that the involvement of students in a multicultural experience is a challenge but at the same time it is an excellent learning experience.

Contextual learning environments allow students to gain additional skills that are typically not received through traditional teaching/learning experiences. During this project students worked in collaborative teams to complete interesting assignments and learned how to collaborate with other professionals in multiple locations utilizing various communication tools. Instead of focusing on their individual specialty the students worked inter-disciplinarily to gain a holistic appreciation of the overall context of the project. Due to the uniqueness of this project students had to learn and use critical thinking and problem solving skills to overcome the various engineering and physical location challenges encountered – language barriers, remote location, and limited resources. Contextual learning allowed the students to clearly perceive the practical application of the material and methods they are studying². These scenarios are very difficult to duplicate and teach in a traditional learning environment.

Knowledge gained from this multi-cultural research project provides important lessons for conducting similar experiences. The team leaders, as members of the two groups, interacted very close with individual group members. Through first hand experiences they had the opportunity to preliminarily identify factors and activities that affect positively the work experience of multicultural teams. The team leaders, presented and discussed as a group, findings based on individual observations of team member behavior, unstructured and informal interviews with team members, and their own analysis of facts that they consider fundamental for preparing successful experience for multicultural team. After dialogue by the team leaders, these are the identified lessons based on this particular project:

- It is better to have a genuine project that must be accomplished in a limited time frame. Having a commitment to a third party provides additional accountability for the deliverable of results. This was not an exercise; it was an actual research experience. Students felt their efforts were making a real contribution.
- Success on a project provides a good learning experience. Planning supports project success and team development success. There must be clear project objectives. It is

important to provide students with the necessary resources, information, and knowledge for completing assigned objectives.

- Partnership with local organizations is essential. When working in a foreign country it provides critical assistance for logistical requirements and allows team leaders to focus on the developing the team members.
- Recruit the correct talent to make your team successful. Skills, basic knowledge, and capacity of the students must match with those required to complete the project. Otherwise the experience can cause frustration and reduce student active participation and the project goals.
- Tasks are an important component of the project. Tasks must be assigned and accomplished as a group. Tasks are very useful for integration. Once explained and put into practice tasks generate collaboration. Successful accomplishment builds confidence.
- Team leaders are necessary; they have an important role promoting participation of individual team members. They assign tasks and provide advice, mentoring, and support to accomplishment of objectives. Considerer using experts to provide information and increase student understanding.
- Individuals must actively participate on the multicultural team. Multi-cultural is not an aspect exclusive for students. They must see the leaders working in a similar fashion.
- Communication is especially important for integration in multicultural projects as mixed languages can present problems. Teams may not have one common language and in such cases it is important to have a network of languages that allows everyone to communicate through other team members. It is not necessary to communicate the existence of this network; it will start to work in some almost magical way and demonstrates team integration.
- Programming team-building activities during early meeting of team members is critical for creating unity and a cohesive team. Participants must meet face-to-face, have time to interact, become aware of their limitations and gain a respect and understanding for other viewpoints.
- Confidence as a leader and confidence in the ability to work as part of a team.

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