AC 2009-1874: HELPING THEM HELPS US, A CASE STUDY: HOW ASSISTING ACADEMIC PROGRAMS IN THE DEVELOPING WORLD MAKES US BETTER TEACHERS BACK HOME

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Helping Them Helps Us! A Case Study: How Developing Academic Programs in the Developing World Makes us Better Teachers Back Home

Abstract

For the past five years, the United States Military Academy (USMA) at West Point and the United States Air Force Academy (USAFA) in Colorado have helped to create, develop and build an undergraduate academic program at the National Military Academy of Afghanistan (NMAA). One of the most successful parts of the program development has been the creation of the Civil Engineering core curriculum and major. The authors, all West Point engineering instructors involved with NMAA’s civil engineering development, discovered many benefits from providing this academic assistance which improved their teaching abilities. While our original mission was focused on faculty, curriculum, and course development, we soon encountered numerous challenges that ultimately improved our educational skills. We quickly found ourselves deeply involved in department level planning and decision-making, complete laboratory setup and training, computer software setup and training, infrastructure assessment, faculty hiring, supply acquisition, and student development. Many of these critical, additional tasks were unfamiliar to us, since they are typically done by other senior administrators or by those in specialized jobs within our department. We were also challenged with ensuring NMAA instructors could adequately explain material to those for who English is a second language, convincing them that our advice was in the best interest of student learning, and continually making changes on the fly. This paper will detail the challenges we faced and investigate the correlation that exists between our unique experiences and our development as faculty members, stressing those things we brought back that have enhanced our teaching in the US. While our efforts were focused on one program, in one country, these lessons could be applied to any faculty members building educational programs elsewhere in the developing world.

Creating a Civil Engineering Program in Afghanistan

The National Military Academy of Afghanistan (NMAA) located in Kabul, Afghanistan, recently graduated its first class as a result of the combined efforts between US advisors and Afghan military leadership. Its short history began in August 2003, when the Vice Dean for Education from the US Military Academy (USMA) at West Point, NY, went to Afghanistan and met with Afghan and US military officials to discuss starting a military academy. While Afghanistan has had military academies in the past, they were all modeled after Soviet institutions where there was only a military training emphasis. The NMAA model includes four pillars: academic, physical, military, and character-leadership development, all supported by a foundation of Islamic based morals and ethics. Graduates from NMAA would receive a four year undergraduate degree. This new institution would resemble West Point in many ways. The Afghan leadership envisioned this would be the way to prepare their future military leaders for the countless challenges their country faced. This institution was such a priority that in just two short years, the country was ready to start this envisioned crown jewel of military education in Afghanistan. By September 2004, the admissions process selected 120 new cadets out of the 360 applicants. Just four months later, this first class of cadets began their journey. Four years later,
84 of the original 120 became the first NMAA graduates on January 25, 2009. Of these, 18 chose civil engineering for their major.

Figure 1. The first graduating class of NMAA.

NMAA’s mission is “to educate, train, and inspire the Cadet Brigade so that each graduate is a competent, courageous, and honorable officer in the Afghan National Army committed to continuous professional development and a lifetime of military and civilian service to the nation.”3 Reaching that goal will be a challenging one; however, incredible progress has been made at NMAA in a very short period of time. Significant financial and military support provided by the U.S. military and its allies have improved security and constructed new facilities that are undoubtedly some of the best in the country. Real progress, however, was impossible without the added dimension of putting mentors on the ground. The dedication of American mentors from both West Point and the US Air Force Academy (USAFA) in Colorado made that part possible. In fact, volunteers from a wide variety of disciplines continue to deploy to Kabul to help them reach their academic, military and physical objectives. To date, over 90 specialists from both academies, both civilian and military, have provided assistance to NMAA. In total, the authors spent 32 months in service to NMAA, with each of us serving between 60-120 days in country, and one spending an entire year.

In this paper, we will demonstrate that through our efforts in developing NMAA, we have improved our own skills as instructors. As quoted from Epstein, “what all great teachers appear to have in common is love of their subject, an obvious satisfaction in arousing this love in their students, and an ability to convince them that what they are being taught is deadly serious.”4 While our main goal in serving as mentors in Afghanistan was to develop and improve their civil engineering program, we found that the experience also moved us closer to the great teachers described by Epstein. Other papers in the past have documented the details of developing and initially implementing the civil engineering program at NMAA. Developing courses
contributed to a solid mastery of our area of expertise. The Afghan faculty’s questions of us in other subjects brought us back to the basics and increased our breadth of civil engineering knowledge. This unique experience required us to conduct faculty development which improved our ability to teach and communicate effectively. Our time in Afghanistan provided stories and photos that improved our ability to make classes interesting and relevant to our students back in the US. This stimulated them to care and work harder to master our courses. It changed the way we approached and assessed our program, and it improved our administrative proficiencies, allowing us to focus more of our efforts developing innovative methods to engage our students.

**Teaching that Promotes Student Learning**

There are several different learning style models and theories. One of the key dimensions of most models, to include the popular Felder Index of Learning Styles, includes the theory that students prefer to receive information either visually or verbally. Study after study, to include one conducted in the Agricultural and Biosystems Engineering Department at Iowa State University over several years confirmed that most engineering students prefer to learn visually over verbally. While this may be the case, most teachers tend to focus on their lecture and notes for their chalkboard or whiteboard in lieu of providing a visual alternative to learn the material. This inevitably leads to students performing below their ability and retaining limited course material. Reports from the Socony-Vacuum Oil Company contend that an individual’s retention was only 10 percent from reading alone, 26 percent from hearing alone, 30 percent from seeing alone. Yet, allowing individuals to see and hear material increases retention to 50 percent! As a result, it is imperative for teachers to adjust their pedagogy from simply writing on boards or lecturing to include visual opportunities for their students to learn.

Teachers have successfully brought in pictures, videos and demonstrations to improve student learning. A three year study from 2000 to 2002 was conducted in the Mechanics of Materials course in the Department of Civil and Mechanical Engineering at West Point. In the first year, very few physical models and demonstrations were used in the classroom. In the two subsequent years, several props and demonstrations were added to the course. Despite virtually no change in course content, the instructors saw a significant improvement in their course end feedback the final two years. Students noted the instructors’ use of effective teaching techniques, their ability to motivate them to learn, their ability to communicate effectively and their ability to use visual aids effectively. The largest gain was in the student motivation to learn and continue to learn, where the ratings increased by 0.5 points on a 1-5 scale! The authors of this study also pointed out immediate spikes in both student-faculty engagement and in student questioning upon using a demonstration or physical model during class.

Educators have also found success in improving student learning through storytelling. Instructors will often bring in personal experiences from the field, relevant current events from the news, an infamous case study of a failure, or great success story to add something different or extra into the classroom. Dramatically telling the story of the Kemper Memorial Arena collapse from the perspective of Arthur LaMuster, the sole person in the arena at the time of the collapse, captures the attention of students while stressing the importance of redundancy in structural systems and the impact ponding can have on a structure. The ability to tell a story relevant to the class keeps the students engaged and reinforces the importance of the course. It can be
something planned ahead of time for a class or can be used when students begin to show signs of boredom. Several instructors at West Point have successfully brought the elements of “shock and awe” in the civil engineering classroom through drama, storytelling, and competitions to assist students understand tough concepts and improve their ability to remember concepts long term. In short, treating teaching with the same preparation, energy and creativity as a live performance on stage stimulates students and promotes learning.

There’s little doubt that the true measure of an institution’s worthiness is in the professionalism, development, quality and expertise of the staff and faculty and in the outcome of its students. The effective teaching techniques discussed thus far merely scratch the surface as it pertains to quality teaching. To move closer to an exemplar teacher, many attend and lead teacher workshops, conferences, or seek and lead mentorship opportunities. Without this faculty development, teachers develop cynicism and become bored, leading to a decline in their productivity and performance. Solutions to these problems for faculty include teaching a new course, teaching outside their discipline, and using different teaching methods. These solutions allow instructors to develop new skills and receive exposure to cutting-edge topics within and outside their field of expertise. This generates a new excitement for both the instructor and for the students. Our experiences in Afghanistan that follow reinforced high quality teaching techniques, the importance of establishing rapport with our students, and rejuvenated our desire to bring something unique and advantageous back to our institution.

Back to the Basics

Mentors initially went to Afghanistan on a “just-in-time” basis to develop the next semester’s set of courses prior to a course being taught for the first time. We developed a number of courses to include Design of Reinforced Concrete, Structural Analysis, Hydrology and Hydraulic Design, Technical Communication and Steel and Masonry Design. While many if not all of these courses are traditionally taught in the US, all of the courses needed considerable work in order to make them appropriate for use with students in Afghanistan. Syllabi, study guides, homework, board notes, and slideshow presentations had to be either recreated or significantly revised. We chose textbooks, specified reading assignments, and created physical models for their classes. We did all of this while creatively breaking down material to the simplest level. Clear, concise communication was of great importance since the students’, and some of the faculty’s, ability to read and understand English was limited. It is important to note that English was the declared language of engineering in Afghanistan, a decision Afghan education officials made no doubt due to the lack of textbooks and resources in the native Dari or Pashto languages. Cadets either knew or learned limited English through coursework at NMAA. Faculty and student ability to read or understand a challenging engineering subject written in an English textbook was almost non-existent. As a result, any creative way to tie an example or demonstration to something they were familiar with or could relate to was paramount. This effort also paid great dividends to us as we returned to our institution. Since the courses we developed at NMAA were all related to the courses we taught back at West Point, this additional time spent developing their courses and teaching the material to the NMAA instructors only made us more prepared to teach when we returned. Our overall lesson preparation time decreased, allowing us to dedicate more time to creatively improve our lessons. Sometimes having to look at material we considered ourselves
to have mastered in new ways allowed us to be better able to explain it to our students in the US as well.

Despite the fact we were sent to focus on a specific course, we were also considered the experts on all other subjects within the curriculum. For example, the “steel expert” sent to set up a course in Steel and Masonry Design was asked how to solve a textbook problem involving open channel flow from the Hydrology and Hydraulic Design course or explain a moment distribution physical model used in a Structural Analysis course. For most of us, our last experience with topics outside of our area of expertise was either just before taking the Professional Engineer exam or back in our own undergraduate education. Getting back to the basics in other courses improved our civil engineering knowledge and provided us with new ideas to link courses we routinely teach at West Point to other courses outside of our own specialty.

**Developing Faculty**

Another helpful aspect of our experience was the process of hiring and training faculty. As junior faculty, none of us had any previous experience in the hiring process. With all lesson plans and textbooks written in English, the priority was to find the best qualified engineers that could also speak English. Finding a truly qualified instructor was very rare and this led to perhaps our greatest challenge. The interview process, however, was another positive and unexpected experience for us. Conducting thirty plus interviews caused us to really ponder what characteristics made a good engineering faculty member. The obvious prerequisite was to have an engineering background and a solid understanding of the engineering fundamentals. Fortunately, our relationship with Kabul University provided us with a source of recent graduates from their Civil Engineering program. However, we all knew that we needed to find more than just talented engineers if we wanted the NMAA program to excel. We had to find candidates with a passion to teach and learn. Hearing the personal stories of the candidates and knowing the limited opportunities for employment made the decision process difficult. As a result, the deliberation over who to hire caused all of us to take a look at our own teaching fervor.

![Figure 2. Thrilled mentors after making a new hire.](image-url)
Our self reflection continued as we started training the new faculty using the Excellence in Civil Engineering Education (ExCEEd) model. All of us had been through multiple weeks of faculty development programs at West Point and had all served as junior or senior mentors for ExCEEd in the past. We were expecting that providing this training would be easy. However, early on, we found ourselves spending three hours teaching a workshop that normally took one hour. Several words per slide had to be defined, and it was evident the new hires were not learning the way we hoped. There were resource and cultural challenges to overcome and time had to be set aside to clearly outline expectations and standards. It was evident that in order to develop this set of faculty, we had to add examples, demonstrations and exercises that were tailored for an “Afghan ExCEEd”. As we improved our ability to communicate, the seminars quickly fell into place. We took turns and team taught throughout the two week training on numerous topics to include Learning to Teach, Principles of Effective Teaching, Introduction to Learning Styles, Organizing a Class, Communication Skills, Instructional Technology, and Homework and Grading. In between classes, we demonstrated the use of classroom assessment techniques recommended by Angelo and Cross, such as the Background Knowledge Probe and the Minute Paper.

In addition, each of us provided demonstration classes to the new hires in attempts to model outstanding teaching. Our demonstration classes were followed by practice classes by each of the new instructors in front of us and their peers. In order to provide them with the best assessment we could, we asked them to consider trying to teach their practice class in English, which about half of them did.
After graduating from the Afghan version of ExCEEd, we regularly visited the instructors’ classrooms and continued to assess their teaching. Even though classes were taught in Dari, we still found that we were able to conduct an adequate assessment and provide useful instructor feedback. Spending time in the classroom provided us with different ideas for our classroom and gave us some insight into what works and what does not work. Teaching the seminar and seeing the new faculty members’ excitement and desire to do more inspired and reminded us to exude the characteristics which make teachers great in our own classroom.

**Bringing Relevance into the Classroom**

Another great part of this experience was that in a developing country like Afghanistan, infrastructure development is a huge mission for the nation. At NMAA, there were numerous ongoing construction projects on the academy. As a result, we spent significant time observing and assessing different construction methods. There were also several occasions where the American staff facilities engineer asked for one of us to escort him as he met with the engineers and construction managers on a project. Often this was to receive our professional judgment and to document unsafe construction practices or low quality work. In fact, on one instance where the facility manager was unavailable, we were asked to inspect a concrete sidewalk and masonry wall being put up by an Afghan contractor on campus. The work was so terrible, that we immediately had to order the contractor to stop work. As faculty members in the US, we typically do not have the time or permission to freely tour construction sites. In our courses, we typically focus on the design and analysis of systems. This experience taught us a great deal about what does not work when it comes to physically building some of these systems, giving us the opportunity to continue to grow and develop additional skills as engineers.
We were also asked to provide input into the NMAA gymnasium roof structural system. A modification to the original plans for the gym called for columns to be placed in the middle of the basketball floor! Fortunately, we were able to explain the advantages of an open floor space in the gym. The plans were corrected again to a truss system (see Figure 6), allowing future NMAA cadets to play basketball without having to dodge columns. We were also asked to confirm the bolt type for the gusset plates once the bolts arrived from Germany without any shipping identification. These are just two experiences of many that just do not happen every day for junior faculty members.

Figure 6. Afghan contractors assembling the NMAA gym truss.
We also had the chance to tour the construction of the new Kabul Afghanistan International Airport (KAIA) base camp, which consisted of several steel and reinforced concrete buildings. This experience, more than the others, provided us with plenty of examples of “what does work” with regards to quality construction. As a result, we took several pictures of steel connections, baseplates, rebar, formwork, masonry walls, and spray-on concrete walls for use in our classrooms back at West Point.

![Construction at the new KAIA base camp.](image)

We videoed Afghans working for the US Army Corps of Engineers (USACE) performing a slump test. Many of these pictures are now posted around our classrooms, inserted in PowerPoint presentations, and serve as the background to homework problems for our West Point courses. They enhance the ambiance of the classroom and generate new and creative opportunities for the students to learn.

These experiences in Afghanistan allowed us to bring relevance into the classroom. From day 1, we were able to show why our particular class was relevant to the future lives of our students. For example, in West Point’s Design of Steel Structures course, there is now an opening slideshow which asks, “Why is this course important to you?” The pictures that follow show United States Army Corps of Engineer (USACE) steel structures under construction to include the Kabul Joint Aviation Facility, Afghanistan-Tajikistan Bridge, the Afghan National Army Power Plant, and the Kabul Military Training Center. With most of our students preparing to join the Corps of Engineers and all of our majors preparing to spend time overseas, the visual pictures captured the students’ attention.

One way we have been able to assess the benefit of our experience has been through course end feedback. Comparing feedback from semesters prior to and after the NMAA experience with regards to our ability to demonstrate the relevance of our course showed an improvement by all
Students were asked to give a rating of 1 (low) to 5 (high) to the following question: “My instructor helped me to understand the importance and practical significance of this course.”

This average 0.31 point gain in this important category is considerable since ratings were already approximately 4.5 and thus had less upward sensitivity. Clearly, the technique of connecting course content with real world examples enriches the learning experience and adds excitement to the class. This initial assessment seems to confirm that our NMAA experience improved our ability to make our courses relevant to our students.

Making a Change to Our Program

Significant time was spent leading department level planning and decision-making concerning the creation of the CE program. Specifically, we made decisions on courses and course sequences to incorporate in the program. At first glance, the simple solution would have been to take a civil engineering program from the US and transplant it as the Afghan program. However, we quickly realized the needs of Civil Engineering graduates from Afghanistan do not exactly match those from the US. For example, the building and construction of new roads is a major requirement in Afghanistan. At the time we began providing assistance, we did not offer a transportation engineering course at West Point. Environmental Engineering is a popular subject with an entire program curriculum in the US, yet is unknown at Afghan Universities. Nevertheless, both we and the Afghans felt it was important in order to see their country progress in the future. Other courses were specially created to ensure they were appropriate for Afghanistan as well, with Steel and Masonry Design being one example.
These opportunities to look at the NMAA CE program at a macro level gave us a new perspective on our individual courses within West Point. Specifically, the West Point CE program has had a traditional structural focus. With a majority of our West Point CE majors choosing to enter into the Army Corps of Engineers upon graduation, we want to make sure they have the tools they need to be successful. With the high operational tempo of the Army and most West Point graduates serving in Iraq or Afghanistan, we thought maybe our program should look more like the Afghan program. In our case at West Point, the majority of our graduates will be more likely to be involved with basic infrastructure projects and repairs in the developing world than designing large steel or concrete multi story urban structures.

The focus of USACE, for whom many of our graduates will eventually work, is on achieving infrastructure goals in the developing world through evaluation, interaction with locals, and the utilization of available assets. In order to conduct the infrastructure evaluation, USACE uses the acronym SWEAT, or Sewage, Water, Electricity, Academics and Trash. Surveys from 60 military and civilian personnel familiar with the practice of engineering indicated that our graduates have done a great job in the traditional (structural) areas of engineering but were weaker in project management, power generation and infrastructure assessment, just the skills needed in the developing world. One of the questions asked the respondents was to classify subjects as essential, important, or nice to have. Among the top four classified as essential were construction management, infrastructure assessment, structural engineering and infrastructure management. As a result of this survey and our experience in Afghanistan, we have added courses within our West Point CE program in Transportation Engineering and Protective Design. Our experiences abroad helped us contribute to the discussion of what and how to change our program.

At a junior faculty level, it allowed us to step back and reflect on why our specific courses were being taught. Why were certain courses before and others after a course? This motivated a greater emphasis on tying courses together. For example, we noticed a perfect opportunity to take recent experience and tie three courses (CE403 Structural Analysis, CE404 Design of Steel Structures, and CE483 Design of Concrete Structures) together into what is now described to our students as one 9.5 credit hour course. Instead of focusing solely on the next classical method to solve indeterminate members or on the limit states for the next moment connection, a few minutes each lesson was spent tying the lesson objectives for that day into the larger structural engineering cycle of analysis and design. Making these daily connections to prior knowledge and providing a structure to the course material are two learning principles that have shown to lead to success in the classroom.

Developing Different Skills

Working at NMAA also required us to establish their laboratory equipment and training. An in-depth look at each course was required to determine lab requirements. This was followed by the synthesis of the cost and contracting limitations, lab space constraints, and most importantly, training requirements. Without the luxury of lab technicians at NMAA, the maintenance, accountability, and training aspect took most of our effort. American mentors assisted the Afghan instructors to establish an organized setup to the lab. After a time gap in American oversight, the next mentors would likely find the lab in a state of disarray. There were missing
parts and broken lab equipment. Since US instructors often facilitate labs run and maintained by the lab technicians, we did not have extensive experience with the lab equipment. This forced us to dig into the manuals and really learn the specifics of setting up, operating, maintaining, and troubleshooting the equipment. We actually served as lab technicians and had the NMAA instructors bring their students to the lab to design concrete mixes, pour concrete beams, and run the hydraulic channel.

The benefits to us upon our return to West Point were clear. Since many of the labs we had to lead at NMAA were outside of our expertise, they provided us with a more in-depth understanding of some of those subjects. This further enhanced our ability to tie in the courses we teach at West Point with others within the curriculum. The challenges we experienced in setting up and running labs at NMAA motivated us to prepare earlier and play a more prominent role in our own labs at West Point in lieu of solely relying on the technicians.

This additional preparation allows the instructor to find the solutions to potential bugs, helps the lab run more efficiently and provides increased credibility to the instructor. A positive example of this was demonstrated for one instructor in the semester immediately following deployment to Afghanistan. One of the authors conducted early coordination for a welding lab where he had little experience. His coordination and repetitious rehearsals allowed him to demonstrate a high quality butt weld to set the standard for the rest of the class to emulate. This generated a competitive spirit within the classroom and provided students with some added incentive to pay attention during the lab. After all, they wanted to ensure their welded plates had a greater tensile strength than their instructor. This well prepared, instructor involved, competitive lab was

Figure 9. An American mentor runs a concrete mixing lab with NMAA cadets.
specifically mentioned by many students in course end feedback as their favorite part of the course.

The experience at NMAAA also included extensive computer software setup and training. Brand new computers were purchased and installed into a new computer science building. Without a computer specialist to rely on, we were required to personally power and connect computers, install and update anti-virus software, install projector systems and instructor computers in classrooms, and establish user access for mentors, guests, and cadets. The installation was just the start. Maintenance also took considerable effort, since many computers crashed as they were quickly infected with viruses. In an attempt to bring modern technology into their civil engineering program, we procured and installed Visual Analysis, MathCAD, Watershed Modeling (WMS), and the West Point Bridge Design program on all computers in the computer lab.

![Figure 10. NMAA instructor and lab technician teach cadets the West Point Bridge Designer.](image)

Lacking confidence and skill to educate their own students on the software, we became involved in teaching engineering software programs to both the faculty and the students. While we eventually hired and trained an individual to maintain the computer lab, we primarily worked without the safety net of an experienced computer technician. This forced us all to become more intimate with the software programs and to develop our own “tricks of the trade” when things
went wrong. This only made our ability to solve computer issues at West Point that much easier. Instead of responding to student hardware and software issues with a shoulder shrug and the computer technician’s office number, we now had the experience to troubleshoot many problems on our own. Licensing issues and other bugs with new programs at the beginning of every semester that often frustrate students and instructors were quickly fixed or mitigated from the start. This prevented apprehension that students get when encountering a new program and instead instilled them with confidence. This reassurance created student desire to learn instead of resistance to spend the time necessary to become proficient with the software.

Finally, we also grew as instructors by getting involved with the Afghan cadets. While sitting in classes to assess the instructor, often time cadets would start asking questions through their instructor to find out more about us. This limited interaction quickly expanded as we were called to help with labs, teach software, and lead the Conversational English classes. Our interaction with the cadets spread to weekly basketball and ultimate Frisbee games. The personal rapport we developed with the cadets set an example for the Afghan instructors to emulate. Under the Soviet model, students would not even have the opportunity to ask a question until the last 10 minutes of class, when the instructor finished their 40 minutes of uninterrupted lecture. The rapport gradually developed between the Afghan instructors and students, led to students seeking additional instruction from their instructors outside the classroom! Watching their faces light up during every encounter reemphasized the importance of rapport with students.

Figure 11. NMAA students seeking assistance outside the classroom.

Both the funny and relevant stories and pictures from our experiences in Afghanistan captured the minds of the students in the US during class and helped make us in many ways become more approachable. Beginning an occasional class with a personal story, interjecting some self-deprecating humor in the middle of a lesson and attending a student-athlete’s sporting event all generate more class participation and a greater desire to attend class. The generation of trust and respect through the frequent contact between teacher and student has proven to increase student learning.
Helping Them Does Help Us

As instructors, we are all responsible for demonstrating teaching excellence. The experience in Afghanistan provided us with the opportunity to develop in a wide variety of areas. While much still needs to be done, our efforts have helped develop NMAA’s Civil Engineering Department in just three short years. At the same time, their growth and intense desire to become the crown jewel of Afghanistan generated a new enthusiasm and inspiration for us to improve as instructors within our own institutions. The experience allowed us to become more engaging and relevant in the classroom with new stories and pictures. Our time in developing courses and working in the labs increased our status as a complete intellectual authority. Our interaction with instructors and students caused us to become more approachable and patient. In the end, the experience at NMAA moved each mentor towards achieving the high interpersonal rapport and high intellectual excitement of the complete exemplar instructor described by Joseph Lowman’s Two-Dimensional Model of teaching. The most rewarding part of this experience was in the development of our ability to teach and in our students’ enhanced ability to apply what they learned from us, their improved instructors.

References


