

# Building Undergraduate IT Programs in Developing Countries

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## Abstract

ICTD (Information and Communication Technology for Development) is an emerging area of research and practice among computing scholars. In this paper we will look briefly at ICTD and explore how it differs from building undergraduate computing programs in developing countries. Our exploration will include first-hand accounts of computing programs in two developing countries: Afghanistan and Cambodia. We will contrast the struggles and challenges found in developing nations with those found in the United States. Thoughtful consideration will be given to the impact of computing education on the developing culture and economy. We will also offer observations from experiments with distance education in developing countries.

**Keywords:** ICTD, information systems education, distance education, STEM

## 1. INTRODUCTION

In 1992 Neil Postman wrote, "We proceed under the assumption that information is our friend, believing that cultures may suffer grievously from a lack of information, which, of course, they do." (Postman, 1992) ICTD responds to the challenges of the developing world through such initiatives as mobile phones for remote medical diagnosis, the use of computers for sustainable education and to encourage literacy. In this paper we will explore the impact of building undergraduate computing programs (such as Information Technology and Computer Science) within developing nations. Our aim is to consider the impact that IT educational opportunities provide in such countries for the elite student. The assumption is that the culture and economy of the developing nation will be better served by keeping their brightest students at home as opposed to exporting them to a Western nation, which often leads to "brain drain" as these students often become enamored with Western culture and standards of living when educated within countries like the US.

"We believe that technology, along with good governance and macroeconomics, represents the path forward for the majority of the world's people. Consider that in 1970, South Korean and African incomes were similar; but the rapid relative rise of South Korea shows what is possible, due in large part to technology." (Dias, 2009) The difference in African and the South Korean economies is undeniable (Kim, 2003). However, significant cultural differences are completely ignored in the context of the article quoted above. The interested reader may consult a plethora of various corruption rankings in journals and via the Internet. Invariably one will find African nations populating the bottom of the list and South Korea will easily score in the top quartile. Thus, we do not find it necessary to defend the claim that the rise of South Korea over African rivals has little to do with technology and much to do with cultural and ethical issues.

The cultural context of a nation will have a dramatic impact on the ability of that country to develop and sustain educational pro-

grams such as IT or CS. Establishing an educational program of study is not the greatest challenge. Rather, the greatest challenge is creating a cultural and economic context that will provide for technological progress that has the potential to participate in a global economy. As we will show shortly, nations that ignore intellectual property law on a large scale will not be able to provide employment opportunities for graduates of IT programs within their borders. The idea of providing for economic opportunity for the most educated citizens (such as IT undergraduates) has not been explored in the traditional ICTD literature. However, we contend that creating the context for educational and employment opportunity for this societal segment at the top of the economic pyramid will provide an environment whereby the entire developing nation can benefit from long-term, sustainable participation in the global economy.

We should mention at this point that the perspective of building IT educational programs as we have participated in developing nations is not meant to compete with traditional ICTD work, but rather to augment it. The impact of ICTD in developing nations is often dramatic in its scope. Immediate and substantial quality of life improvements in the areas of healthcare, rural education and literacy, disaster recovery, and relief logistics are but a few of the many high-impact contexts where ICTD has provided benefits to developing nations.

The parallel with energy is instructive. No single scenario will solve the problem. A broad array of approaches is merited. "Novel ICT has the potential for great impact in a variety of fields ranging from healthcare to education to economic efficiency. However, we do not propose that ICT offers a panacea for the complex problems facing nations on the path to economic development. On the contrary, at best, ICT can enable new solutions only when applied with a broad understanding and a multi-disciplinary approach." (Brewer, 2005) Furthermore, K-12 education is enhanced through low cost computing initiatives that provide children with hands-on computing opportunities. (Patra et al, 2007) The development of undergraduate IT programs in developing countries must follow this same philosophy. We are creating one thread in the fabric to develop cul-

tural and national health. We contend that this concept is trans-cultural, i.e., it is as important to the developed western nation as it is the developing nation.

## 2. CAMBODIA AFTER THE KHMER ROUGE

During the spring 2003 term, we visited the Computer Science Department of the Royal University of Phnom Penh (RUPP). At that time the program boasted an undergraduate enrollment of about 2,000 students, which is a breathtaking number for a university of just over 10,000 students! A recent look at the University's web site confirms that these numbers have remained at this level ([http://www.rupp.edu.kh/stu\\_statistic.php](http://www.rupp.edu.kh/stu_statistic.php)). While visiting the University, we were given access to classes, labs, instructors and granted an interview with the Chairman of the Department of Computer Science. We made a number of observations during our visit, which we will report here.

The curriculum is labeled "Computer Science" however the content contains much of what most would describe as Information Systems or IT. In 2003 the major programming language for instruction was Visual Basic. Although VB remains a core language, they have since included C++ and Java courses. At the time of our visit, the vast majority of the 400+ graduates each year would seek employment performing basic IT functions (physical setup and maintenance of PCs, software installation, network installs, etc.). There was no evidence of any graduates doing development work. More on that later.

Most of the faculty members consisted of the first class of undergraduates to complete the program. They were offered the opportunity to complete the MS in Computer Science at the RUPP. This strategy was necessary as virtually all the faculty members and their families were early victims of the Khmer Rouge genocide in the mid 1970s.

There was still plenty of evidence on the campus in 2003 to indicate that the University was still in the recovery phase as many physical structures still bear the scars of a postwar nation. Figure 1 shows an exterior photo of the main CS classroom building as it appeared in 2003 (see appendix, all pho-

tos taken by the authors). More recent photos on the RUPP website show that the buildings have improved in the years since. Figure 2 shows the remains of the unmaintained outdoor pool.

As figure 3 illustrates, the programming classes at RUPP are filled to capacity. Unfortunately, the local economy does not provide graduates with the opportunity to exercise their development skills due to lack of any control of intellectual property rights. When asked about the Microsoft software being used in the labs, we were informed that all of it was indeed pirated. Furthermore, pirated software, books, and music are plentiful on the streets of Phnom Penh. In fact, as a visitor, you would be hard pressed to find legitimate copies of any intellectual material. Thus, it comes as no surprise that businesses would not want to engage in the development of intellectual property such as software. However, there is an upside to piracy. "Piracy has more to recommend it as a strategy for developing countries than is often admitted. It speeds diffusion of the local IT base, creates a broad foundation for learning through 'reverse functional engineering,' and saves huge wads of foreign exchange." (Heeks, 1999) The downside on the other hand diminishes the number of high-wage development jobs as well as limiting foreign investment. Thus, we conclude that piracy may provide some small advantages in the early stages of economic development in a developing nation. But it will hinder economic growth and full participation in the global economy down the road. Open source software may provide a better means for improving developing economies (Camara and Fonseca, 2007). We must conclude at this stage of its economic development that the incentive of low paying IT jobs (the equivalent of 400USD per month) is sufficient to attract large numbers of students to the CS program at the RUPP.

### 3. AFGHANISTAN AFTER 9/11

During the fall 2006 term, the first students of AUAF (American University of Afghanistan) began coursework toward the bachelor's degree. AUAF was funded by USAID in the aftermath of 9/11 as part of the effort to promote peace in the region through education. During the fall of 2007, we began to

work with the AUAF administration to create an undergraduate curriculum in IT. By the summer of 2008, we had enough full-time IT faculty members on the ground in Kabul to staff the small number of IT students beginning the program. During the fall 2008 term there were 39 students enrolled in the IT program of a total university undergraduate population of about 350. More details of the AUAF history may be found online (<http://www.auaf.edu.af/history.html>).

Any challenges faced by faculty members and administrators in the US are greatly magnified in the Islamic Republic of Afghanistan. Although this topic alone could consume an entire paper, we will be satisfied to merely list some of the struggles. Power is not stable, therefore generators are needed. Shipping computers and software to Afghanistan is time-consuming and difficult. Getting textbooks in a timely manner is challenging. Recruiting westerners to work in Kabul is one of the greatest challenges. Working with students who have deficient and/or variable language and mathematical skills necessitates a tremendous amount of flexibility from educators. Dealing with the ethnic diversity of the Afghan culture creates a plethora of problems. For example, students will show little respect to professors from certain ethnic groups. Students in the Afghan culture are quick to point out their disappointments and are more likely than their western counterparts to question class policy and negotiate due dates and grades. Attracting and recruiting students with the academic background needed to be successful in an English language, American-style University is another hurdle. In short, working at AUAF in Kabul is not for the timid.

The AUAF facilities provide students with a unique learning environment in Afghanistan. The power on campus was stabilized through generators (much of the infrastructure was placed by the US Army Corps of Engineers). The Internet service was fairly reliable (we experienced only about 10% down time over a 10 day period). Figures 4 and 5 show a lab and the campus grounds respectively. The campus is an oasis in the midst of a dry, dusty city. Figure 6 will help the reader to appreciate that this work is going on amidst a war-torn country.

Opportunities for graduates of the IT program at AUAF appear to be promising. Currently, the vast majority of the students enrolled in the IT program work in the IT sector for government or business in Kabul. The most common work is network administration. Many of the students work full-time and as a result many of the classes are offered in the evenings. However, as was the case in Cambodia, the regard for intellectual property law is virtually non-existent. Thus, careers involving software development are not available (though there is some web development that is limited in scope). One curious problem that we encountered at AUAF is that the students have petitioned the administration to re-label the IT degree as a "Computer Science" degree as the students feel that the most prestigious computing programs are the CS degrees at American universities. However, when faced with the reality of the curricular issues, the students (and the governmental and business constituents in Kabul) prefer to take courses in applied IT such as network administration, database administration, and IT management.

The degree programs at AUAF consist of three: liberal arts, Business, and IT. Currently the IT program is the smallest and newest. It has also proved to be the most difficult to staff with faculty. Although student interest was high initially, there has been some fallout as the difficulty of the major has come to light. Thus, some students have elected to change their major to Business from IT. All of the faculty members have reported struggles with students not being prepared for class content, which has resulted in amended (i.e., shortened) syllabi in IT courses. The top complaint among the students, however, has been that availability of courses is too infrequent, which lengthens degree completion time.

In order to increase the number of offerings in the IT program, we decided on a two pronged approach in the early portion of 2008. First, we began to aggressively recruit for another full-time tenure track IT faculty member to start in August 2008. That search was successful and the candidate began work in Kabul in August of 2008. The first year was considered by all a tremendous success as the candidate not only became an effective pedagogue at AUAF, but

also assumed significant leadership roles on faculty committees outside of IT.

The second prong to our strategy was to experiment with a "partial distance education" paradigm. We choose two courses, one in Business and one in IT, to be offered during the summer of 2008. The instructors were professors who were already tenured at an American university and had some experience with the course management system that we would utilize (eCollege). The IT course offered was Database Management Systems. Since our instructors were limited to 10 days on the ground in Kabul, we organized the partial distance course such that the face-to-face instruction occurred in the middle of the five week summer session. Thus, students were utilizing eCollege for this course during the beginning and ending portions of the five week summer term. The course was the first exposure to eCollege (or any course management system for that matter) and distance education for these students.

We learned several things from this experience. First, the students' command of English was much better than we anticipated. Along with this, we found that the students possessed great motivation to apprehend the material. We discovered that the students we were working with were among the brightest in Afghanistan (it also became clear to us that they were among the wealthiest too). All of them held significant IT positions, either full or part time, outside of their studies. However, on the downside, most of the students did not have the prerequisite knowledge that we expect going into the course. Part of what we uncovered during the process was the fact that the University had no mechanism to police the prerequisite structure. Another observation was the cultural tendency to want to negotiate with the instructor on everything from course content to due dates to actual grades themselves. Probably the most important observation we made was the absolute necessity of the face to face time. Understanding the cultural and academic differences between an American professor and middle-eastern students cannot be discerned via a course management system. At the end of the term, all had completed the course successfully.

#### 4. CONCLUSIONS

We have written about some of our experiences helping to create IT programs in developing countries. Furthermore, the work runs parallel to a relatively new research area in computing, ICTD. The ICTD field offers humanitarian, economic, and educational benefits to developing nations. Two questions that have been asked about ICTD merit some discussion. Will ICTD provide viable paths for tenure-track faculty positions and will it help motivate a new generation of students in the US to enter our field? (Dias, 2009) The answer to the first question remains to be seen. In our experience, the work in developing countries is contributing to our research and service portfolios that play heavily into the tenure and promotion process. As for the second question, we believe it may be the more important of the two. We have been using our experiences to inform our American students about the opportunities available to influence the world while studying computing. More importantly, we hope that our students will be more likely to engage in study abroad options when they see their own professors engaged in work abroad. We believe this type of experience for both students and faculty will create sustainable growth for our field to help mitigate enrollment losses experienced over the past decade.

Another approach to impacting a developing nation is to bring the youth of that country to the US. Our country is currently engaged in such a program in the aftermath of 9/11. The Youth Exchange and Study (YES) program was created by the U.S. Government in 2004 as a response to the events of September 11, 2001 with the purpose of advancing mutual understanding between the United States and countries with significant Muslim populations. High School students from Muslim countries spend a year in the US living with a host family and study in US High Schools. We interacted with several of these students from Afghanistan this year and hosted them in our homes. What we found after a year of living in the US is that these students were more concerned with returning to the US than with impacting their home country with the ideas of civic responsibility and volunteerism, which the program aims to promote. The net impact may turn out to be more "brain drain" for Afghanistan

than anticipated. We started with Postman's idea that "cultures may suffer grievously from a lack of information." However, we, like Postman, are starting to understand that "cultures may also suffer grievously from information glut." Therefore, we conclude by reminding ourselves and our readers that our task as educators is to help our students both in America and abroad, to resist the temptation to live for the existential comforts of our culture and to find meaning in an educational experience that is transcendent and trans-cultural.

#### 5. REFERENCES

- Brewer, Eric, et al (2005) "The Case for Technology in Developing Regions." *IEEE Computer*, vol. 38, no. 6, pg. 25-38.
- Câmara, G. and F.T. Fonseca (2007) "Information policies and open source software in developing countries," *Journal of the American Society for Information Science and Technology*, vol.12, no.4, pg. 255-272.
- Dias, M. Bernardine and Eric Brewer (2009) "How Computer Science Serves the Developing World." *Communications of the ACM*, vol. 52, no. 6, pg. 74-80.
- Heeks, Richard B. (1999) "Software Strategies in Developing Countries." *Communications of the ACM*, vol. 42, no. 6, pg. 15-20.
- Kim, S. J. (2003) "Information Technology and its Impact on Economic Growth and Productivity in Korea." *International Economic Journal*, vol. 17, no. 3, pg. 55-75.
- Patra, R., et al (2007) "Usage Models of Classroom Computing in Developing Regions," *Proceedings of ICTD 2007*, pg. 158-167.
- Postman, Neil (1992) *Technopoly: The Surrender of Culture to Technology*. Random House Inc., New York, pg. 70.

**APPENDIX – Figures**



Figure 1. Main Academic Building of Royal University in Phnom Penh.



Figure 2. Pool at RUPP used by local children in 2003



Figure 3. Visual Basic programming class at RUPP in 2003, standing room only!



Figure 4. Database students working in one of the AUAF labs, July 2008.



Figure 5. AUAF campus grounds on a summer afternoon.



Figure 6. Remains of the Royal Palace within a few blocks of AUAF.