

USING INFORMATION AND COMMUNICATION TECHNOLOGY TO ENHANCE EDUCATIONAL GOALS IN DEVELOPING COUNTRIES: THE EXAMPLE OF THE CATHOLIC UNIVERSITY OF ANGOLA

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In 1998, the Angola Educational Assistance Fund (AEAF) and the Catholic University of Luanda (UCAN) started a collaborative effort, joined later by the University of Trento (UniTN), which resulted in the development of a curriculum study for a Computer Engineering Department (CED) whose classes began in January 2001. The purposes and objectives of the CED have been coordinated with the strategic goals of UCAN as well as the specific needs of the private and public sector and the local community at large. The ultimate goal was to design a program that could offer young Angolans valuable and practical skills needed to be successful in the growing Angolan economy.

1. Background

The Republic of Angola is blessed with abundant natural resources, including petroleum, diamonds, agriculture and fishing resources, and has definitely the potential to be one of Africa's brightest stars. It has a population of over 11 million people and a territory of about 1.2 million square kilometers, which makes it about twice the size of France. Located on the Atlantic Coast of southern Africa, Angola is bordered by Namibia to the south, Zambia and Zaire to the east and the Democratic Republic of Congo to the north. The over 1,600 km-long coastline and its four major ports make it a natural trans-shipment point for the entire region.

However, civil war has been the norm in Angola since independence from Portugal in 1975. A 1994 peace accord between the government and the National Union for the Total Independence of Angola (UNITA) provided for the integration of former UNITA insurgents into the government and armed forces.

A national unity government was installed in April of 1997, but serious fighting resumed in late 1998, rendering hundreds of thousands of people homeless. Up to 1.5 million lives may have been lost in fighting over the past quarter century. No matter how uncertain the future of the country may be, the biggest challenge ahead is the rebuilding of the country's post-war society. Meeting immediate human needs is a necessary current focus, but belief in a recovered and thriving Angola requires attention to long-term requirements as well, including the need for institutions of higher learning and academic research which will educate Angolans in Angola, at the highest world standards, and provide leaders at all socio-economic levels.

The Catholic University (UCAN, www.ucan.edu) is the first non-governmental university in Angola. It is based in Luanda and has been inaugurated in November 1999, with the opening of the Department of Law and the Department of Economics and Management. Its mission is

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to provide human, academic and professional education to the Angolan people. As an open university, it is ruled by principles of absolute liberty of access, regardless of race, gender, religion and social and economic conditions, with the only limits being those deriving from available space and academic selection criteria.

The Angola Educational Assistance Fund (AEAF, www.aeaf.org) is a 501(c)(3) nonprofit organization based in Boston. It was created in 1996 by Michael Kennedy, the late Chairman of Citizens Energy, in order to promote higher standards of academic education in Angola through the establishment of the Catholic University of Angola.

In June 2000, UCAN asked AEAF to help create a Computer Engineering Department. An international team of experts under the guidance of AEAF and the University of Trento has developed the academic curriculum and planned the course structure. Official approval by the Angolan Ministry of Education is expected soon. Classes are scheduled to begin in March 2001.

2. Curriculum

Our basic approach considers one essential aspect of Information Technology (IT): rapid, continuous change. New technologies are constantly introduced, and existing ones become obsolete in a short time span. The rapid evolution of the discipline has a deep effect on computing education, affecting both content and pedagogy. As a result, university-level curricula need frequent updating to remain effective. Our methodology toward the UCAN curriculum has been to consider the fast changing reality of the Angolan economy, and its need for IT skilled personnel in the near future.

The model curricula that we used as a reference, developed by international computing associations [1,2,3] or universities [4], are generally based on common structures and degree programs as available in North America and Europe. Assumptions about student backgrounds and degree programs may not be applicable in other countries, in particular in developing countries. However, the models are also grounded in a fundamental body of computing and information systems knowledge. They can, therefore, with some modifications and adaptations, be employed as a reference model for international use.

Early on, it also became evident that a needs assessment would be necessary in order to ensure that the curriculum would be tailored to Angola unique requirements. The petroleum industry, dominant in the Angolan economy, provided a natural environment for the needs assessment of the private sector.

The necessity for a Preparatory Year (Propedêutico)

There are some general prerequisites that should be met prior to formal Computer Engineering courses. Students are expected to have basic proficiency in the fundamental tools of personal computing such as Internet and e-mail, spreadsheets, word processing, databases, presentation graphics, statistical analysis, and external database retrieval. As a basis for lifetime learning, students should also have an introduction to the behavioral, social and natural sciences. Other prerequisite or interleaved topics directly applicable to the curriculum include communications (general and technical writing, oral communications, listening skills, basic knowledge English), quantitative and qualitative analysis (discrete mathematics, introduction to calculus, statistics), and organizational issues (general economics, accounting, logistics, finance, human resources, marketing, production and international aspects of business).

For various reasons, the high school system in Angola is currently unable to provide a uniform level of general knowledge and preparation for an undergraduate degree in Computer

Engineering. UCAN introduced therefore a “Propedêutico” (preparatory) year as a prerequisite for students, to be successfully completed before they are able to begin the degree program. The Propedêutico improves the overall cultural background of the students and ensures that a comparable level of preparation exists within the class.

General structure of the curriculum

In order to develop a curriculum, it is essential to form a detailed understanding of the knowledge encompassed by that discipline, i.e. to define the “*body of knowledge*”. Such body of knowledge should be integrated defining:

- Introductory and supporting topics and courses. Define the necessary requirements. Identify a minimal list of supporting courses deemed essential to an undergraduate program, as well as additional supporting courses.
- The computing core. Specify material that is deemed essential to a foundation in computing and develop the core as a curricular alternative to the traditional approach of organizing programs around artifacts (e.g., courses in compilers, operating systems, databases, and so forth) [1].
- Professional practices. Identify the needs of effective education in various aspects of professional practices and how these can be integrated into the curriculum.
- Industry participation. Specify the ways to involve practitioners in the design, development, implementation and evaluation of the curriculum [5].
- Research activities. Identify and specify graduate and undergraduate activities.

The overall program has been structured in three steps (each with its own exit point) totaling at least five years and six months to achieve the higher degree.

- The preparatory year (year zero, *Propedêutico*) will give students the title of “computer literate”. At the end of the year a computer literate will have knowledge in and familiarity with the use of information systems and software tools for office automation.
- The undergraduate degree (three years, *Bachelorato*). Computer engineering undergraduates will be able to carry out professional and technical activities in the design, organization and management of computer systems and networks.
- The graduate degree (another year, *Licenciatura*, plus another six months for the internship program and the thesis). Typical occupations for computer engineering degree graduates range from pure and applied research to innovation and production development, advanced design, planning and programming, complex systems management.

This structure is compatible with the needs to conform to the Angolan higher education regulations, and by offering intermediate degrees will also present an opportunity to students not able to end the program.

Professional practices and the role of the private sector

Most undergraduates in computing programs are offered jobs in the industry, and often do not seek more advanced education. Because computing is an integrated discipline, it is essential for all programs to emphasize the practical aspects of the discipline along with the theoretical ones. Today, much of the practical knowledge associated with computing exists in the form of professional practices that are present in the industry. To be successful, students must be exposed to these practices as part of their education. In addition, other requirements are usually added to computing-specific skills, and include management, ethics and values, written and oral communication, and the ability to work as part of a team. Partnership with local

companies and the public administration is strongly encouraged in order to expose the students to these requirements early on. Possibilities for collaboration include:

- Classes taught by non-academic professors and/or practitioners
- Professional development programs.
- Visits to local industries, organizations and computer related facilities.
- Organization of state-of-the-art seminars and conferences.
- Participation at different levels of industry activities, including research activities.
- Internship programs.
- Corporate Advisory Panel for continuous feedback and relationship building.

Computer engineering degree courses culminate with an important design or research activity and a related thesis. The student will demonstrate mastery of the arguments, the ability to operate autonomously, and a good level of communication and presentation skills.

The role of the private sector is also important for defining contents and complexity level of the compulsory and optional classes at the end of the program. These classes should be defined in collaboration with local and/or international industries, companies, research centers and universities, paying particular attention to research opportunities, available resources and teacher's availability.

Private sector needs assessment

Representatives from the private sector (mostly the petroleum industry) were interviewed because of their role as future employees of the graduates of the CED and as significant players in the current and future economic and social development of Angola in general. While the needs assessment will be an on-going mechanism (see discussion on a corporate advisory panel below), the first findings resulting from meetings led to the following results.

The private and the petroleum sector are undergoing expansion. While all companies interviewed would like to hire local labor for new job openings, the severe shortages of skilled labor in the Angolan labor market forces foreign investors to look abroad to fulfill their needs. In terms of IT skills, the petroleum companies stated a need for knowledge of and skills in hardware, network, communication, PC LANs/WANs, MS Office administration, financial systems, database and MIS, complaining of "the missing IT middle class". In addition to technical skills, the companies emphasized accountability and the ability to communicate effectively as essential requirements.

In terms of technical equipment, the companies generally rely on a mix of UNIX (+SPARC) and Windows NT machines. All use satellite communication, but have long-term plans for the use of fiber optics. The reason for switching to fiber optic, in addition to greater bandwidth, is the difficulty experienced due to unregulated airwaves.

We also had the chance to explore the banking sector. There is an extensive computerization effort in the banking sector in general. Banks in general are looking to install computerized reliable payment systems, optical readings, long-distance communication and payment clearing mechanisms.

A preliminary conclusion of the private sector needs assessment was that about 80-90% of the market requires technicians with networking/web skills. However, due to the unique requirements of Angola, which include rapidly changing regulatory laws, inflationary economy, and dual currency accounts, the software developed outside of Angola is not always adequately suited for Angola's reality. Many managers therefore would prefer to buy software systems developed locally. As it stands now, there is also a fundamental shortage of Angolans with adequate programming skills.

3. Faculty Staff

While carrying out the needs assessment, we proceeded to also ask the private sector whether they would be interested in lending some technical staff to the University for carrying out lab sessions, training the university's IT staff, and/or participate in seminars. The companies interviewed were all positive to such arrangements. The involvement of enterprises in the educational process is widely recognised as a necessary step toward *information systems engineering* [5].

In the first period of activity it will be necessary to recruit teachers abroad. Contacts are currently being established with UniTN and other universities. To increase the benefit of involving teachers from abroad, each one will team up with a member of the CED staff in a sort of "train the trainers" program performed in a real working setting. This will also ease the requirements, possibly helping with the language or substituting the teacher if there is the need to periodically returning back home. Currently the major difficulty in the implementation of this idea is the limited numbers of people in the CED staff.

In addition to these strategies, there will be an effort for allowing exchange programs for both faculty and students, giving them the opportunity to visit other universities and inviting students and staff from abroad.

4. Community Capacity Building

AEAF has been actively supporting UCAN in a wide variety of projects. In 1998, AEAF focused these efforts on Information and Communication Technology (ICT). One of the results has been a state of the art Computer Center that features a local area network with over 150 personal computers, divided in several classrooms and public access areas. A spread spectrum wireless link to Ebonet, a local Internet Provider, allows a broadband permanent Internet connection. The Computer Center has greatly enhanced UCAN's educational objectives as well as its various academic activities.

The existing ICT facilities at UCAN provide a solid foundation for the creation of the CED. Many individuals and organizations (concerned about social development issues or representing the Angolan private sector) have visited the facilities at UCAN and were favorably impressed by the installations, and are, in some cases, looking at ways to replicate the success elsewhere.

Additional activities carried on jointly by AEAF and UCAN include:

- The School Networking Project, a project supported by the Canadian International Development Research Centre (IDRC) with the objective to connect local high schools to the Internet and train teachers in using information technology to improve the quality of education offered to the students. In January 2001, four schools had been identified by AEAF, and their teachers have attended formal ICT training held at UCAN (computer classes totaling 40 hours over 10 weeks). A container with about 80 donated personal computers and miscellaneous hardware material sent by AEAF to Angola has arrived and the hardware will soon be checked and installed at the schools. The next phase of this project (to be completed in 2001) will be to extend the collaboration between Angolan schools and other African schools under the auspices of the SchoolNet Africa network, an initiative by the Canadian International Development Research Centre (IDRC).
- Training programs for the local business community. English as a Second Language and Computer Literacy programs have been organized by AEAF at UCAN. The revenues generated through these programs have helped to finance other activities in support of

UCAN and the completion of the Computer Center at UCAN. Plans to extend the course offering to the local community at large are under way.

- Student internships in local companies will give the opportunity to strengthen the relationships between UCAN and the private sector. The students will also act as facilitators for the introduction of technological innovation.

In addition, we carried out a number of training courses on the use of Information and Communication Technology (ICT) for teachers, small businesses, community leaders, journalists, non-governmental organizations, etc, and we plan to make these activities a permanent part of the service offering at UCAN. Other initiatives that are being considered are the creation of a “computer refurbishing” Lab in the University, employing students in exchange of lowered tuition or even part-time salaries, and the possible role of senior students as tutors of individuals attending training courses.

5. Plan for the Future: The Research Center

To link the CED to the international research community, we plan to start a joint research center with UniTN and selected companies operating in Angola. Its research activities will be focused on several areas, including applied technologies in emerging countries, digital divide, and multi-cultural working settings. The center will offer an opportunity to engage in field research in a very unique and dynamic environment.

The activity of the center should encompass impact and implementation studies as well as development of technology and prototypes. The planned approach is multidisciplinary: in Angola, as well as in the rest of the world, technological innovation issues are no longer separable from organizational and social aspects.

To foster the participation of international researchers in the center activities, an international scientific committee will be appointed. The CED Curriculum and the center will mutually benefit from each other activities, carried on in tight correlation.

The private sector will also play an important role both as an object of study as well as a beneficiary of consulting services by the research center. The overall setting of the center suggests a large potential for an Action-Research approach [6], in order to effectively bring innovation in the Angolan society. In the long run, the center personnel should be encouraged to start private spin-offs from the center activities. The birth of these new companies will have a dramatic and positive impact on the socio-economic development of Angola.

6. References

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