Accessibility through a Hybrid Educational System: A Case Study

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Abstract— **In this paper we study the interesting attempt at computerizing academic life at Birzeit University in Palestine. The experience maybe unique in many ways: in that the decision to go to an internet-centered education was forced by political circumstance to circumvent the inaccessibility of the (physical) campus; in that the transition was fast without much preparation and took place in an environment with severe limitations on computer equipment and internet bandwidth; in that the goals of the experiment were still being defined at the time when the system was deployed. The experiment is in its infancy and needs continuous monitoring and evaluation. However, even at this stage it is clear that it helped substantially improve and better utilize the IT infrastructure at the university and its surrounding, resulted in an educational system accommodating diverse practices that constitute an adaptation of multiple technologies to the limitations of a resource poor environment as well as higher awareness on part on the university community of the potential and limitations of information technology in general and its educational uses in particular.**

Index Terms—**Information Technology in Education, Computing in Developing Countries, E-education, Social Implications of technology.**

I. Introduction and Background

DEVELOPING countries differ substantially in the degree of introduction of information technology (IT) products in the various aspects of life[2,3]. Within an individual country IT resources are not uniformly distributed. This is the case in Palestine where major discrepancies in IT resource availability depend on such factors as region of residency, family income, educational level of parents among others, and where the trend seems to be towards more polarization in this regard[1].

This nonuniform distribution of resources is characteristic of the educational system as well. The degree of availability of computing resources and internet bandwidth varies between educational institutions and within units of the individual institution[1]. Historically, it was always the case that more computational resources were devoted to administrative than to academic needs and the proportion devoted for instructional uses is very limited[8]. Connectivity was restricted and therefore security and access control were not major issues. Things started to change with the advent of the Internet which started in Palestine in the early nineties. Electronic communications through the Internet between the various entities proved beneficial in terms of economic returns and access to limited/unavailable resources such as library materials. Many in the administration came to realize that computer networks offer access to rare resources worldwide and can serve as a tool to promote their institution on the global level. The limited bandwidth of the connection to the Internet was devoted to public relations and other administrative uses and students and faculty had only limited access to the outside world through the small number of stations with access to the Internet. It took several years to start passing the benefits of IT and the Internet to the student body at the university.

It is generally the case that science and engineering students and faculty have better access to the university IT resources than their counterparts in other schools. On average an engineering student at Birzeit University has less than 5 hours of computing time per week available to him/her at school. Other students are less lucky in this regard. The bandwidth is very limited and substantial delays are in effect whenever the number of students accessing the web is large. Failures are common due to the limited expertise of the staff and the limitations on resources. The lack of duplication makes many failures critical to the overall performance of the computing facilities.

The university offers email accounts and web hosting facilities to its faculty members but not to its students. The latter have to resort to commercial providers for their email/web accounts. However, the university grants no home access to its computing resources to faculty and students except on commercial basis. The reason advanced is the absence of funding. This lead to a situation where computing resources are idle outside the limited operational hours of the university (evenings, holidays and weekends: more than 50% of the time).

As for out of school access differences exist depending on family income of the individual student (the price of a PC is about twice the average monthly income of a family and even limited internet access can cost up to 20% of the monthly income), place of residence (rural areas are less likely to be connected than cities) and other factors[1]. However, a great

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majority of engineering students had home computers many with connections to the Internet.

Home links are mainly dial-up with low connection speeds and high costs for connections. No DSL/cable service is offered on the market. Internet service providers have limited resources and denial of service is frequent during low cost times. This makes it difficult to deal with content characterized by large storage needs such as formatted text and multimedia data.

The main mode of instruction is the traditional one with the web use limited to individual teachers and mostly for informational purposes. Noninsructional tasks such as registration, advising, student finance and reporting were done the traditional paper way with a minimal role for information technology despite the obvious need for more technically advanced and resource saving procedures.

In late 2001 and early 2002 the political circumstance changed and physical access to the university campus became erratic and at times impossible to the vast majority of students and faculty. This disrupted academic life to the degree that the graduation and admissions processes were threatened. Many were apprehensive about a return to the extended closures of the late eighties and early nineties when schools were closed for years at a time.

It is in this environment that Birzeit University took the bold step of resorting to IT and the Internet to network its students and enable the university community to communicate and the institution to continue functioning. This was accomplished by accelerating the work on a student portal that was still at the development/testing stages. The portal was deployed with the limited functionality it had at the time around March 2002.

In the remainder of this paper we discuss the modalities of the abrupt transition from a marginal role of IT/Internet in the educational process to a heavy reliance on computer and communications technology for many aspects of academic life at a Third World university. We assess the degree of success the experiment achieved so far and its shortfalls. We offer some suggestions on what should be done next to ensure the sustainability of the experiment and a reasonable return on the investment in the system. This evaluation may be coming too soon after the deployment but even at this time much can be said about the current experiment.

II. THE TRANSITION

At transition time the university community of 4000+ students and about 600 faculty/employees was served by about 800 computer stations, mostly PCs of various models. About half of those were connected to the Internet and the proportion was much less for PCs dedicated to student use. The overall available bandwidth was very limited (0.5mbps line) and congestion was a frequent occurrence at peak times. The number of open hours for the computer labs was limited especially due to the prevailing security conditions and is generally limited to 8 hours a day. Computer literacy courses were offered regularly. However, major differences existed between students at various colleges with better conditions for engineering and science students. The university surrounding had a large number internet access points in the form of internet cafes offering their services at reasonable prices. The issue of technology use in education was sparsely discussed and very little was done to integrate IT into the instruction process.

An administrative directive was issued for all faculty to place their educational materials on the web so that students are able to continue in a self study mode as long as access to the university campus remained dangerous and/or impossible. Objections were raised by faculty and students on the grounds of the inadmissibility of an abrupt transition without the needed preparation and study and that many courses could not be administered this way (labs, studio sessions,…). The directive was withdrawn in favor of a more restrained use of the Internet as an auxiliary tool for students who are unable to join their classes at the university. This will become characteristic of the system: shifting goals as more progress is made. Faculty and students were required to have frequent access to the web since much of the instructional material was to be placed on the web and much of the student feedback was to become computer based. The system functionality was extremely limited.

The system allowed instructors to place files and pointers to educational materials and assignments and exchange messages with students of individual classes. System documentation was incomplete and the terminology was still developing so frequent miscommunications was a major problem. No guidelines were issued to advise potential users on ways to minimize access costs through the proper selection of data formats and connection times. Despite the dedication of the system development staff it was difficult to cope with the workload resulting from the entire university population attempting to come on line.

The first semester of “experimenting” with the system was chaotic. However, the number of students and faculty members who were *forced* to join the system by acquiring the required user names and passwords was impressive: the majority by the end of the semester and almost all students and the majority of faculty by the start of the next term. Of course having a login name and password doesn’t reflect the real picture. Still major discrepancies existed between students of various specializations with those who are computer literate and having more computer access at school logging in more frequently. The system evaluation took the form of informal surveys and direct feedback through email and a hotline. Despite many reservations the overall response was generally positive as reflected in the informal surveys which consistently give the system a 75% approval rate[9].

The next step was to force students to do online registration. Every student had to use the system. However, this exposed major weaknesses: the available resources were not adequate to meet the high demand and technical considerations rather than good design methodology was the main factor behind the adopted approach. To speed-up the process and conserve bandwidth the advising process was abandoned and students registered on their own. Once more this generated a hot debate but a positive consequence was that an advising system had to be developed for subsequent semesters: a long awaited development. Next grad reporting and course/instructor evaluation were moved online and were linked so that students are obliged to perform certain tasks before they are allowed to view their course grades. To make the system more attractive to faculty and staff some administrative/financial services were added and lumped together with the academic records[5].

The system is already part of university life. Even individuals who feel it is in need of major improvements and validation are accepting its existence and using it to one degree or another. It seems that since the system goals are loosely defined, every body sees it as part of his/her vision of how IT should be incorporated into academia. Nevertheless, substantial differences exist between the degree of using the system between colleges, departments and individuals. Factors like internet access and computer literacy play a leading role. Students of courses where instructors rely heavily on the system tend to use it (and accept it) more than students who are not forced to interact with the system.

III. THE FALLOUT: THE GOOD AND THE BAD

In this section we discuss the influence the system had on some aspects of university life both the positive and the negative.

A. Positive Impact

Despite its short life, the deployed portal has already influenced the university community in more than one positive way.

1)Infrastructure: It served its original purpose of maintaining communications between instructors and students and allowing delivery of educational materials at reasonable cost even when physical contact is not possible. The university investment in IT and related technologies and expertise has been substantially increased. New access points have been added and the bandwidth available has been increased fourfold with an eye on further improvements as the functionality of the portal is upgraded[9].

2) Access Patterns: Access to the internet by students, faculty and staff has become a must not only from inside the university but also from a distance. The number of hits to the university web pages experienced vast increases when the system went on line and that number continues to grow as the portal acquires more functionality and more students and faculty are relying more heavily on the system for their various needs. Traffic is maintained beyond the university operational hours thus utilizing the otherwise idle resources. A balance is being restored between the incoming and outgoing traffic: the university is converting into a content provider in addition to being a consumer.

The percentage of faculty logging into the system during the current term ranged between 90+% for science and engineering and about 70% for arts and commerce. Every student was practically obliged to log into the system. However, even for optional use, student access to the system is still impressive by local standards. About 70% of the university students used the system during the latest one week period for which statistics are available (February 2003)[9].

3) Management Issues: The fine points of managing information technology resources are being placed on the discussion agenda of the university. The proper governance of IT resources, legal considerations, the ethics of IT utilization and security and access control issues are being recognized as important to the proper functioning of the system. Technical faults are less tolerable as they can severely disrupt academic life. Much of this was hidden from the public before the portal deployment.

4) Staff and Training: The technical skills of the development staff are being sharpened to deal with the multiplicity of tasks offered by the system. However, the development staff still needs better exposure to the best practices in the field through training and interaction with centers of excellence worldwide so that to be able to design better systems and be prepared for eventualities.

5) Hybrid Networking Patterns: The combination of the ambitious (though shifting) goals of the system and the limited resources available is producing interesting products that are hybrid in more than one way. The limited internet access forces many students to acquire hard copies of the material placed for them on the web for further study. Inaccessibility of the internet for many students is generating networks utilizing cellular[1] and terrestrial phones, other media and photocopying equipment to distribute messages/materials placed on the web[4].

B. Negative Factors

Experimentation with the system reveals several points in need of careful consideration in order for it to achieve better acceptance by the university community even when operating under more normal conditions.

1) Man-machine interface: Little attention is being given to man-machine interface considerations. Text based menus are almost the only form of user interaction. The interface frequently changes and is always in a state of flux. It is common to have a certain service available from a certain

[1] The use of SMS messaging is envisioned to become part of the delivery system of the portal[5].

menu then have it change location or lose its menu entry. This results in a lot of confusion during navigation and a need to place calls to the support center which is only operational during limited hours. Help online is not adequate and can often be misleading and doesn't have the casual user in mind. Coupled with the access speed variations, the experience with the portal is often frustrating for the nonexpert and many potential users would use it only reluctantly.

The language issue is also a problematic area of the system. Much of the interface is implemented in English which creates major difficulties for many at the university and potential users from the outside (say potential university students). This may also create problems for access to content in Arabic when the correspondence between the terms is not obvious.

2) System Design: The limited staff working on the project responds fast to requests dealing with functionality. However, it seems that little expertise goes into the design and system integration stages resulting in incorrect functioning or incompatibility with the common accepted practices. Besides, little attention is given to the issue of resource sufficiency for the tasks being offered. Despite the limited bandwidth and slow connection speeds, the preferred method of putting info on the system is that of formatted text and graphics data as opposed to the less costly text data. Transaction documentation is not addressed adequately and it is often the case that input errors can result in the need to redo major tasks, which is a frustrating experience for the user.

3) Limited Scope: The system should be placed in realm of administrative computing in the sense that it is only used to offer administrative support for academic life and as a delivery tool for instructional materials between faculty and students. It has no components to integrate information technology into the educational process itself such as e-tutoring, testing and (virtual) experimentation. This is no accident as this usage was the purpose of introducing the system to ensure a good level of continuity of academic life even during campus closures. However, the goals are being expanded systematically and it is important that instructional uses of computing be incorporated to ensure sustainability even under normal campus access conditions.

4) Management Issues: Historically, the management of IT resources at the university had many problems emanating from the differing views on the role of technology in the running of an institution[7]. The deployment of the portal with the diverse content it offers is bound to further complicate matters. System documentation has been problematic all through computer utilization. The pressure to add functionality makes it more difficult to properly document to the system and individual transactions. Issues like control over bulletin boards and system performance monitoring and evaluation are becoming to be problematic. With more information being placed on line issues like access control, password distribution and system security are bound to become more acute. Staff replacement considerations will also be important. It is already observed that skilled workers tend to relocate to more attractive jobs in the industry and the university is generally not able to compete in this regard. Additionally, ethical training of system staff and the user community is needed to avoid conflicts resulting from unauthorized access to records that were not as readily accessible to them before.

IV. WHAT IS NEXT?

Now that the internet portal has been deployed it is good to treat it as a proof-of-concept system: the internet can be used to support academic life at the university given sufficient resources. One has to realize that the system can be sustained only if more uses are found and incorporated, in particular in the area of e-education. This is due to the substantial resources needed to ensure the smooth functioning of the system. Such an investment can be motivated only if more applications are found, in particular instructional uses.

It is clear that the problems that plagued university computerization in Palestine in the past may come to hinder the success and possible expansion of the system to better serve the university community[8,6,7]. For this process to succeed one would need to address the following points:

- The system has to be application rather than technology driven. So far the available IT resources defined the applications being deployed. It is time to reverse the process and have the well-defined and needed application dictate the resources needed. IT-based education should be given utmost attention to make better use of the existing resources.
- The system development must follow the scientific method. Sufficient planning, requirement specifications (including user interfaces, help menus), testing, modification and documentation must precede system deployment.
- The system governance has to become expert based. It must include individuals with expertise in areas of concern: computing, educational technology and education to ensure good planning and compliance with the goals.
- Performance evaluation has to be detached from the parties involved in the design and implementation processes to ensure neutrality. Open forums must be used to solicit users feedback and discuss them for possible integration.
- The publicity for the system should be accurate and reflect the sources of the incorporated ideas, emphasize not only the advantages of the system but also its shortcomings and possible improvements. One would even advocate sharing resources and ideas with institutions with similar needs or with interest in the experiment. This may help avoid investments in reinventing similar systems once and again, a common feature of system development in Developing Countries[4].

- Attention should be given to staff training and retention to ensure better quality and preempt any surprises after system deployment that could disrupt academic life. Also potential users (especially faculty) have to be offered training and facilities to produce good quality instructional materials for placement on the web.
- Measures have to be taken to ensure the smooth functioning of the system. Activities have to be planned with an eye on avoiding congestion and guidelines for data formats that ensure proper performance under unfavorable internet connection speeds dominant.
- Instructions have to be issued to guarantee the system security and protection against equipment failures (e.g. system backup and duplication), unauthorized access (e.g. monitoring and encryption) and to encourage ethical conduct of users and developers.

V. CONCLUSIONS

We presented the experience of a *forced* experiment of using IT to maintain continuity in academic life at a developing nation university with severely limited resources. The deployed portal is mostly work-in-progress and the final judgment needs to wait for more elaborate testing. Without focusing on numbers and tables we discussed the positive and negative fallout of this experiment. However, the experiment is interesting in that it is generating a heated debate on more than one aspect: on the role of IT in education: the potential, right ratios and limitations; on the wisdom of investing available resources in a computerized system that has not been proven in a comparable environment; and the modalities of managing the various aspects of IT use in academia. The *imposed* interaction with the web by faculty and students is bound to improve computer literacy and likely to enlarge the pool of IT users and create demand for better services in the field. The experiment is also attracting the attention of society at large and is thus helping create better awareness about potential and limitations of information technology way beyond the limits of the university campus.

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