International Education Journal, 2006, 7(3), 235-244.
ISSN 1443-1475 © 2006 *Shannon Research Press*.
http://iej.com.au

Internet use in the developing world: A case study of an African university[1]

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The internet has become an indispensable tool in the twenty first century. However, the development may be slowed by a lack of appropriate facilities in less developed nations. A study of existing facilities in Burkina Faso was undertaken to answer five questions on the participants' perspectives on internet usage: (a) how do the participants perceive internet utilisation; (b) what factors encourage the use of the internet; (c) what factors discourage internet usage; (d) is the internet a tool for enhancing learning and (e) how can improved management of available technology lead to greater internet usage in the Humanities Faculty at Ouagadougou University?

Participants were selected because of their interest and involvement with technology, their computer knowledge and their prior experience with the internet. The current status of internet knowledge and utilisation were examined and factors that influenced internet usage were considered. Six recommendations for improved practice at the post-secondary level were discussed.

Internet, computer technology, rural access, Africa

INTRODUCTION

Although the internet is growing rapidly in much of the world, the international digital divide is still significant (Solomon, Allen and Resta, 2003), and emerging countries appear to be falling further behind. In 2003 there were an estimated 490 million people online, representing only 6 per cent of the world's population. Of these 490 million, 41 per cent are in North America, possibly as a result of the fact that the United States has more computers than the rest of the world combined. 26.5 per cent of the online population lives in Europe and the Middle East; 20 per cent of the online population logs on from the Asia Pacific region; and only 4 per cent of the world's online population is in South America. Only 1.4 per cent of the online population resides in Africa (Benton Foundation, 2004). The same trend is observed in higher education where the internet is rapidly expanding to allow access to the resources necessary for undertaking research, teaching, and linking scholars in new global networks.

While the internet is present in education in the developed world (Byron and Gagliardi, 2000), only a handful of post-secondary education institutions in emerging countries have access to it

[1] This article was extensively edited by Dr B. Matthews, Research Associate, Flinders University Institute of International Education.

(Jensen, 2002). A survey by the Association of African Universities in 1998 found that only 52 of the 232 academic and research institutions had full internet connectivity, the remaining 180 institutions had access that was deemed inadequate (Useem, 1999).

For the University of Ouagadougou in Burkina Faso, West Africa, as well as its counterparts in sub-Saharan Africa, the internet represents a significant opportunity to revitalise higher education by providing a way for academics to overcome their isolation (Useem, 1999). As a result, there is a concerted effort to solve the problem of internet access and usage in higher education institutions in Burkina Faso. Renaud (1994) issued the *Statement of Ouagadougou* at the end of the second African Conference on Information and Communications Technologies, in which administrators, academics, and researchers identified strategies required to implement and to bring about change in internet access and utilisation (Renaud, 1994).

The current study was designed to describe the patterns in internet utilisation among faculty and students at the *Unité de Formation et de Recherche/Sciences Humaines* (UFR/SH) at the University of Ouagadougou. In order to understand better internet utilisation, the participants' perspective about the internet and factors encouraging and discouraging its utilisation were examined. The way participants use the internet in learning and managing technology at the institution were also examined. This paper seeks to provide information that is likely to be useful for university administrators engaged in meeting present and future institutional needs in equipment acquisition, training, user support, and student facilities.

BACKGROUND TO THE STUDY

The internet in post-secondary Education in sub-Saharan Africa

Internet growth in emerging countries has been impressive (Jensen, 2002). According to the World Telecommunication Development Report, the number of internet hosts increased in the early 1990s to approximately 140,000 in 1997 in sub-Saharan Africa, and the number of internet users grew 59.9 per cent between 2001 and 2002 (UNCTAD, 2004). This increase has come from new applications of the internet. Concurrently, the pursuit of digitisation has become widespread in higher education and there is a growing awareness and commitment to prepare students for effective participation in the global knowledge economy. As early as 1993, the Association of African Universities (AAU) warned, "If our African universities fail to connect to the electronic network, we will have to face the fact that we will be awarding degrees of lesser quality" (AAU, p. 1).

There are great possibilities for higher education at all levels through the use of the internet (Byron and Gagliardi, 2000) because curricula can be developed collaboratively and educational materials distributed and updated more cheaply, offering additional ways for students to interact with their study materials as well as their instructors. There are also pressures to make learning more flexible even for those students who have access to the internet on a university campus (Brown, 2001). Further, there are multiple forces driving internet expansion in higher education including globalisation and the need for workforce training (Twigg and Oblinger, 1996), learner on-demand services (Milliron, 2000), digitisation, knowledge explosion, and cost effectiveness (Bates, 2000). Over the last 10 years, a great effort has been made to connect African universities to the internet. Given that an increasing number of academic resources are moving to the internet – and in some cases being made available exclusively online – it is imperative that African universities become connected rapidly if they are not to stagnate in the modern academic world. Because there are many issues associated with internet use in post-secondary education institutions in sub-Saharan Africa, the World Economic Forum has set up a Digital Infrastructure Initiative to "help developing countries leverage the potential of communication, technology and knowledge tools necessary for participation in the knowledge economy" (Elliot, 2000, p. 1). The

primary barriers to internet utilisation include limited telecommunications infrastructure, lack of access, limited technology support and expertise, high costs, sluggishness in infrastructure development, and other more political obstacles all of which contribute to a lack of internet access (African Development Forum, 2000).

The internet in Burkina Faso

As one of the first countries in francophone Africa to gain access to the internet in 1989, Burkina Faso has made considerable progress in the field of telecommunications. Yet, the country still has to make further progress, based on standards developed by the United Nations Development Program (UNDP) indicating that a teledensity of one line per 100 inhabitants is acceptable. Burkina Faso only had a teledensity of 0.80 and 4.60 for every 100 people in its largest cities (Lacroix, 2002), while requests for telephone lines are greater in number than the ability of the National Office for Telecommunication (ONATEL) to provide service. According to Zannou (2000), the acquisition and appropriation of the internet would allow people to exchange resources, work collaboratively at a distance, participate in virtual training online, and utilise scientific and technical information to facilitate action-research and socio-economic development in Burkina Faso.

Ouédraogo (2000) studied access to the internet in Burkina Faso and emphasised that its use could accelerate social and economic development. He investigated collective internet access, uses, and training by interviewing users in public departments, non-governmental organisations, and educational institutions. Ouédraogo noted that collective access locations were arranged spaces where individuals could go to use and learn how to use a computer and the internet, and he found that even if access at these locations was sometimes offered at no charge, access was typically based on utilisation fees. Ranked in order of importance, the following rates were provided about the use of information and communications technologies in 1999: fixed telephony (90%), mobile telephony (6%), and the internet (4%).

There is a growing interest in internet use as an economic consideration. Internet technology costs relatively less than other means of communication such as the telephone and fax. Since the internet is a relatively new form of technology, one of the major problems is the ability to manage it in order to maximise its benefit. Internet use in Burkina Faso is a recent phenomenon; for example in 1997, 48 per cent of those utilising the internet had been using it less than two years. In addition, internet use is mainly limited to applications including email and accessing the World Wide Web (WWW). Electronic mail is the most widely used application on the internet. The WWW is used by 97 per cent of internet users for research and is generally carried out through the use of a URL address. The use of search engines is not a common practice, as only 11 per cent of internet users employed search engines to parameterise their search for information. Other internet services including chat rooms, newsgroups, and videoconference applications were known to only 19 per cent of users (Lacroix, 2002).

Zannou (2000) described the barriers to internet use indicating that technology is regarded as a luxury that an average Burkinabé cannot afford, and about 60 per cent of the population in Burkina Faso do not read and write French, making computer-based technologies a prerogative of the elite. In addition, telephone coverage in urban and rural areas is limited, causing the telecommunications infrastructure to be a restraining factor to internet development. Present internet configuration using FasoNet as the gateway to the internet needs to be modified in order to extend internet accessibility. The prospects for developing the internet are further hindered by the constraints of the ONATEL monopoly. A final challenge is support and training. Currently, many users spend far too much time on the internet carrying out simple tasks. Many people use the internet without first learning basic computer concepts (DELGI, 1999).

The internet in Higher Learning

Higher education lags behind the business sector in access to the internet in Burkina Faso. The country has three major universities: the University of Ouagadougou, the Polytechnic University of Bobo-Dioulasso, and the Teacher's College of Koudougou, each with approximately 16,000 students enrolled. In terms of computer equipment, it was estimated in 1997 that there were only 0.050 computers per student, and 70 per cent of the available computer equipment was five to 10 years old (Ouédraogo, 2000).

The University of Ouagadougou has access to the internet through the network for learning and research (RENER) that was established in 1996 by the educational and research institutions in Burkina Faso. This terminal enables educational and research institutions including the African and Malgache Council for Higher Education, the Institute for Research and Development, the National Centre for Technologies and Research, the SYFED centre, the RESAFAD centre, the International Engineering School for Rural Welfare, and the Polytechnic University of Bobo-Dioulasso to be linked together and to the internet through routers. The main terminal of the network is hosted at the University of Ouagadougou and is connected to the ONATEL's terminal at a rate of 256 Kbps. In 1998, the technology context at the University of Ouagadougou was characterised by the following:

1. The absence of an institutional technology plan decelerates campus computerisation as regards the administrative and financial management of technology. The consequences are insufficient coordination of various initiatives and disparities in terms of equipment between academic units.
2. Technicians and technology coordinators are in demand. There are only four qualified technology directors for the University of Ouagadougou. They are assisted by a dozen other technicians who are adequately informed about technology trends, issues, and problems.
3. The lack of equipment for faculty and students is crucial. Faculty and students need more computers and increased internet access and connectivity.
4. The absence of training is due to limited human resources. The problem of basic training for administrators, faculty, as well as for students persists.
5. The lack of sufficient linkage between existing computers on campus illustrates the limited networking at the University of Ouagadougou. A high performing intranet on campus would facilitate communication and data transfer (DPNTIC, 2000, p. 10).

Despite the challenges for many administrators, faculty members, and students to gain convenient access and use the internet on a regular basis, the internet is quickly becoming the preferred way to communicate and carry out research.

RESEARCH METHODS

Grounded theory was the theoretical approach used in conducting the study, and qualitative research methods were employed to collect data about the patterns on internet utilisation. In this study data were gathered in three different ways: (a) in-depth, open-ended interviews; (b) direct observation; and (c) written documents (Patton, 2002). The data collected were used to answer the following research questions: (a) what are the participants' perspectives of internet utilisation? (b) what factors encourage internet utilisation at UFR/SH? (c) what factors discourage internet utilisation at UFR/SH? (d) what are users' experiences with the internet as a tool for enhancing learning? (e) how can better management of technology improve internet utilisation at UFR/SH?

The University of Ouagadougou is an appropriate site for the study because there are significant pressures upon post-secondary institutions in sub-Saharan Africa to use technology. The

University is a state-supported and research institution with a total student population of 14,000. Reorganised in 2000, the University currently comprises six academic units: *UFR des Sciences Juridiques et Economiques* (FR/SJE) or Law and Economics; *UFR des Lettres, Arts et Communications* (UFR/LAC) or Languages, Arts, and Communications; *UFR des Sciences Humaines* (UFR/SH) or Humanities; *UFR des Sciences Exactes et Appliquées* (UFR/SEA) or Computer Sciences, Physics, Mathematics; *UFR des Sciences de la Vie, de l'Environnement et de la Terre* (SVETRM) or Life and , Environment Sciences, and Mining; *UFR des Sciences de la Santé (UFR/SS) or Health Sciences; Institut des Arts et Métiers* or Civil Engineering and Architecture (The University of Ouagadougou, 2000).

This study was limited to UFR/SH, an academic unit that comprises two sections: The humanities section included the sociology, psychology, and philosophy departments and the history, archaeology and geography sections that includes the history, archaeology, and geography departments. UFR/SH was an information-rich faculty that provided an interesting foundation for research, and choosing this unit as the site for this study was a pragmatic decision because it could provide significant information for the process of improving internet utilisation.

A purposeful sampling method was employed to identify two faculty members, 10 students, and two technology coordinators to participate in this study based on their background, national origin and experience with the internet. The participants were native to Burkina Faso. The participants used the internet at least five times a week or spent at least one hour a day on the internet using any of its features. The faculty members were chosen because the UFR/SH's administration recommended their participation due to their interest in technology and their involvement in meetings and conferences to bring about technological change in the UFR/SH division and on campus. The students were chosen based on their exposure to the internet, their interactions with faculty members and on the recommendation of the two faculty members, who, in turn, based their recommendation on the students' attendance, grade point average (GPA), interest, and involvement with technology. The technology coordinators were chosen because of their experience with the internet and on professional their relationships with faculty members. The technology coordinators had an excellent understanding of the technology and internet context at the institution, knew about on-going hardware and software availability and problems, and in their work they provided support and training to faculty members and students.

In order to triangulate data sources and to ensure data validity, three formal data collection techniques were used in the study.

1. Interviews were conducted with faculty members, students, and the technologycoordinators through the use of a standardised open-ended interview format, which comprised 30 questions developed from the literature review and personal and professional experience as sources of theoretical sensitivity (Strauss and Corbin, 1990). The questions were posed to the participants according to themes including background information, experience with the internet, and support and technological training. Informal conversational interviews were used to gather additional data from the participants was also conducted throughout the study.
2. Direct participation and observation was a major part of this study. In order to provide a descriptive account of the situation that was being observed, focus was shifted from the environment, the workstations' specifications, and the connection speed to activities being accomplished, keywords, challenges faced, participants' thoughts and remarks on the technology, the degree of satisfaction with internet access, and participants' overall behaviour in front of the computer.
3. Written document collection was an on-going process throughout the study. Conference reports, studies, technology plans, articles, and books about the internet and its utilisation were initially collected.

The analysis of data is a progression of three levels of coding: open, axial, and selective (Strauss and Corbin, 1990). These levels of codes take data and break it down, reorganise it, connect it, and analyse the phenomenon in new ways. The constant comparative method was used throughout this study to shape explanations directly from the emerging data (Denzin and Lincoln, 1994).

DATA RESULTS

Categories

Six categories were identified in the coding process and provided the framework for presenting data in this study. The categories included: labelling the internet, reasons for using the internet, reasons for not using the internet, experience with the internet, support and training, and improving internet utilisation. The guiding questions are presented along with responses based on the findings generated through analysis of the data.

1. **What is the current status of internet utilisation at UFR/SH?** The current status of internet utilisation at UFR/SH is generally characterised by the lack of computers with internet access. UFR/SH is facing mounting internal and external pressures to change the way information is accessed, how learning takes place and the way research conducted. The internet is viewed as a means for improving internal and external communications at the institution to provide access to considerable resources for learning and research. In 2001, there were approximately 1,700 internet users connected to the university network although there were 14,000 students enrolled in degree programs on campus. Only 50 per cent of the faculty members at UFR/SH regularly used the internet, and on campus they had access to it in the computer labs located at the Department for Promoting the Use of Information and Communications Technologies (DPNTIC), the Central Library, and the SYFED and RESAFAD centres. Student internet access at UFR/SH was restricted to postgraduate students due to the limited capacity of these labs. For these reasons, internet utilisation at UFR/SH was highly restricted.
2. **What factors encourage internet utilisation at UFR/SH?** Faculty, staff, and students at UFR/SH reported using the internet for two purposes: to improve communications with other research workers and online information accessibility. The internet was chosen because it provided fast communication services, allowing faculty, staff, and students to send and receive messages and exchange information with distant and overseas colleagues and collaborators. As a result, the internet greatly enhanced communications and the exchange of information between faculty, staff, and students within and outside UFR/SH. Furthermore, the costs of these communications were less expensive than for telephone or fax, making the internet an inexpensive and convenient tool to use. In addition to communication opportunities, the use of the internet was highly influenced by the WWW, which allowed access to information that could be used in administration, teaching, and research in order to support student learning at UFR/SH. For faculty, staff, and students, the WWW helped to overcome the lack of resources available in the libraries at the institution.
3. **What factors discourage internet utilisation at UFR/SH?** There were many obstacles to internet use that were identified in the study. These obstacles, perceived as factors for not using the internet, included unavailable technological infrastructure and computer equipment, limited capacity of available computer equipment, power outages and connectivity problems, high usage costs, insufficient technical support, lack of training in basic internet skills, and English as the predominant language on the internet. In the UFR/SH faculty at the University of Ouagadougou, the crucial challenge was financing technology. High costs associated with the technology and its use made it very difficult for the university to provide computers with internet access for faculty, staff, and students. The existing technological equipment was numerically insufficient and most computers had hardware and software that were not up to

date, rendering the online experience challenging for campus users. Faculty, staff, and students spent lengthy amounts of time browsing the internet, and were frequently disconnected from the main server while using the internet. In addition to limited computer equipment available, users at UFR/SH experienced skill challenges due to under-funded computer support and training. As a result, technical problems were frequent and faculty, staff, and students encountered challenges in using keyword search strategies, which impeded their search results, their overall internet experience, and their personal satisfaction. Due to on-campus internet access problems, faculty, staff, and students used the services of off-campus internet providers where they were charged for connection time. Furthermore, English, the predominant language on the internet is not widely used in Burkina Faso. In fact, very few people can speak, read, or comprehend English since French is the official language in the country. In 2002, only 2.81 per cent of the web sites were in French. In addition, French was less used in online discussions comprising 1.5 per cent of all forums on the internet (Networks and Development Foundation, 2002). Even if the literacy rate would appear to be high (60 per cent), only 24 per cent of people in Burkina Faso speak, read, and comprehend French. At the village level, the majority of the people speak their own dialects. As a result, language remains a significant barrier in internet use. In addition to language barriers, about 80 per cent of people live in rural areas and many live far from towns and telephone lines (Lacroix, 2002).Therefore, they do not use the internet in their daily lives and they do not consider it as a necessity. This lack of use impacts the ability of students to use the internet efficiently when students from remote areas of the country enter higher education where computers and the internet are available.

4. **What is users' experience with the internet as a tool for enhancing learning?** The internet offers a broad range of possibilities for learning at all academic levels. There is a growing interest in developing ways of incorporating these technologies into the curriculum at UFR/SH so that faculty members and students may reach their full potential. Faculty and students' internet experiences at UFR/SH are hindered by lack of finances, insufficient technological infrastructure and equipment, limited support and training, and linguistic barriers. The majority of the faculty members and students first became acquainted with the internet in 1998. Thereafter, they have regularly used email to send and receive messages and browse the WWW, using search engines including Yahoo, Google, and Caramail. Yet, the use of internet services including File Transfer Protocol (FTP), and news and discussion groups is not widespread. Although limited, internet use has a positive influence on learning for all at UFR/SH, and this would undoubtedly increase if support and training were provided on a regular basis. The major on-campus support to students remains the free access to the RESAFAD and Syfed computer labs where some user assistance is provided. Due to lack of institutional support, independent learning is used as the method to become familiar with the information and communications technologies.

5. **How can management of technology improve internet utilisation at UFR/SH?** DPNTIC provided computer support and training to administrators, faculty members, and students. Four modules of computer training including Windows, MSWord, Excel, and internet (email and Internet Explorer to surf the WWW) were designed and provided by DPNTIC staff.

Yet, the leadership hindered technology use because the centralised approach to management of technology by the university has not proven to be effective in assessing needs, acquiring computers, and providing support and training at UFR/SH. For that reason a short-term plan to improve internet utilisation at UFR/SH is necessary. Under mounting financial pressures, more research must be done to study effective means of computer equipment acquisition and increasing the connectivity rate. Providing UFR/SH with its own dedicated network or an intranet would greatly improve internet accessibility in this academic unit. Increasing the number of computers

and creating separate faculty and student labs would reduce friction between users. In comments on the importance of training, the participants indicated that student training should be implemented, and more assistants should be available in computer labs. Users' internet experience is likely to improve if they are provided with the necessary computer support and practical training.

Grounded Theories

Two selective codes emerged from the step-by-step analysis. The first theory was drawn from the selective code, 'experience with the internet', and illustrated the reasons why participants did and did not use the internet at UFR/SH. Thorough analysis of the data provided the basis for the formation of a first theory in the study: The level of internet use in post-secondary institutions in emerging countries was primarily influenced by seven factors including personal satisfaction, information accessibility, enhanced learning, cost effectiveness, technology infrastructure and equipment, financial challenges, and skill challenges. The second theory arose from the selective code, 'support and training', and was related to the role of support and training as a component in internet utilisation. Thorough analysis of the data provided the basis for the formation of Theory 2 in this study: Therefore, the absence of ongoing training, professional development, and adequate administrative support for technology negatively impact on internet utilisation in colleges and universities in developing countries.

IMPLICATIONS FOR IMPROVED PRACTICE

A major objective in the presentation of the data was to provide readers with the greatest amount of information possible to enable them to apply the findings to similar contexts in post-secondary education institutions. Previous research offered little basis for generalisation to this study, due to the limited number of specific studies conducted concerning internet utilisation in colleges and universities in developing countries. This study focused on three principal factors associated with internet utilisation, including: (a) benefits, (b) barriers, and (c) infrastructure. Finding effective means to facilitate the introduction of the internet into higher education in these countries is worthy of examination. The internet should be available to play the same role in institutions of higher education in less developed countries as in more technically advanced countries, supporting research, enriching curriculum, and greatly increasing administrative performance. As a result, this study is not only significant to administrators and scholars in post-secondary institutions in emerging countries, but it is also significant to those in colleges and universities universally. Administrators in both developing and developed countries are not only provided with useful information about user experience within higher education institutions, but they are also alerted to difficulties associated with internet adoption including linguistic, financial, and digital equity issues.

This study could be useful to college and university administrators in emerging nations because it suggests that in order for effective internet utilisation to occur at institutions of higher education, the following must occur.

1. **Provision of strong leadership for change**. Campus leaders must provide the strong personal leadership required to bring about technological change effectively. Without leadership and a strong sense of support for change in colleges and universities, the barriers affecting technology are likely to remain.
2. **Development of a shared campus vision**. Developing a shared vision concerning the value and future impact of information and communications technologies is important. It is critical for campus leaders, decision makers, and other important stakeholders to understand and agree

that a shared vision is necessary and that it must be the guiding focus behind campus planning and strategy.

3. **Building consensus through a campus-wide strategic plan**. A written strategic plan for information and communication technologies that is understood and embraced by all should be employed. All key stakeholders must consider the internet (including the campus network) as an integral part of the institution's information and communication-based resources.
4. **Establishment of an effective and integrated information technology organisation**. As more and more of its critical services are moved to its network and become dependent on it, a campus must create an effective organisation that addresses all aspects of human and technical support for information and communications technologies. It is recommended that the structure of the information technology organisation encompasses a mixture of centralised and decentralised strategies to support all constituencies on campus.
5. **Implementation of faculty and staff development and training**. In this time of rapid changes in information and communication technologies, there must be a strong commitment to faculty and staff development and the provision of ongoing organisational support and training at the institutional level.
6. **Building partnerships and fostering inter-institutional collaboration**. Campus leaders must take the initiative in the establishment and promotion of institutional partnerships and collaboration should be developed to exchange experiences and learn from each other, to facilitate the exchange of information between staff and students to conduct joint research, to implement network-based applications, and to share the cost of joint course development and delivery.

REFERENCES

Association of African Universities (December 1993). *Electronic Networking for West African Universities*. [Online] http://www.sas.upenn.edu/African_Studies/E_Mail/WEST_AAAS.html [June 10, 2001].

African Development Forum. (March 2000). *Theme 4 - Democratizing Access to the Information Society*. [Online] http://www.bellanet.org/partners/aisi/adf99docs/democratising.htm [September 14, 2002].

Bates, A.W. (2000). *Managing Technological Change.* San Francisco, CA: Jossey-Bass.

Benton Foundation (2001, March). *Digital Divide Basics Fact Sheet*. [Online] http://www.digitaldividenetwork.org/content/stories/index.cfm?key=168 [April 20, 2003].

Brown, M M. (April 2001). Can ICTs address the needs of the poor? *UNDP News*, 2-5.

Byron, I. and Gagliardi, R. (August 2000). Communities and the information society: The role of Information and Communication Technologies in education. [Online] http://www.anais.org/ARTICLES/DOC22.HTML [June 23, 2001].

Delegation Generale de l'Informatique (DELGI) (1999). *Plan de développement de l'infrastructure nationale d'information et de communication du Burkina Faso* [National Information and Communication Infrastructure] *2000-2005*. Ouagadougou, Burkina: Faso DELGI.

Denzin, N.K. and Lincoln, Y.S. (2000*). Handbook of Qualitative Research (2nd edition).* Thousand Oaks, CA: Sage.

Direction pour la Promotion des Nouvelles Techniques de l'Information et de la Communication, (2000). *Perspectives de dévelopement des nouvelles technologies de l'information et de la communication et de la formation a distance a l'Université de Ouagadougou* [New information and communication technologies and distance education development perspectives at the University of Ouagadougou]. Ouagadougou, Burkina Faso: DPNTIC.

Elliot, A. (October 2000). *Internet Issues in Africa.* [Online] http://www.middlemarch.co.nz/anne/africa/intro.html [October 18, 2002].

Jensen, M. (May, 2002). *The African Internet: A Status Report*. [Online] http://www3.sn.apc.org/africa/afstat.htm [January 20, 2003].

Lacroix, E. (2002). *L'internet au Burkina Faso en 2002: Situation, enjeux et perspectives* [The internet in Burkina Faso in 2002: Situation, stakes, and prospects]. Unpublished Master's Thesis, Université Polytechnique de Bobo-Dioulasso, Burkina Faso.

Milliron, M.D. (2000). Internet Vision: Unleashing the power of the internet in the higher education enterprise. In M.D. Milliron, and C. Miles, (Eds.), *Taking the Big Picture Look at Technology Learning and the Community College,* (pp.317-331). Mission Viejo: League for Innovation in the Community College.

Networks and Development Foundation (2002, February). *Languages and Cultures*. [Online] http://www.funredes.org/LC/L5/ultimas.html [June 10, 2003].

Ouédraogo, S. (August 2000). *Acces aux nouvelles technologies de la communication au Burkina Faso: Une analyse des centres d'acces collectifs et des comportements des usagers de l'internet* [Access to information and communication technologies in Burkina Faso: An analysis of collective access centres and internet users' behaviour]. [Online] http://www.anais.org/ARTICLES/ARTICLE115.HTML [November 5, 2001].

Patton, M.Q. (1990). *Qualitative Evaluation and Research Methods (2nd edition).* Newbury Park, CA: Sage.

Renaud, P. (1994). *Statement of Ouagadougou.* Ouagadougou, Burkina Faso: ORSTOM.

Solomon, G., Allen, N.J. and Resta, P. (2003). *Toward Digital Equity: Bridging the Divide in Education.* Boston, MA: Pearson Education Group.

Strauss, A.L. and Corbin, J.M. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Thousand Oaks, CA: Sage.

Twigg, C.A. and Oblinger, D. (November 1996). *The Virtual University.* Washington, DC.: Report from a Joint Educom/IBM Roundtable.

United Nations Commission on Science and Technology for Development (2004). *Information and communication technology*. [Online] http://www.unctad.org/en/docs/gdscsir20041c7_en.pdf [July 20, 2004].

United Nations Development Programme. (1999). New technologies and the global race for knowledge. *Human Development Report*, 57-76.

Université de Ouagadougou (2000). *La refondation de l'Université de Ouagadougou: Rapport Final* [The reorganization of the University of Ouagadougou: Final report]. Ouagadougou, Burkina Faso: Université de Ouagadougou.

Useem, A. (April 2, 1999). Wiring African universities proves a formidable challenge. *The Chronicle of Higher Education*, A25.

Zannou, C. (2000). *L'internet au Burkina Faso* [The internet in Burkina Faso]. Ouagadougou, Burkina Faso: RIFOD.