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ICT for education and training

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About the journal

The International Journal of Education and Development using Information and Communication Technology (IJEDICT) is an e-journal that provides free and open access to all of its content.

Regional economies and communities are facing increasing economic, social and cultural hardship in many parts of the world as economies adjust to the demands of the new orders of commerce and governance. A part of this is the paradox that regional economies and communities can be either enhanced or disadvantaged by information and communication technologies (ICT) products and services. The potential enhancement comes from the increased social, economic and cultural capital that comes from harnessing ICT products and services in a community sense. The disadvantage comes from the power that ICT products and services have in centralizing commerce, service provision and governance away from the regional community.

Unless we get a greater level of access AND adoption of information and communication technology (ICT) for education and development at community level, we will miss the opportunity to turn the "digital divide into a digital opportunity for all, particularly for those who risk being left behind and being further marginalised" ("Declaration of Principles", WSIS-03/Geneva/Doc/4-E, Principle 10). The International Journal of Education and Development using Information and Communication Technology (IJEDICT) is an e-journal, with free and open access, that seeks to address this issue.

IJEDICT aims to strengthen links between research and practice in ICT in education and development in hitherto less developed parts of the world, e.g., developing countries (especially small states), and rural and remote regions of developed countries. The emphasis is on providing a space for researchers, practitioners and theoreticians to jointly explore ideas using an eclectic mix of research methods and disciplines. It brings together research, action research and case studies in order to assist in the transfer of best practice, the development of policy and the creation of theory. Thus, IJEDICT is of interest to a wide-ranging audience of researchers, policy-makers, practitioners, government officers and other professionals involved in education or development in communities throughout the world.

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IJEDICT has a major emphasis on the use of ICT in education and development in hitherto less developed parts of the world. The journal includes descriptive case studies about ICT projects in developing countries and in rural and remote regions of developed countries, as well research articles evaluating such projects, developing policy or creating theory. Topics covered include, but are not limited to, the following areas:

Community informatics and development in remote, rural and regional areas;
Developing regional industries (e.g., agriculture, tourism) with ICT;
E-Commerce and Business in remote, rural and regional areas;
ICT for micro, small and medium enterprises;
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This section contains articles that have been reviewed by at least two academic peers in a process that ensures that authors and reviewers remain unknown to one another. To be included in this section, articles must be based on research and scholarship, and contribute "new" and significant knowledge to the field of ICT for education and/or development. Reviewers for research articles are selected from the Editorial Board, the Review Board and the Peer Review Panel.

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This section includes peer-commented and editorially reviewed case studies (2000-5000 words) of the use of ICT in education and/or development.

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This section includes peer-commented and editorially reviewed articles describing research in progress.

Literature Reviews

This section includes peer-commented and editorially reviewed articles that review the literature of the use of ICT in education and/or development.

Project Sheets

This section includes brief descriptions (500-1000 words) of education and development projects that utilise ICT.

Notes from the Field

This section contains short comments or notes that are useful for practitioners working in the field of ICT in education and/or development.

Book/Media Reviews

This section contains editorially reviewed reviews of books that are relevant to the use of ICT in education and/or development.

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- Please use Arial 12-point font for the Title, which should be in bold "title" (upper and lower) case.
- Use Arial 10-point font for the remainder of your article.
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Submitted manuscripts must be written in the Harvard editorial style:

- References should relate only to material cited within the manuscript and be listed in alphabetical order, including the author's name, complete title of the cited work, title of the source, volume, issue, year of publication, and pages cited. See the following examples:

    Marshall, S. (1991), "A genre-based approach to the teaching of report-writing". English for Specific Purposes, vol. 10, no.1, pp. 3-13.

    Taylor, W. & Marshall, S. (2002), "Collaboration: the Key to Establishing Community Networks in Regional Australia", Informing Science, vol. 5, pp. 155-162.

    Marshall, S., Taylor, W., & Yu, X. (eds.) (2003), Closing the Digital Divide: Transforming Regional Economies and Communities with Information Technology, Greenwood Publishing, Westport CT.

- o   Citations in the text should include the author's name and year of publication where you use the source in the text, as in the following examples:

    In this way, information technology can be seen to effect and influence changes in organisational structure (Orlikowski & Robey 1991).

    Edwards (1995, p.250) views the globalising of distance education as "invested with the uniform cultural messages of modernity".

    Globalisation, especially in relation to open and distance education, will reduce the tolerance of difference and so "how can local issues and contexts be addressed?" (Evans 1995, p.314).

- o   Further information about the Harvard editorial style can be found at:

    http://lisweb.curtin.edu.au/referencing/harvard.html
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Editorial: ICT for education and training

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Welcome to Volume 2, Issue 4 of the International Journal of Education and Development using Information and Communication Technology (IJEDICT). This issue contains articles concerned with using information and communication technologies (ICT) in educational settings so as to empower local communities. It brings articles from and/or about Australia, Barbados, Canada, Eritrea, India, Nigeria, South Africa and the Sultanate of Oman.

A major focus of this journal is on the utilisation of responsive and localised ICT for the socio-economic empowerment of rural communities. This is also the focus Ganga Prasad GL, Amitav Nath and Rakesh Mishra in their article "Community content sharing: Towards telecentre's Lab to Land approach". They explain the methodology of "lab to land" adopted by the ICT R&T Centre in India, and that this is well accepted by the farmers and women who are using ECKO successfully. They also outline the issues of learning, challenges faced and the edge that technology has over other community based management systems.

In "Pattern of usage of various electronic media by higher education students", S. Arulchelvan and D. Viswanathan provide an analysis of the different investment-centric educational media from the perspective of the student users in urban and rural areas of Tamilnadu in India. Respondents were requested to provide information on the frequency, timing, and place of usage of radio, TV, internet, compact discs and teleconferencing and were asked to report on the usefulness of these media. The various demographic variables are associated with media usage patterns. The main findings of the analysis suggest that the Internet is comparatively more-utilized among the media.

Ken Stevens describes how small schools in rural Canadian communities have had a special role in the development of e-learning and the management of digital knowledge within customized electronic educational structures. His article, "Rural schools as regional centres of e-learning and the management of digital knowledge: The case of Newfoundland and Labrador", he describes how the school district digital intranet provides a new educational environment that complements and extends traditional schools. It also challenges the traditional educational practice of teachers and learners interacting in closed learning environments and encourages them to consider the possibilities of engaging in open classrooms that are compatible with a knowledge-based economy.

In "Applications of computer-aided assessment in the diagnosis of science learning and teaching", Muwanga-Zake reports on a qualitative evaluation using questionnaires and interviews in South African Grade 10 classes on the diagnostic value of Computer-Aided Assessment (CAA). A two-stage evaluation was necessary: the first stage involved validation of diagnostic test items; and the second stage evaluated the diagnostic value of data that CAA produces. While results confirmed earlier findings about the advantages of CAA, the diagnostic and remediation potential of CAA data depended upon teachers' capacity to set diagnostic test items particularly in a multiple-choice format, teachers' ability to interpret data produced by CAA, teachers' skills in

remedying their classroom as well as learners' problems, the quality of the test items, and the learning as well as the teaching strategies.

Ravinder Rena, in "Education and human resource development in post-independent Eritrea: An explanatory note" describes how the Government of Eritrea is offering both formal and informal training programmes at different levels in order to develop human resources in the country. The author analyses the educational and human resource development after independence, and also provides a detailed account of technical and vocation education with special reference to skill development programme.

In "Impact of WebCT on learning: An Oman experience", Syed Naqvi describes a study that investigated the impact of WebCT on students learning taking a course "Introduction to Computers in Business" offered at the College of Commerce and Economics, Sultan Qaboos University in the Sultanate of Oman. The finding showed that though the students have little exposure of WebCT at the beginning of the course but towards the end they have appreciated the importance and the use of WebCT as it is easily accessible from any Internet enabled location at any time. In addition it helps them in better understanding and learning the course material.

The article "Perceptions of information and communication technology among undergraduate management students in Barbados" by Glenda Gay, Sonia Mahon, Dwayne Devonish, Philmore Alleyne and Peter G. Alleyne describes an exploratory study that examined attitudes and usage of ICT among undergraduate management students in Barbados. The study showed that students were generally favourable towards ICT. Males were more inclined to incorporate ICT in web-based instruction compared to other teaching activities. Older students were more interested in using ICT only as a supplement to teaching activities. They suggest that university administrators need to address the gender and age differences regarding ICT usage as well as develop strategies to maintain positive student attitudes and high usage of ICT.

In "A neomillennial learning approach: Helping non-traditional learners studying at a distance", M.D. Sankey reports on Australian research investigating the perceptions of first year distance education students studying a foundation communications course using a multimodal learning environment. It demonstrates higher levels of engagement are possible when a neomillennial learning approach is adopted for designing course materials catering to a diverse student body, whilst maintaining a balanced environment for more traditional learners.

The objective of the research described by Carlos Rodríguez in the article "Educative uses of ICT, technological skills and academic performance of the Venezuelan university students (Barineses): A causal perspective", was to analyze the relations among the educative uses of ICT, levels of skills in the technology handling (ICT Skills Index) and academic performance of the Barineses university students, in order to propose a model of causal relations that represents suitably, the effects of the technology use with academic aims on the results in the studies.

In his article "Interactive Child Learning Aid Project (i-CLAP): Design and development of an indigenous instructional multimedia model for Nigeria", Joseph Izang Azi describes a "Research in progress" project concerned with the design and development of an indigenous Instructional Multimedia prototype for enhancing early child-education in Nigeria. It is structured based on a combination of African art, Computer Graphics and Animation, contextualized to accommodate the needs, preferences and styles of the local learner.

Kehbuma Langmia provides a literature review in the article "The role of ICT in the economic development of Africa: The case of South Africa". The author discusses and analyzes the contributions of scholars in the field of technology in bringing about change in the lives of people in Africa in general and South Africa in particular. The author contends that the reviews and

analysis of the contributions of the scholars in the field of development will be critical in judging the overall significance of the role of the Internet in promoting social change.

Murugan Krishnapillai reviews the book by Garai, Atanu and B. Shadrach (2006): *Taking ICT to every Indian village: Opportunities and challenges* published by OneWorld South Asia. This book revolves around the concept of wired or wireless infokiosks, which may be conventionally or non-conventionally powered, and seems to recommend it as a viable rural connectivity model. Building a case for infokiosks, the book reports on the various civil society and government initiatives in India over a period of three years since 2003 to extend the benefits of ICT, which have hitherto been within the urban domain, to the rural India represented by 600,000 and odd villages that house about 700 million of the more than 1 billion population.

The emphasis in IJEDICT is on providing a space for researchers, practitioners and theoreticians to jointly explore ideas using an eclectic mix of research methods and disciplines, and we welcome feedback and suggestions as to how the journal can better serve this community.

Stewart Marshall and Wal Taylor
Chief Editors, IJEDICT

Original article at: http://ijedict.dec.uwi.edu//viewarticle.php?id=287&layout=html

Perceptions of information and communication technology among undergraduate management students in Barbados

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The University of the West Indies, Barbados

ABSTRACT

This exploratory study examined attitudes and usage of ICT among undergraduate management students in Barbados. Of the sample of 166 students, the majority indicated they had access to a computer, and had access and regularly used the Internet. In addition, more females than males had access to a computer off campus. Over 90% used the course-based WebCT, whereas only 30% used the Campus Pipeline. The study showed that students were generally favourable towards ICT. Males were more inclined to incorporate ICT in web-based instruction compared to other teaching activities. Older students were more interested in using ICT only as a supplement to teaching activities. The findings suggest high usage of and positive attitudes toward ICT among tertiary level students. University administrators need to address the gender and age differences regarding ICT usage as well as develop strategies to maintain positive student attitudes and high usage of ICT.

Keywords: *Information and communication technology; WebCT; Internet; management students.*

INTRODUCTION

Information and Communication Technology (ICT) encompasses the effective use of equipment and programs to access, retrieve, convert, store, organize, manipulate and present data and information (Gay and Blades, 2005). E-learning, which is described as the use of ICT to enhance or support learning and teaching in education, has become increasingly important in tertiary education (OECD, 2005). ICT skills are currently of great interest to governments, businesses and individuals alike. Through the use of automation, ICT has become integrated in the management of knowledge and its accompanying ICT tools. Industry and commerce also depend on knowledge management, which has forced businesses to become ICT savvy (COM, 2003). More importantly, it is expected that ICT would be fully integrated into the academic curriculum in order to prepare students for the world of work.

Background

The University of the West Indies (UWI) is the major tertiary level institution in the West Indies and has three campuses in Barbados (Cave Hill Campus), Jamaica (Mona Campus) and Trinidad and Tobago (St. Augustine Campus). All three campuses have embraced ICT in their quest to enhance teaching and research to students and staff. This exploratory study looked at ICT at only one of the campuses, Cave Hill Campus. Students at UWI, Cave Hill Campus, have access, at minimal cost, to a variety of electronic information resources. These include:
- the Distance Education Centre (DEC), which was intended to explore the potential for using telecommunications technology across the three campuses,
- on-line registration of courses, and

-   access to course material via web-based tools such as WebCT and Campus Pipeline.

Web Course Tools (WebCT) is an online virtual learning tool used by many educational institutions for the delivery of e-learning to students. This tool has numerous benefits for students and lecturers including effective communication of course material, email exchanges, online discussion and general course management. Campus Pipeline is another online system that caters to students, faculty and administration by providing centralised Web access to information and services. Some of the benefits of Campus Pipeline include reducing time on administrative tasks, distribution of information to students an faculty and extend communication beyond the classroom.

Objectives of the study

This study sought to explore the attitudes and usage of ICT among undergraduate management students at the Cave Hill Campus of the University of the West Indies in Barbados. The present study addressed four main research questions:
1) What are the attitudes of undergraduate students to ICT?
2) To what extent do students use ICT?
3) How does gender and age impact on the use of and attitudes to ICT?
4) What are the main reasons behind students' ICT usage?

Rationale for the study

This study is important as it measures the attitudes and usage of ICT in a small developing country. The Government of Barbados has invested millions of dollars in encouraging ICT in primary and secondary schools via a project called Edu-tech, with one of its perceived benefits being the increased proficiency in ICT among students entering the tertiary level – the level to which secondary students should proceed. Thus, this study should show whether Edutech has achieved its main objective of promoting the widespread use of ICT in schools. It is hoped that this paper will inform government and educators on how to shape their educational policy regarding student use of ICT and its supporting resources. Educators will also be informed as to whether they need strategies to encourage students to fully embrace ICT in their learning. More importantly, this study will contribute to the scant body of literature on the usage of ICT among tertiary level students in Barbados, and by extension the Caribbean.

Structure of the paper

The paper is structured as follows. The first section presents a selective review of the literature on the nature and importance of ICT. The second section presents the methodology and data collection procedures of the study. Next, the findings and discussion are presented as it relates to the main research questions. The final section concludes the present study.

SELECTIVE LITERATURE REVIEW

The increased use of computers and the level of Internet access by businesses and individuals alike is an important measure of technological development. Governments also measure this development in areas such as education and health. This development has been heavily influenced by the introduction of formal and informal ICT training, whether conducted in the workplace, through an institution, or by self-training. Training therefore is of paramount importance as current and future employees are expected to be adequately skilled in ICT.

Online learning, using ICT and e-learning, have become the norm across tertiary educational institutions where students have been identified as stakeholders in the development and implementation of online learning (Ling et al., 2001; Petrova and Sinclair, 2005; Lee and Nguyen, 2005). To support online learning, administrative and faculty offices at universities utilize substantial proportions of their budgets to provide this technology for their students in the learning process.

Universities have sought methods of developing ICT skills and knowledge in their graduates in an effort to prepare them for employment. These methods include possession of basic ICT certification as an entry requirement, specific ICT foundation courses, or integrating ICT skills into the curriculum, which is accredited as part of the degree award (DEE, 2001).

Universities and other tertiary education institutions have indicated that e-learning has a generally positive effect on the quality of teaching and learning, although few have been able to offer detailed evidence (Goldman et al., 1999; Petrova and Sinclair, 2005; OECD, 2005). Many student satisfaction surveys (Dorup, 2004; Shashaani, 1997) have been conducted on the use of e-learning tools. For example, Dorup (2004) found that most students reported that they had a strong preference for ICT resources to supplement teaching and that they would prefer to use a computer during their studies. However, it is still unclear whether students use these resources enough. It should be determined whether refraining from its use is simply through ignorance or some other underlying concern, and how it can be addressed. Without investigation, it is difficult for universities to know if they are meeting the needs of students effectively (OECD, 2005). Goldman et al. (1999) has argued that computer usage has numerous benefits as it primarily assists student learning. Chavez (1997) argued that Internet and computer usage can also impact positively on critical thinking, problem solving, prompt feedback and collaborative instruction.

The University of the West Indies (UWI), whose role is the delivery of high-quality, relevant tertiary-level education to meet the human resource development needs primarily of the Caribbean basin, finds itself having to respond to a number of challenges in this Millennium Era. As the business of education becomes increasingly competitive, and more for-profit stakeholders enter the marketplace, the UWI, like any private sector business, must find ways to respond effectively to the new threats. This challenge, coupled by the need to deliver to rapidly increasing numbers of students, many of whom opt for the part-time rather than full-time mode of study, has led the UWI to respond by implementing a number of ICTs.

Another challenge facing tertiary education institutions concerns the rapid development of ICTs. For example, Seely Brown and Duguid (2000: 210) argued that:

> *these technologies offer new ways of producing, distributing and consuming academic material. As with so many other institutions, new technologies have caused universities to rethink not simply isolated features but their entire mission and how they go about it.*

In addition, this challenge is joined by the Barbadian government's mandate to harness the ICTs as a tool that could be utilized to further transform the Barbadian society and economy. Consequently, there is a the need to capitalize on thrusts that would harness the new ICTs' power to support development and economic growth in both the public and private sectors (Nation, 2005)

As Petrova and Sinclair (2005:69) proposed:

> *organizational formats developed to accommodate the new educational paradigm need to be managed carefully in order to avoid early disillusionment and the subsequent failure of students to realize the full education potential of online and e-learning.*

For UWI to have a competitive advantage in the global marketplace, e-learning and use of ICTs must be managed effectively as a business. Therefore, the infrastructure and management of human resources must be ready for the challenge. This includes the ability of administrative and teaching staff to be capable of designing, creating, delivering and managing e-learning. Ultimately, much of this responsibility falls upon the teaching staff who have to deliver the course materials. Similar to other international universities, which are re-shaping for e-learning, UWI must also ensure that students are properly prepared for this transition into the blended learning environment (Concannon et al., 2005). Finally, financial costs and adequate budgets must be available to support this infrastructure.

Empirical studies concerning ICT, its importance and usage among students can be noted. For example, Dorup (2004), in a study of undergraduate medical students in Denmark, found that most students had access to computers at home as well as used email and the Internet regularly. In addition, Dorup (2004) found that males had more access to computers at home, and held more favourable attitudes towards the use of computers in their medical studies compared to females. A small proportion of students reported that they would prefer not to use computers in their studies. Males were also significantly more inclined to replace traditional teaching activities with better ICT resources. Finally, there were favourable attitudes toward the use of ICT as a supplement, as opposed to using ICT or distance education as a replacement to traditional teaching activities.

Schumacher and Morahan-Martin (2001) argued that females have less overall experience with computers, and are more likely than males to have negative attitudes towards computers. These authors found that there were significant differences between males and females in computer experience and attitudes towards computers. It was found that males were more likely to take high school courses requiring computer use, and reported higher skills in applications such as programming, games and graphics. Males were perceived to be more experienced and reported higher skills level with the use of the Internet, except for email, than females. Moreover, Kay (1992) also discovered that females had less favourable attitudes toward computer and Internet usage. Shashaani (1997) also made a similar discovery where higher levels of interest in Internet usage existed among men than females.

In terms of age, Kraut et al (1998) found that Internet usage was higher among older persons, compared with younger persons. However, Ramayah and Jantan (2003) found that age was negatively related to Internet and computer usage where younger students were more likely to use these facilities. Overall, previous findings regarding age differences in Internet and computer usage tended to be mixed.

Cuban (2001) found that university students in America usually utilized computers for word processing, searching the Internet, and for using email, while teachers used computers for research purposes rather than for teaching in the classroom. Frizler (1995) argued that computers may never replace teachers, and that computers could make excellent and fairly inexpensive supplementary materials available to improve classroom teaching.

METHOD

Sample, Instrument and Procedures

The sample was chosen from the undergraduate management students in the Department of Management Studies at the Cave Hill Campus of the University of the West Indies in Barbados. Three hundred undergraduate management students were targeted for the study, using a self-administered questionnaire. The questionnaire sought to measure students' attitudes, experience

and reasons for the use of ICT on and off campus. It was adapted and modified from Dorup's (2004) study of medical students in Denmark. The first part of the questionnaire sought demographic information such as age, gender and enrolment status. Table 1 shows the demographic profile of the respondents in the sample. One hundred and sixty-six useable responses were obtained, resulting in a 55.3% response rate. Of the students who returned the questionnaires, the majority were female (77%), persons 25 years and under (61%) and full-time students (53%).

Table 1: *Demographic Profile for the Sample*

	N Frequency	% Percentage
Gender		
Male	39	23
Female	127	77
Age		
25 years and under	102	61
Over 25 years	64	39
Enrolment Status		
Full time	88	53
Part time	78	47

The second part of the questionnaire elicited information on students' attitudes to computer use, which were dichotomously scored ("yes" and "no"). These questions were:

1.   I like to use a computer for typing assignments, calculations or reports.
2.   I wish I would not have to use a computer as part of my studies.
3.   I would like to use the computer as a supplement to other teaching activities.
4.   I would like to use the computer instead of other teaching activities.
5.   I would like to use email to ask questions to my teachers if possible.
6.   I would like to use the computer for distance education from home.

The third section of the questionnaire focused on students' usage of computers and other ICT resources. The responses were also dichotomously scored ("yes" and "no"). The questions were:

7.   Do you have access to a computer off-campus?
8.   Do you have Internet access at home?
9.   Do you have an off-campus email address?
10.   Do you use WebCT for any of your courses?
11.   Do you use Campus Pipeline?
12.   Do you know the campus home page?

In the fourth part of the questionnaire, students were asked to indicate the extent to which they used the Internet and email, on a five-point scale ranging from 1 (Never) to 5 (Daily). The final item on the questionnaire asked students to identify their primary reasons for using the Internet. This item had an open-ended format to allow students to respond freely.

Data Analysis

Due to the descriptive nature of research questions 1 and 2, frequencies and percentages were computed. For research question 3, Pearson's Chi square analyses were conducted to examine the effects of gender and age on attitudes to ICT and ICT usage. Research question 4 was addressed qualitatively by summarising the key themes relating to students' reasons for ICT usage.

FINDINGS AND DISCUSSION

Attitudes to Information Technology

Table 2 shows that the majority of the sample expressed favourable attitudes to the use of ICT within the academic environment. Particularly, students were more inclined to use computers for: typing assignments (92%), part of their studies (95%), supplementing other teaching activities (72%), emailing questions to teachers (90%), and distance education from home (68%). However, students were resistant to the use of computers as full replacement of the regular, traditional teaching experience. This finding suggests students' strong preference for both forms of the academic experience (i.e., interaction with the teacher and interaction with information technology), which is consistent with Dorup's (2004) findings. Furthermore, Frizler (1995) asserts that although computers can never substitute teachers, computers can "provide excellent and fairly inexpensive supplementary materials to enhance classroom instruction" (Bataineh and Baniabdelrahman, 2005:35).

With respect to gender, no significant gender differences were found on five of the six attitudinal ICT statements, indicating that both males and females generally had a preference for the use of information technology (See Table 3). However, males (55%), to a significant degree, generally preferred to use computers as replacements to other traditional teaching activities, compared to females (33%) (Chi-square = 6.10, p < .05). This finding was also congruent with that of Dorup (2004). Moreover, previous research has documented that male students have more positive perceptions about computers and information technology than female students (Schumacher and Morahan-Martin, 2001; Shashaani, 1997; Young, 2000).

Concerning comparisons using age, no significant differences were found on five of the six items (p > .05). However, a significant age difference was found for using the computer as a supplement to other teaching activities. Older students (over 25 years) (81%) preferred using the computer as a supplement to teaching, compared to younger students (25 years and under) (67%) (Chi-square = 4.18, p < .05) (See table 3). This finding is consistent with Kraut et al.'s (1998) findings and implies that older students may have a somewhat more positive perception of computers.

Table 2: Overall Attitudes to Information Technology

	% Yes	% No
I like to use a computer for typing assignments, calculations or reports.	92	8
I wish I would not have to use a computer as part of my studies.	5	95
I would like to use the computer as a supplement to other teaching activities	72	28
I would like to use the computer instead of other teaching activities	39	61
I would like to use email to ask questions to my teachers if possible	90	10
I would like to use the computer for distance education from home	68	33

Table 3: Attitudes to Information Technology by Gender and Age

	GENDER χ^2	AGE χ^2
I like to use a computer for typing assignments, calculations or reports.	1.39	.64
I wish I would not have to use a computer as part of my studies.	.02	.004
I would like to use the computer as a supplement to other teaching activities	.96	4.18*
I would like to use the computer instead of other teaching activities	6.10*	.27
I would like to use email to ask questions to my teachers if possible	.04	.47
I would like to use the computer for distance education from home	1.02	2.69

Notes:

Chi-square statistics were computed with gender and age as the independent variables for separate analyses.
*$p<0.05$.

Computer and Internet Usage

Table 4 shows that majority of students in the sample had access to a computer off campus (94%), 89% reported they had access to the Internet at home, and 96% had an off-campus email address. Concerning the on-campus facilities, over 90% indicated that they used WebCT and were aware of the campus online homepage. However, only a third of the sample (30%) indicated that they use the Campus Pipeline system. This finding suggests that most students were actively taking advantage of the available computer and information technology facilities and resources at

their institution. Again, these findings were consistent with Dorup (2004). Moreover, Raymayah and Jantan (2003) and Machmias, Mioduser and Shemla (2000) all argued that computers and Internet usage have pervaded the world of education in hope of making student learning easier and more enjoyable. Concerning the Campus Pipeline, the low usage of this resource may be attributed to the fact that students are not required to use this facility and that other resources, such as WebCT, have gained popularity among lecturers and course administrators due to flexibility and convenience.

In relation to gender, no significant gender differences were found with the exception of the access to a computer off-campus; females (96%), to larger degree than males (87%), reported that they had access to a computer off-campus (Chi square = 4.37, p < .05) (See table 5). This finding conflicts with Dorup (2004), who found that males were more likely to have access to computers off campus, compared to females. This finding is also inconsistent with that of Machmias et al. (2000) and Ramayah and Jantan (2003) who found that computer and Internet usage was higher among males than females. This study's finding implies a growing interest in ICT among females, compared to that of the past. With respect to age, no significant differences were found.

Table 4: *Overall Computer and Internet Usage*

	% Yes	% No
Do you have access to a computer off-campus?	94	6
Do you have Internet access at home?	89	11
Do you have an off-campus email address?	96	4
Do you use WebCT for any of your courses?	98	2
Do you use Campus Pipeline?	30	70
Do you know the campus home page?	92	8

Notes:
+Chi- square statistic was computed with gender as the independent variable.
*p<0.05.

Table 5: Computer and Internet Usage by Gender and Age

	Gender $^+\chi2$	Age $^+\chi2$
Do you have access to a computer off-campus?	4.37*	1.55
Do you have Internet access at home?	.04	2.08
Do you have an off-campus email address?	.14	1.26
Do you use WebCT for any of your courses?	1.23	.32
Do you use Campus Pipeline?	.08	.001
Do you know the campus home page?	1.87	.34

Frequency of and Reasons for Internet Usage

In relation to frequency of Internet usage at home, majority (64%) of students surveyed indicated that they use the Internet regularly. In addition, a larger proportion (75%) indicated that they regularly use email. This finding correlated well with that of Dorup (2004). This finding is consistent with that of Machmias et al. (2000) and Ramayah, Jantan and Aafaqi (2003) who also discovered high Internet and email usage among students. The finding presents a favourable picture that ICT is becoming increasingly important to students and that the use of Internet and email is now a commonplace practice among management students.

A question was posed concerning the primary reasons for Internet use. The most common responses, cited by students, included *research*, *school assignments*, *emails* and *chatting*. This finding implies the growing importance of the Internet for school-related activities and that students are seemingly taking advantage of this resource. Overall, these findings are consistent with that of Goldman et al. (1999), who argued that computer and Internet usage can assist student learning. In addition, Chavez (1997) has suggested that computer usage (including the Internet) assists critical thinking, problem solving, prompt feedback and collaborative instruction. Particularly, Machmias et al. (2000) found that the most frequently cited reasons for using the Internet were email exchanges and chatting, consistent with the current finding. Ramayah et al. (2003) have argued that the extent to which students use the computer and the Internet depends on the perceived usefulness of this resource in terms of effective communication and access to information to complete projects and assignments efficiently.

CONCLUSION

This study found that management students were generally favourable to ICT in an academic setting. In addition, males were more favourable towards the use of computers as replacements to other teaching activities. Older students were more favourable to computer use as a supplement to other teaching activities, compared to younger students.

Students had access to computers and the Internet off campus. There also seems to be widespread usage of various forms of information technology such as Internet, WebCT and email. No significant gender differences were found with the exception of the access to a computer off-

campus; females to a larger degree than males (87%), reported that they had access to a computer off-campus. With respect to age, no significant differences found. The main reasons for the use of the Internet offered included research and email.

Based on the above findings, it is recommended that academicians and course administrators pay more attention to gender and age differences regarding the use of ICT resources as a major component in classroom teaching. This should serve to attract greater support for ICT and e-learning among all categories of students. Secondly, it is recommended that university administrators maintained the high levels of ICT usage among students through continuous education and promotion of the benefits attached to ICT resources. This would involve the use of seminars and training programmes as well as encouraging lecturers and course administrators to embrace e-learning and its resources.

These findings are important in that they can serve to inform educators about the usage of information and communication technology in an academic environment. This is important in that the students will need to use ICT in the workplace and prior preparation is a necessity. Moreover, the international community has embraced information technology in business, and these findings augur well for business in Barbados and the wider Caribbean.

A limitation of the study was the relatively small sample size, which may limit the generalisability of these findings to the population under study. Future research should examine ICT usage among students in different disciplines campus wide. In addition, future research could consider undertaking large-scale studies of attitudes to ICT and its usage outside the academic setting, targeting business professionals and other practitioners.

REFERENCES

Bataineh, R.F. and Baniabdelrahman, A.A. (2005), "Jordanian EFL students' perceptions of their computer literacy", *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, vol. 2, no. 2, pp. 35-50.

Chavez, C. (1997), "Students take flight with Daedalus: Learning Spanish in a networked classroom", *Foreign Language Annals*, vol. 30, no.1, pp. 27-37.

COM (2003), *Choosing to grow: Knowledge, innovation and jobs in a cohesive society*, Report to the Spring European Council, 21 March 2003, on the Lisbon strategy of economic, social and environmental renewal. Retrieved March 23, 2006 from: http://europa.eu.int/comm/lisbon_strategy/pdf/5b_en.pdf .

Concannon, F., Flynn, A. and Campbell, M. (2005), "What campus-based students think about the quality and benefits of e-learning", *British Journal of Educational Technology*, vol. 36, no. 3, pp. 501–512.

Cuban, L. (2001), *Overbought and undersold: Computers in the classroom*, Harvard University Press, Cambridge, Massachusetts.

Department of Education and Employment (DEE). (2001), "ICT Access and Use", *Report on the Benchmark Survey.* Retrieved March 20, 2006 from: http://www.dfes.gov.uk/research/data/uploadfiles/RR252.doc.

Dorup, J. (2004), "Experience and attitudes towards information technology among first-year medical students in Denmark: Longitudinal questionnaire survey", *Journal of Medical*

Internet Research, Vol.6 No.1: e10. Retrieved March 10, 2006 from: http://www.jmir.org/2004/1/e10/.

Frizler, K. (1995), "The internet as an educational tool in ESOL writing Instructor", Unpublished Master's thesis, San Francisco University. Retrieved July 10, 2006 from: http://thecity.sfsu.edu/~funweb/thesis.htm.

Gay, G. and Blades, R. (2005), *Information Technology for CXC CSEC*, Oxford University Press, Oxford, UK.

Goldman, S., Cole, K. and Syer, C. (1999), "The technology/content dilemma", Paper presented at the Secretary's Conference on Educational Technology. Retrieved July 10, 2006 from: http://www.ed.gov/technlogy/techconf/1999/whitepapers/paper4.html.

Kay, R. H. (1992), "Understanding gender differences in computer attitudes", *Journal of Research on Computing Education*, vol. 25, no. 2, 159-171.

Kraut, R., Mukhopadhyay, T., Szypula, J., Kiesler, S. and Scherlis, W. (1998), "Communication and information: Alternative use of the Internet in households." *Proceedings of the CHI 98*, ACM, New York.

Lee, Y. L. and Nguyen, H. (2005), "So are you online yet?! Distance and online education today", *Managing Modern Organizations with Information Technology*, pp. 1035-1036.

Ling, P., Arger, G., Smallwood, H., Toomey, R., Kirkpatrick, D., and Barnard, I. (2001), *The Effectiveness of Models of Flexible Provision of Higher Education,* Department of Education, Training and Youth Affairs, Commonwealth of Australia.

Machmias, R. Mioduser, D., and Shemla, A (2000), "Internet usage by students in an Israeli High School", *Journal of Educational Computing Research*, vol. 22, no. 1, pp. 55-73.

Nation (2005), "Business of Government - ICT Plan - a tool to transform the economy*", Nation Newspaper,* November 14.

OECD. (2005), "E-learning in tertiary education: where do we stand?", *Education & Skills*, vol. 4, no. 1, pp. 1-293.

Petrova, K., and Sinclair, R. (2005), "Business Undergraduate Learning Online: A One Semester Snapshot," *International Journal of Education and Development using Information and Communication Technology,* vol. 1, no. 4, pp.69-88.

Ramayah, T., and Jantan, M. (2003), "Internet usage among Malaysian students: the role of demographic and motivational variables." *International Conference on Innovation in Higher Education,* Kiev, Ukraine, May 16-19.

Ramayah, T., Jantan, M. and Aafaqi, B. (2003), "Internet Usage Among Students of Institutions of Higher Learning: The Role of Motivational Variables." *The Proceedings of the 1st International Conference on Asian Academy of Applied Business Conference,* Sabah, Malaysia, July 10-12.

Schumacher, P. and Morahan-Martin, J. (2001), "Gender, internet and computer attitudes and experience", *Computers in Human Behaviour*, vol. 17, no. 1, pp. 95-110.

Seely Brown, J. and Duguid, P. (2000), *The social life of information*, Harvard Business School Press. Boston, MA.

Shashaani, L. (1997), "Gender differences in computer attitudes and use among college students", *Journal of Educational Research Computing Research*, vol. 16, pp. 37-51.

Young, B.J (2000), "Gender Difference in Student Attitudes toward Computers", *Journal of Research on Computing in Education, v*ol. 33, no. 2, pp. 204-216.

Impact of WebCT on learning: An Oman experience

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ABSTRACT

The World Wide Web Course Tool (WebCT), Blackboard and Moodle are used for teaching and learning in higher education institutions around the globe. This study investigated the impact of WebCT on students learning taking a course "Introduction to Computers in Business" offered at the College of Commerce and Economics, Sultan Qaboos University in the Sultanate of Oman. The finding showed that though the students have little exposure of WebCT at the beginning of the course but towards the end they have appreciated the importance and the use of WebCT as it is easily accessible from any Internet enabled location at any time. In addition it helps them in better understanding and learning the course material.

Keywords: WebCT; Information Technology; on-line learning; Internet; students

INTRODUCTION

Trends affecting education

One of the most apparent trends affecting education is the advancement of technology. As computers are increasing in speed while decreasing in cost, and high-speed network connections continue to expand (Cetron and Daview, 2003). This advancement in technology transforming higher education (Oblinger et al., 2001), one example being the changes caused by broader use of digital course materials (Chick et al., 2002). By the year 2012, schools and colleges will routinely use "computerized teaching programs and interactive television lectures and seminars, as well as traditional methods" (Emerging technologies and ground-floor investment opportunities: Special Report, 2003). Videoconferencing and other technologies will also help enrich distance media and provide many benefits over the face-to-face instructions.

Online learning is said to be an innovative way of learning suited to meet today's learner's learning requirements, particularly as the industrial economy evolves into a knowledge-based economy (EU-Asia e-learning, 2003).

Hadengue (2004) describes online learning, as an educational concept, which utilizes local area networks (LAN), wide area networks (WAN), or the Internet to communicate and spread digital material in support of learning and students and teachers interaction. Wang and Hwang (2004) argued that the effective learning process could be created by electronically delivered content in support of more learning. The online learning is becoming the way to go if students are encouraged to take more responsibility on their learning goals (Thurab-Nkhosi, 2003) and if education is to be made available to all irrespective of location and status in the society on affordable scale (Lumande et. al 2005).

Dunn (2000) projected changes in higher education's landscape over the next 20 years, "The number of degree-granting institutions will continue to grow, while the number of traditional campuses will decline". Several universities have already started offering courses using WebCT (Machovec, 2001), Moodle, Blackboard or similar packages for their students' on line learning needs. (Thurab-Nkhosi, 2003). In Oman Sultan Qaboos University has also joined the universities using WebCT.

Background to the study

Oman is a developing nation striving fast especially in the area of education. Human capital or human resources now have the most important factor in the development of nations. In the Sultanate of Oman, His Majesty, Sultan Qaboos bin Said, has placed great importance on the development of nation's valuable human resources i.e. university students.

Sultan Qaboos University is the only national university in the country. The university opened in 1986 serving to more than 7000 students. The traditional Islamic separation of the sexes is maintained in the architecture of the University. There is separate access to buildings through lower and upper walkways for men and women and separate seating in the classrooms. Altogether, the campus portrays the rich heritage of Oman and Islam while incorporating all the efficiencies of modern life. The result is an educational and living environment which is both functional and attractive. (Sultan Qaboos University, 2006).

There are seven colleges; namely Medicine, Engineering, Agriculture, Education, Science, Arts and Commerce. In addition, there are five centers; namely the Center for Human Resources and Staff Development, the Students Counseling Center, the Language Center, the Center for Information Systems and the Center for Educational Technology. Recently the Center for Education Technology (CET), of Sultan Qaboos University has provided access to WebCT-campus edition to all colleges in the university with its support.

Purpose of the study

The purpose of this study was to explore the students' feedback on the use of WebCT and its impact on students learning the material of the course "Introduction to Computers in Business" offered at the Sultan Qaboos University.

Brief Description of WebCT

WebCT has set the standard for e-learning systems in higher education. WebCT provides a highly flexible e-learning environment that empowers institutions across the educational spectrum with the ability to achieve their unique objectives. Thousands of colleges and universities around the world, from community colleges to large university consortia, are using WebCT to expand the boundaries of teaching and learning (Learning Without Limits, 2006).
Learners use WebCT to access digital contents of the course independent of place and time. Learners who prefer support can also access the contents in self paced laboratory sessions with the assistance of an instructor. The learners who have attended face-to-face sessions can use this digital course material for further review and reinforcement. It also, according to Wang and Hwang (2004), enables users to submit and retrieve information and incorporate collaborative tools like chat, threaded discussion, email, white boards, internet links, etc. Further it can help users keep track of learning progress, download and upload learning materials, and link to relevant resources.

It allows educators to design the appearance of course pages, it provides a set of educational tools that can easily be incorporated into any course, and it provides a set of administrative tools that assist the educator in the task of course administration (Murray et al., 1996). The advantages include a simple interface that can be accessed from anywhere a network-connected computer is available and at any time of the day (Williams, 2003).

WebCT is available in two major editions i.e. Campus and Vista. Campus Edition is designed for single institution usage basically it is a Course Management System. The Vista edition is

designed for a more scaled deployment. It is an academic enterprise system provides private file space where students can work on projects and store them on their server. It could also include link to discussion topics, assignments, assessments and URLs (Learning Without Limits, 2006).

METHODOLOGY

As described earlier, this study was conducted on students taking course "Introduction to Computers in Business". The students were both male and female with similar educational background and very little or no initial IT skills. The total sample size was seventy one subjects.

A questionnaire was designed for this study with fourteen questions, covering four major domains related to accessing WebCT, Attitudes toward WebCT, WebCT helps in understanding and learning and the students preferences mode of learning through Instructor, WebCT or both. The questionnaire was administered in similar way to all students in the course. There were two stages for data collection Prior and After. The Prior data collection point was at the beginning of the course, while After data collection point was at the end of the course.

Responses to each item were based on Likert scale ranging from 1 to 5, where 1 = Strongly Disagree, 2 = Disagree, 3 = Uncertain (never used WebCT before), 4 = Agree, 5 = Strongly Agree, as shown in Appendix 1.

A course outline and syllabus and data collection and processing tools were used in the study. The responses-means prior to the course and after the course were compared to see if there was any marked difference on students attitudes toward WebCT, its effects on learning and their preferences over Instructor versus WebCT.

All class sessions took place in a computer lab equipped with 28 Pentium computers loaded with Microsoft Office in a network setup. All students were given similar access procedure to computer facilities. Simple statistical tests were used to analyze the data by comparing the means to assess the size of change from Prior to After stage.The results of these comparisons were incorporated to examine the change on issues like accessing WebCT, attitudes toward WebCT, learning through WebCT and students preferences Instructor versus WebCT.

RESULTS AND FINDINGS

WebCT Accessibility

The means of the survey at Prior and After stages along with the size of change are tabulated in Table 1 and graphically presented in Figure 1. The overall WebCT accessibility was found to be low for students at the beginning of the course (M=2.93), but at After stage most students responded very high (M=4.47).

It appears that the students were having little or no exposure of WebCT Prior to the course. But when the instructor enrolled them, then the students were freely exposed to WebCT. It was interesting to know that the students found WebCT easily accessible from any networked computer at any time of the day for any length of time.

Table 1: Accessing WebCT

	Mean		Size of Change
	Prior	After	After-Prior
Accessing WebCT Comfortably	2.82	4.49	1.67
Accessing WebCT from any location	2.82	4.47	1.65
Accessing WebCT at any time.	3.13	4.42	1.29
Accessing WebCT any length of Time	2.95	4.49	1.54
Overall (WebCT Accessibility)	2.93	4.47	1.54
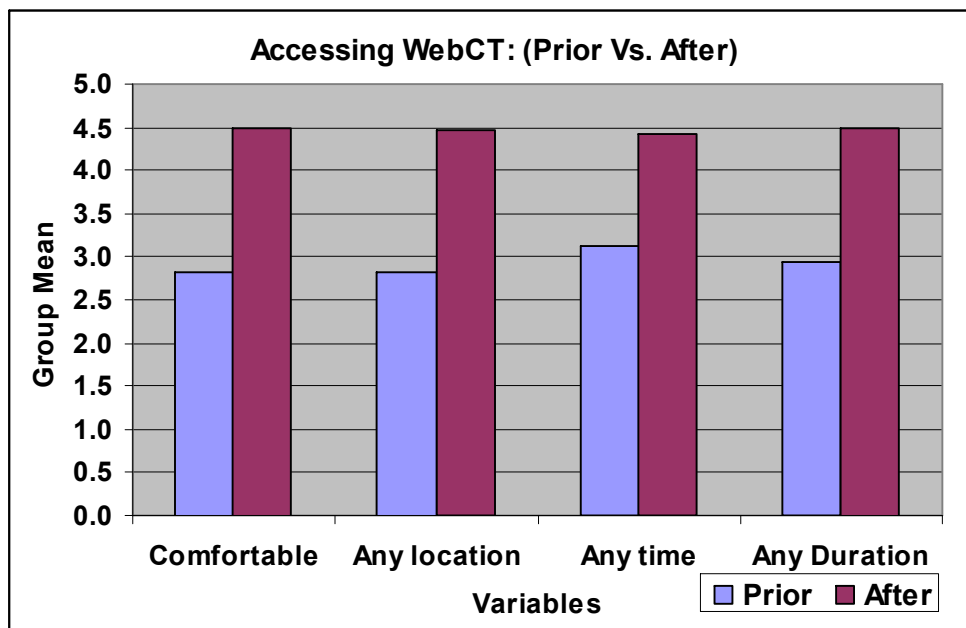
Figure 1: Accessing WebCT (Prior Vs. After)

Attitudes toward WebCT

The means of the survey at Prior and After stages along with the size of change are tabulated in Table 2 and graphically presented in Figure 2. The overall attitudes toward WebCT was found poor at the beginning of the course (M=3.16), but at After stage most students responded very high (M=4.48).

As we have seen earlier that the students Prior to the course were having no or little accessibility of WebCT. It appears that it may be the main cause of this poor attitudes at the beginning of the course. When the students of this course were given equal and free exposure to WebCT, their overall responses at After stage (M = 4.48) indicating a positive change from Prior to After. It

appears from students responses that they felt WebCT as an important tool for learning and also felt at ease while using it. This indicates their more positive attitudes toward WebCT.

Table 2: *Attitudes toward WebCT*

Dependent Variables	Mean		Size of Change
	Prior	After	After-Prior
Feel at Ease Using WebCT	3.09	4.23	1.14
Feel WebCT is Important	3.22	4.61	1.39
Overall(Attitude towards WebCT)	3.16	4.42	1.26
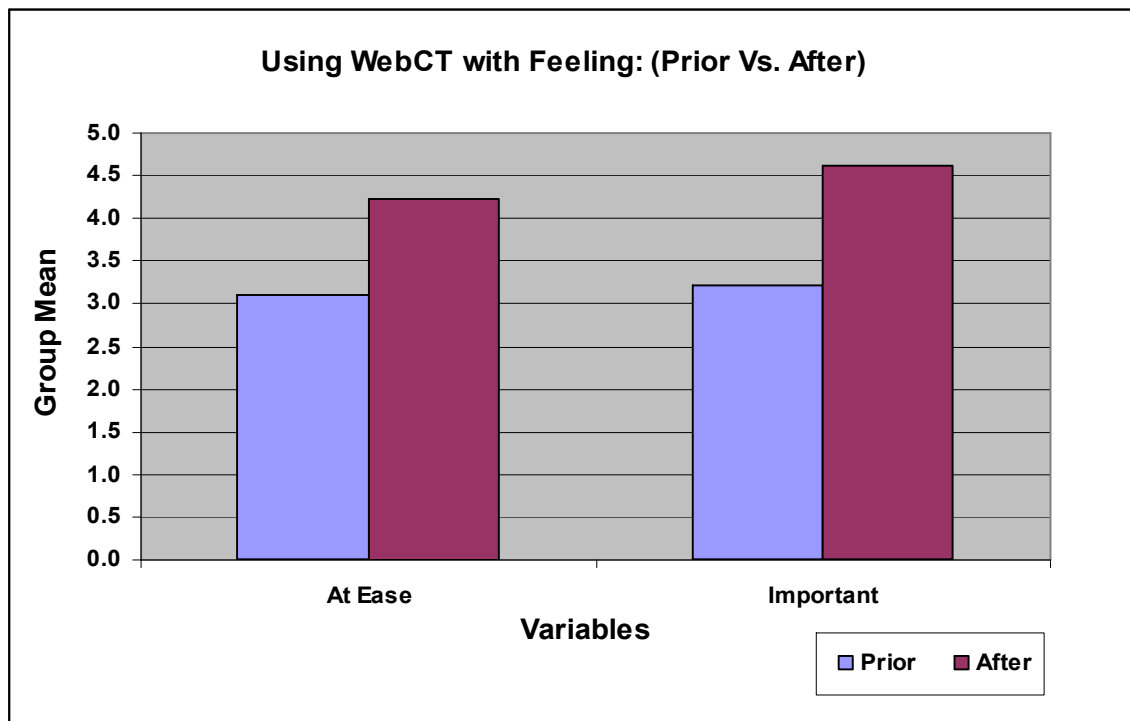
Figure 2: *Attitudes toward WebCT (Prior Vs. After)*

Learning through WebCT

The overall perception of students towards the WebCT as a tool for learning was poor Prior to the course as indicated by their responses (M=2.93). But when asked at After stage of the course the students have really appreciated the impact of WebCT on their learning and their mean response was (M= 4.69). This is shown in Table 3 and graphically presented in Figure 3.

The students have indicated the positive effects of WebCT on their better understanding and learning the course material as well on their better exam preparations. It seems that more accessibility of WebCT contributes to more positive students' attitudes toward WebCT, which in turn contribute to their better understanding and learning the course material.

Table 3: WebCT and Learning

Dependent Variables	Mean		Size of Change
	Prior	After	After-Prior
Better understanding	2.86	4.64	1.78
Better learning	3.00	4.67	1.67
Better preparation for exams	2.93	4.76	1.83
Overall(Helps in the course learning)	2.93	4.69	1.76
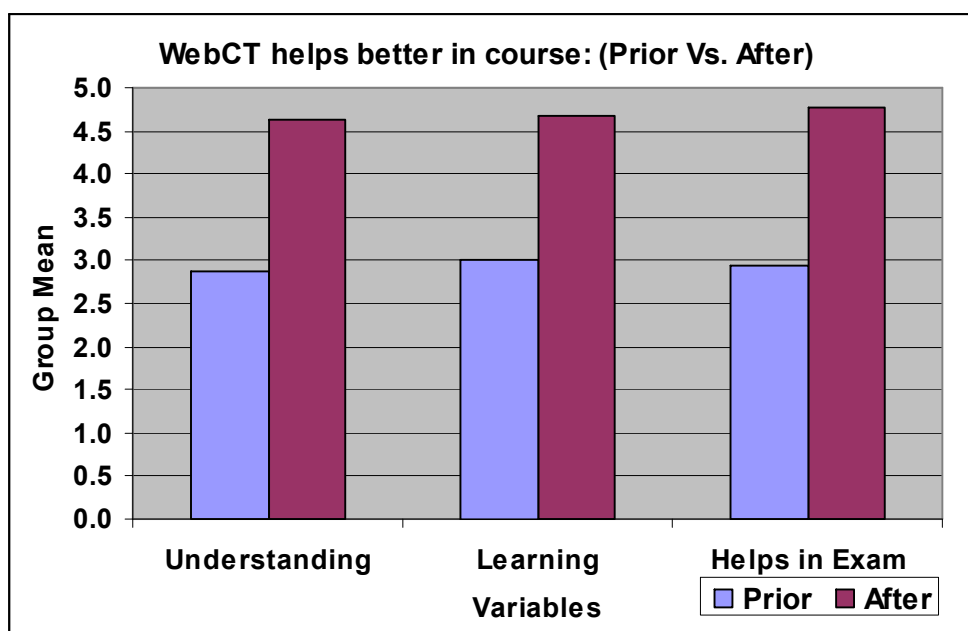
Figure 3: WebCT and Learning

Students Preferences

The students were asked their preference mode of learning either through instructor only, WebCT only or the combination of both i.e. Instructor and WebCT. The overall students mean response was lowest for the WebCT only (M=2.49) while for the Instructor was higher as the overall mean response was (M= 2.77). But the most preferred response (M = 4.71) were as that the course be taught by Instructor and enforced with digital material on the WebCT. This is shown in Table 4 and graphically presented in Figure 4.

Table 4: Students preferences

Preferences	Mean
Learning through Instructor Only	2.77
Learning through WebCT Only	2.49
Learning through Instructor and WebCT	4.71
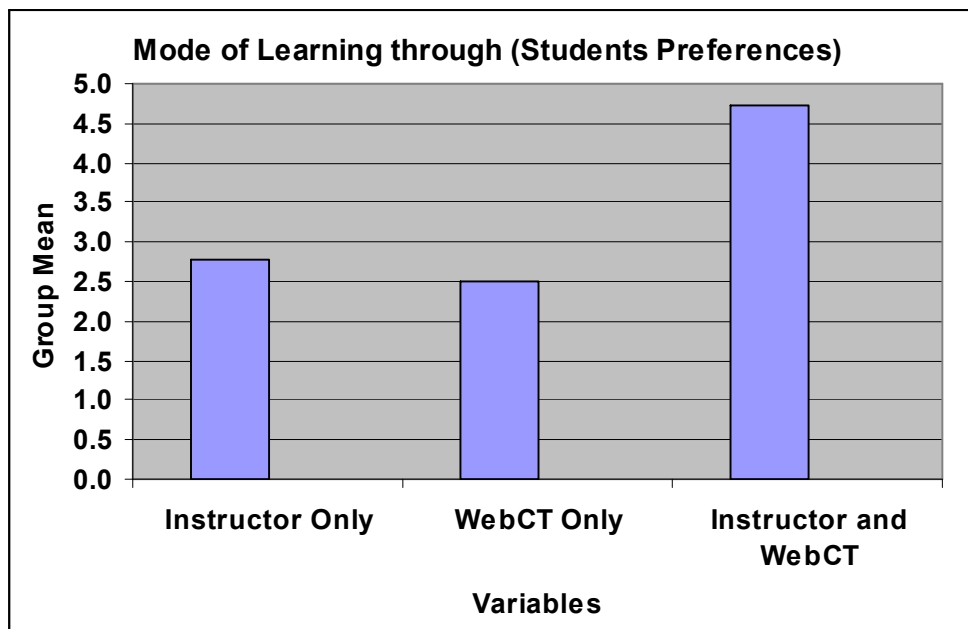
Figure 4: Students preferences

SUMMARY AND CONCLUSION

In summary, those students who were exposed to the WebCT online learning environment, had positive attitudes toward WebCT and in turn had better learning and understanding of the course material. The findings of this study are also in line with Koohang (1989), Hunt and Bohlin (1993), in that greater use of IT brings about more positive attitudes and hence greater confidence in the users.

As the Internet and other information technology devices are becoming more prevalent while technological fluency is becoming a common expectation. Distance education is becoming more abundant, especially online, and location independent, increasing the need for effective course-management systems and teaching strategies that utilize technology. The more use of WebCT, Blackboard and Moodle or similar packages may impact the students learning and understanding with positive attitudes may pose a challenge to our traditional institutions offering

courses in traditional face to face mode. Most students preferred face to face mode but supported with online digital contents for comfortable learning.

REFERENCES

Cetron, M. J., & Daview, O. (2003), *50 trends shaping the future*, Special Report Published by the World Future Society, Bethesda, Maryland, USA.

Chick, S., Day, R., Hook, R., Owston, R., Warkentin, J., Cooper, P. M., Hahn, J., and Saundercook, J. (2002), *Technology and student success in higher education: A research study on faculty perceptions of technology and student success*. McGraw-Hill, Toronto.

Dunn, S. (2000), The virtualizing of education. *The Futurist*. 34(2): 34-38.

Emerging technologies and ground-floor investment opportunities. Special Report: Forecasts for the Next 25 Years. (2003). The World Future Society: Bethesda, Maryland pp. 8. in Howell, S, Williams, P. and Lindsay, N. (2003), Thirty-two trends Affecting Distance Education: An Informed Foundation for Strategic Planning, *Online Journal of Distance Learning Administration*, State University of West Georgia, Distance Education Center 6 (3): 10-19. Retrieved Jan 12, 2004: http://www.westga.edu

EU-Asia e-learning (2003), *Understanding e-learning*, Retrieved May, 11, 2005: http://www.eael2003.org/news.

Hadengue, V. (2004), What can e-learning do for university libraries*? Library Review*, 53 (8): 397-400

Hewett W. G. (1997), The Whys and Whats of an IT Specialization within a Generalist Management Tertiary Education, TC3 WG3.4. In *IFIP, International Conference on the Place of Information Technology in Management and Business Education*. Chapman and Hall, Inc., London.

Howell, S, Williams, P. and Lindsay, N. (2003), Thirty-two trends Affecting Distance Education: An Informed Foundation for Strategic Planning, *Online Journal of Distance Learning* Administration, State University of West Georgia, Distance Education Center, 6 (3):10-19.

Hunt, N. P. and Bohlin, R. M. (1993), Teacher education students' attitudes towards using computers, *Journal of Research on Computing in Education*, 25 (4): 487-497.

Koohang, A. A. (1989), A study of attitudes toward computers: Anxiety, confidence, liking and perception of usefulness, *Journal of Research on Computing in education*, 22(2): 137-50.

Learning Without Limits (2006), Retrieved on July 5, 2006: http://www.webct.com

Lumande, E., Ojedokun A., Fidzani, B. (2005), Information Literacy Skills Course Delivery Through WebCT: The University of Botswana Library Experience, *International Journal of Education and Development using Information and Communication Technology (IJEDICT)* 2 (1): 66-78

Machovec, G.S. (2001), Course Management Software: Where is the Library? *Online Libraries and Microcomputers*, 19(10): 1-2.

Murray W. Goldberg, Sasan Salari and Paul Swoboda (1996), *World Wide Web Course Tool: An Environment for Building WWW-Based Courses, Computer Networks and ISDN Systems*.

Oblinger, D., Barone, C.A., & Hawkins, B.L. (2001), Distributed education and its challenges: An overview. *American Council on Education (ACE).* Retrieved June, 2003: http://www.acenet.edu/bookstore/pdf/distributed-learning/distributed-learning-01.pdf

Paturi T. (1997), Information Technology Studies in Higher Business and Management Education. TC3 WG3.4. In *IFIP, International Conference on the Place of Information Technology in Management and Business Education*, Chapman & Hall, Inc. London.

Shan, F. Jun, C. and Tong, L. (1997), Information Technology in China, TC3 WG3.4: In *IFIP, International Conference on the Place of Information Technology in Management and Business Education*, Chapman & Hall Inc. London.

Shank, J. D. and Dewald, N. H. (2003), Establishing Our Presence in Courseware: Adding Library Services to the Virtual Classroom, *Information Technology and Libraries*, 22(1), 38-43.

Students Guide, (2004-2005), College of Commerce and Economics, Sultan Qaboos University, Sultan Qaboos University Press, Muscat, Sultanate of Oman.

Sultan Qaboos University (2006), Retrieved on July 5, 2006: http://www.squ.edu.om

Thurab-Nkhosi, Dianne (2003), *Introduction to Learning Part I: principles of e-learning*, University of Botswana, Gaborone.

Wang, M. and Hwang, M. (2004). The e-learning library: only a warehouse of learning resources*? The Electronic Library*, 22 (5): 408-415.

Williams, P.E. (2003), Roles and Competencies for Distance Education Programs in Higher Education Institutions*. The American Journal of Distance Education*. 17(1): 45-57.

Appendix 1: Questionnaire form
Introduction to Computers in Business (INFS 1411)
Spring, 2005

Dear Student:
The purpose of this form is to get your feedback regarding the course. Your input will help us in understanding and improving the course delivery process and will not at all affect the assessment of your work. Evaluate the following statements by selecting:

1 = Strongly Disagree   2 = Disagree   3 = Uncertain   4 = Agree   5 = Strongly Agree
                                                (Never used WebCT)

Please circle your response;

Thanks for your help

	Before Course	After Course
1. I access WebCT comfortably.	1 2 3 4 5	1 2 3 4 5
2. I access WebCT from any location.	1 2 3 4 5	1 2 3 4 5
3. I can access WebCT at any time.	1 2 3 4 5	1 2 3 4 5
4. I can be on WebCT as long as I wish.	1 2 3 4 5	1 2 3 4 5
5. I feel WebCT is friendly.	1 2 3 4 5	1 2 3 4 5
6. I feel at ease while using WebCT.	1 2 3 4 5	1 2 3 4 5
7. I feel comfortable interacting with computers.	1 2 3 4 5	1 2 3 4 5
8. I feel that WebCT is an important part of this course.	1 2 3 4 5	1 2 3 4 5
9. I prefer this course be taught by the instructor only.	1 2 3 4 5	1 2 3 4 5
10. I prefer this course be taught through WebCT only.	1 2 3 4 5	1 2 3 4 5
11. I prefer this course be taught by Instructor and supported through WebCT.	1 2 3 4 5	1 2 3 4 5
12. Overall, WebCT helped me in understanding better the course material.	1 2 3 4 5	1 2 3 4 5
13. Overall, WebCT helped me in learning more the course material.	1 2 3 4 5	1 2 3 4 5
14. Overall, WebCT helped me in scoring more in the course exams.	1 2 3 4 5	1 2 3 4 5

Educative uses of ICT, technological skills and academic performance of the Venezuelan university students (Barineses): A causal perspective

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ABSTRACT

The objective of this research was to analyze the relations among the educative uses of ICT, levels of skills in the technology handling (ICT Skills Index) and academic performance of the Barineses university students, in order to propose a model of causal relations that represents suitably, the effects of the technology use with academic aims on the results in the studies. It was a random, cross-sectional and anonymous study that follows the habitual evolution of the research process: it begins by being a descriptive research, and finishes as explanatory study. The sampling was by conglomerates and stratified groups, in three stages. The sample for the study consisted of 410 Barineses university students. A questionnaire applied by the students was used. The statistical analysis was carried out in two phases: descriptive univariado and with structural equations modelling. The proposed causal model during the research development, revealed significant influences of several indicators on the scores obtained in the ICT Skills Index; not occurring the same in relation to the influence of this last index on the Academic performance of the Barineses university students. This result seems to support, the often outstanding thing in literature on the subject, in relation to the difficulties found until now by the researchers, to demonstrate the effectiveness of the use of ICT on the results in the studies; and it again places in centre of the debate the well-known paradox of the non significance (see Russell, 1999, for a more detailed analysis of this phenomenon).

Keywords: *Educative uses of Internet; Internet and higher education; Internet in Venezuela; e-Literacy; Academic performance; Effectiveness of the use of ICT.*

INTRODUCTION

The formidable expansion of Internet in the last years seems to show itself of unequal way according to the social group which it is. Our Venezuela country is somewhat straggler, in relation to other countries, respect to degree of penetration of this technology with only 11.66% of the total population connected. However, it has experienced a fast growth in the last years that made elevate the number of users in 62% during the 2000, 40% in 2001 and 32% in 2002. This rate of growth fell appreciably to 0.14% during 2003, but it recovered his ascending tendency in 2004 with 26% of increase and during 2005 with 41% (Tendencias Digitales and Cavecom-e, 2005). In our context, like in many others, the pioneer social sector in the use of Internet has been the university community. Thanks to the impulse of the State by means of the creation and beginning of REACCIUN, the national academic network, fast and easy access to the universities of permanent form starting from 1994 was provided. Initially, this access was restricted to the educational personnel and researchers; nevertheless, gradually the universities have been extending the free connection to the students (especially in laboratories of computers with connection to the Network located in the university campuses).

It is not possible to be denied that in the last years many researches, congresses and workshop, mainly in the American and European universities, have been dedicated to the subject of the usages of the Information and Communication Technology (ICT) in education and learning. Despite the previous thing, it is a well-known fact that in many of those researches, a little

participation of the students in the stage of the projects design is demonstrated (for example, in those cases that imply elaboration of innovating learning materials). Basically, the participation of the students has been confined to inform to the promoters into such initiatives on its ideas and necessities related to the systems that will be implemented. In much counted occasions, the university students have been considered like principal actors in the processes of incorporation of ICT to the higher education institutions. Most of the times, the opinions of university authorities and teachers are only taken into account; in which we could identify like a top to bottom vertical perspective on the subject. The university students like passive individuals on those who will fall the direct influences of the implantation of these technologies, would have to know and to accept the developed models and practical proposals, like only way to obtain a successful incorporation of ICT to the University.

Nevertheless, it is opportune to indicate the existence of some other studies that have followed, indeed, the opposite approach - from bottom to top - trying to measure the students' points of view in relation to the present and potential roll of development of ICT in higher education. To this group they belong, in first term, an American initiative advanced by the Pew Internet & American Life Project (2002) titled "The Internet Goes to College: how students are living in the future with today's technology"; and also, two European projects: SEUSISS PROJECT (2003) and the SPOT PLUS (2003). They have served much as inspiration to generate the research theme of this study.

In the first place, the Pew Internet & American Life Project (2002) carried out a research where basically a profile of the American university students is made, like users of the network for academic and socialization aims of. The research advanced by this organization, had like primary objective to research on the impact of Internet in the daily life of the North American university students and to determine the repercussion of these usages on its academic and socialization routines of. Questionnaires to the students in a wide rank of higher education institutions were randomly distributed. The study was concentrated in the college students; that is to say, those that they look for to obtain a professional title and they dedicate to the majority or the totality of theirs time to that intention. The students reported a broad positive experience with Internet. A 79% of the American university students said that to use Internet it had a positive impact on his academic experience. Approximately half mentioned that the email allowed them to express the professor ideas that could not declare to him in class. Many students also reported that they used the Internet mainly to communicate socially with his friends. In the study the diverse implications of the student uses of Internet in the North American universities are discussed.

On the other hand, in SEUSISS PROJECT (2003) a research went ahead whose north was to evaluate the abilities shown by the students of seven European universities, in the handling of the Information and the Communication Technology. It was possible by means of the determination of an index of technology handling known as ICT Skills Index[1] considering that this is one of the capacities better appreciated in the society of beginnings of century XXI. The fundamental intention of the initiative was oriented to the determination of the technological abilities of the European university students, as much news students as those next ones to graduate. Basically, the objective of ICT Skills Index - according to the approach developed in that study - consists of measuring the levels of experience reported by an individual with a rank of applications software previously selected. One is which we could designate like a scale of 3 scores, concordant with the position of the student towards the following affirmations:

> *"I can make that type of tasks completely single"*
> *"It would need some aid to make that type of tasks"*
> *"Never in my life I have made that type of tasks"*

The applications software considered with the aim of the determination of the ICT Skills Index are the following ones: design Web, presentations manager, databases, graphical programs, spreadsheets, on line bibliographical databases, Web browsers, electronic mail, applications for Chat, and text processors. It consists, consequently, of a scale with a highest score of 10 (crossed of the variable of [0.10]). Although both very excellent work in their area, are limited to describe the habits of Internet usage in the American case, and to quantify the technological abilities of the students, in the European case.

Additionally, Wenglinsky (2003) carried out in the U.S.A. a research on great scale in which it values the impact of certain instructional practices - at level of the classroom - on the students reading understanding. Although it is certain that the work is referred to students of fourth degree of elementary school, for its methodology approach, it has individual interest for the accomplishment with the present investigation. The study relates the pedagogical practices of the teachers, as well as, the characteristics and baggage of knowledge of each one of them, with the student performance in a test on reading understanding; taking in consideration the characteristics from each student.

Kuh and Nelson (2004) analyzed the experiences of a great sample of American university students (more than 12,000) with the usages of the Information Technologies, from the point of view of their possible relation with some aspects of the student engagement[2]. The work extends our level of understanding on the relations between the educative uses of the ICT, and the degree in which the students to get involved in effective educative practices[3], that previous research have demonstrated has a positive incidence on the results in the studies. In first stage of the study it was persecuted to validate a scale that measured the student uses of the technology, besides to prove the sense and strength of his relation with other established indicators of student responsibility. The objective of the second stage of the work was to examine the convenience of changing the present perspective that sees the particular uses of the technology as a form of student engagement itself, by another vision, according to which the ICT would be only a component of other forms of study dedication.

Indeed, animated by the main findings of these four studies arose the challenge to analyze, in the first place: a) the habits of use of ICT for academic aims exhibited by the Barineses university students, b) to quantify the computational competences of these students and c) to try discover that aspects of the user profile - delineated in the literal "a" – cans determine a greater or smaller confidence in the technology use. Next, it used the structural equations modelling looking for discover possible relations of causality among practices of use of Internet in the studies, technological skills and academic performance of the students. Consequently, the objective of the present study was:

- To analyse the relations among the educative uses of the ICT, levels of skills in the technology handling (ICT Skills Index) and academic performance of the Barineses university students, in order to propose a model of causal relations that represents suitably, the effects of the technology use with educative aims on the results in the studies.

The proposed model suggests that educative usages of Internet have a direct influence on the academic performance and, an indirect effect, through degree of technological skill of the student.

METHODOLOGY

The present report is based on the results of a questionnaire, applied to university students of higher education institutions, public and privates, seated in the Barinas state (a province of the centre-western region of Venezuela). The questionnaire was distributed randomly to a representative sample by conglomerates and stratified of a wide rank of universities, with the aid of Statistics students at the Experimental National University "Ezequiel Zamora" - UNELLEZ, in the month of September of 2004. The fact that the questionnaire was applied by university students its homologous ones, guaranteed that the participants in the study remained nameless, reducing to the minimum attitudes towards certain aspects of the Internet usage, that could be considered personal or particularly sensible. The questionnaire direct application also allowed arriving at the students, of a way that had been impossible by other means, like in a telephone interview. The survey was distributed to registered college students in different programs in six institutions of higher education with seat in the Barinas city. **Table 1** shows the conformation of the population in the present research:

Table 1: *Population of university students registered at the Institutes of Higher Education Barinas state*

The institution's name	Institution's Type	Number of students registered
National Experimental university of the Occidental Plains "Ezequiel Zamora" – UNELLEZ.	Public	10.900 [a]
University Polytechnic Institute "Santiago Mariño" - IUPSM	Private	2.000
Technological "Agustín Codazzi" – IUTAC	Private	6.000
Experimental Pedagogical University Libertador – UPEL	Public	1.000
Technological "Antonio José de Sucre" - IUTAJS	Private	2.500
Nacional Open University - UNA	Public	4.000
Total		26.400 [b]

[a] it doesn't include the Mission Sucre students

[b] it doesn't include the Bolivariana university students neither to the Santa María university students

On the other hand, we designed a stratified sample (public institutions, private institutions) with proportional distribution. **Table 2** summarizes the final conformation of the same one.

Table 2: *Conformation of the sub-samples in each Barinesa HEI*

Stratum	Institution	% corrected	Subsamples
Public institutions	UNELLEZ	57,14	117
	UPEL	14,29	29
	UNA	28,57	59
Private institutions	IUPSM	10,53	22
	IUTAC	63,16	129
	IUTAJS	26,32	54
Total			**410**

Every student was asked about the educative uses of Internet, skills in the technology handling and academic performance. Altogether, 410 questionnaires were answered. With a 95% of confidence it can be affirmed that the error attributable to the sampling and other random effects is ± 5% (Arkin & Colton, 1965). Additionally to the sampling error, the way in which the questions were formulated and the practical difficulties to carry out the survey, can be introduce some additional error or inclination in the results. The type and design of research adopted was non experimental, cross-sectional, descriptive, causal, with quantitative approach.

RESULTS AND DISCUSSION

In this section, the principal findings obtained throughout the research development are discussed. The information contained in this section, has been carefully organized according to the following scheme:

- Results referred to the practices of ICT use in the local university context. The most important characteristics of the profile like users of the Network with educative aims, of the Barineses university students are delineated.

- Results referred to causal analysis among educational uses of ICT, technological skills and academic performance. Section of the article dedicated to the formulation of a hypothetical causal model among the variables before indicated, which were developed using the Path Analysis technique implemented with the aid of LISREL© program.

Technological profile of the Barineses university students

From the analysis of **Figure 1**, it is deduced that among the local university students, that are Internet users, the intensity of use of this tool can be catalogued like moderate. A little more than a third (34.9%) of them remains connected four hours or more a week. The percentage of students who exhibited an intensive use of the network - more than 12 hours weekly – only reached at 5.1%. If we compared these numbers with the intensity of Internet use showed by the American college students - 74% more than four hours weekly and 19% over 12 hours (Pew Internet & American Life Project, 2002) - will be clear why the Internet intensity use of the local college students is described as moderate. Nevertheless, a considerable 37% of the Barineses college students, uses most of the time of Internet connection (more of 50%), in activities related to their studies.
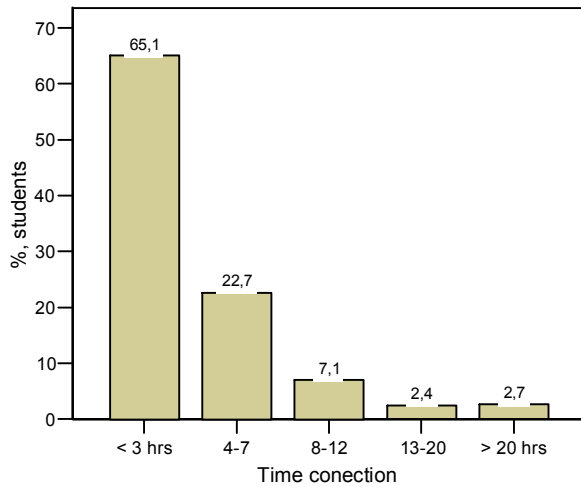
Figure 1. Weekly intensity use of Internet.
Variable: v6.

The local college students who had a PC at home - with its respective peripheral ones - reached a 33.2%, and of them, those who had a Internet connection from the comfort of their houses, reached 26.67% (**Figure 2**). According to the article of Perez Diaz (2006), at level of the Venezuelan population in general, the availability of computers in the home is commonest in the AB class (64.1%) that in the E (7.3%). Of those computers, they were connected to the Network in AB class (28.2%) and in the E (1.4%).
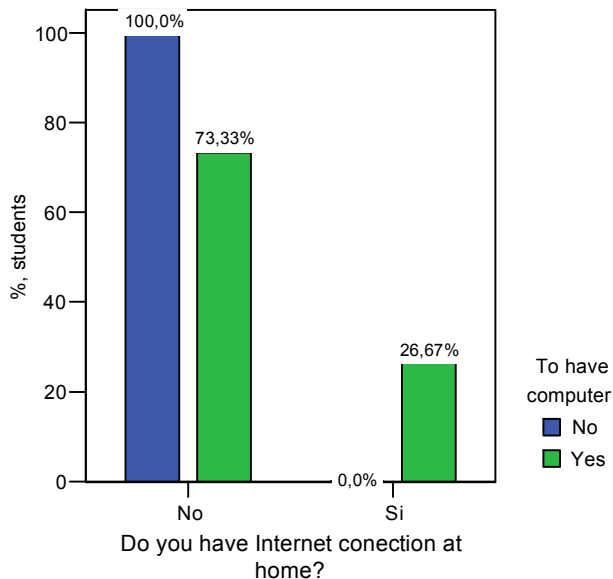
Figure 2. Students w/computer distributed for access to Internet. Variables: v7-v9.

According to **Figure 3**, the printers (32%) were the peripheral one commonest in the homes of the Barineses young people, followed by scanners (19%) and the CD recorders (18%). Returning to the data contributed in the article of Perez Diaz (*op. cit.*), seems that the use of the technology is reinforced more and more in the Venezuelans, and therefore in the Barines. This tendency is more frequent as the age of the person is younger and the level education higher. According to the data that they contribute, the cellular telephone is present in 85% of AB class and in the E, the index of penetration reached 54.2%. Young people are the main users of MP3 players with 43.6% in segment AB. The digital camcorders have a masculine rate of penetration of 30% in the ABC class. The digital cams are used mainly by the ABC class in a percentage that reaches up to 28% of the population. Additionally, in AB classes the penetration of the DVD players is of 80%, while in class E is 35%.
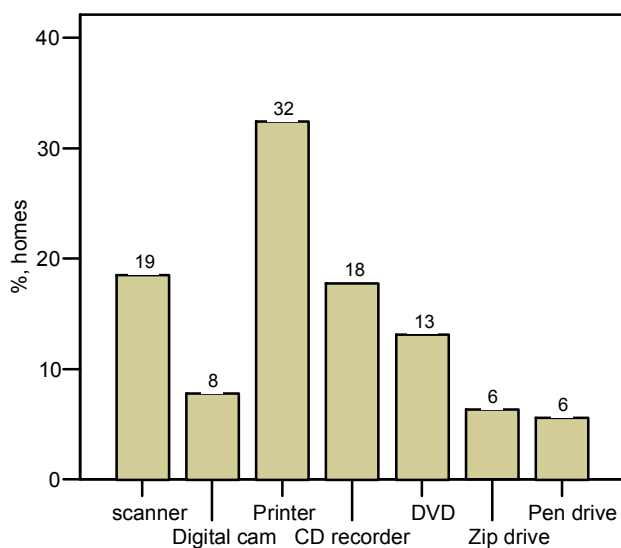
Figure 3. Technological equipment at homes of the barineses university students. Variables: v12a - v12g.

The frequency with which the Barineses college students use the computer in the studies, varied substantially, from one university to another (**Table 3**). The patterns of use of the computer grouped themselves in three categories, that is to say: High (Every day), Medium (Once for week) and low (Monthly, occasional or never). In the UNA, a 23.3% of their students reported a low level use of the computer, compared with the low percentage in this category (3.6% and 8.5%) shown by the IUTAJS and the UNELLEZ. In the IUTAJS and the IUPSM, the students showed the highest percentage of the computer daily use, with an 85.5% and 75.0%, respectively.

Table 3: Frequency use of the computer in the studies,in each Barinesa HEI

		Current Frequency of computer use		
		High (%)	Low (%)	Medium (%)
Educational institution	UNELLEZ	72,6	8,5	18,8
	UNA	51,7	23,3	25,0
	UPEL	58,6	13,8	27,6
	IUTAC	52,7	20,9	26,4
	IUTAJS	85,5	3,6	10,9
	IUPSM	75,0	10,0	15,0

On the other hand, related to the intensity of use of ICT as a tool in the academic activities, among the local university students; it emphasizes in **Figure 4** that the university institution where there is a more intensive use of the technology, was IUTAJS ($\bar{v}_{prom} = 1,22$)[4] and the university centre where this use is more moderate, corresponded to UPEL ($\bar{v}_{prom} = 0,575$). It is important to remember here, the scale used to measure this construct: 0 = Never; 1 = Some times; 2 = frequently; 3 = Very frequently; 9 = Don't Know/Don't answer. Therefore, it is emphasized that the participation of the local college students in good educational practices related to the technology-network, had a noticeable character of occasional, since in average, the value of this indicator was located around the score of scale "1 = Some times".
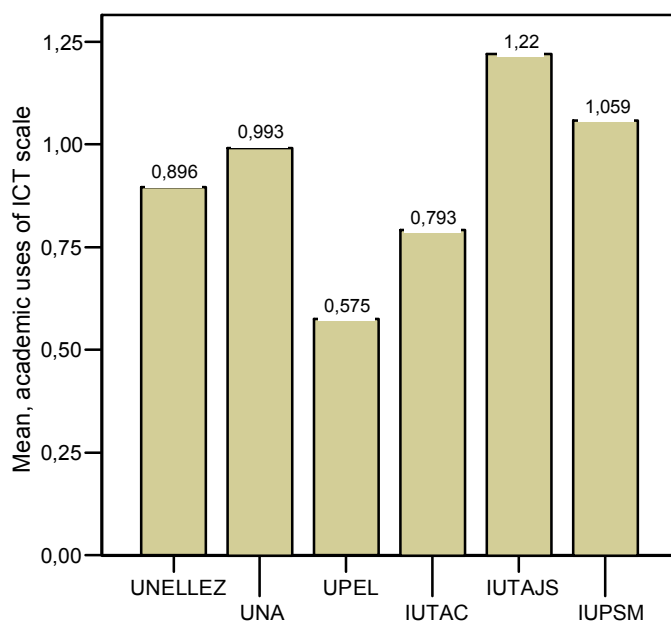
Figure 4. Average in the scale of academic uses of ICT, in each barinesa HEI. Variables: v00-vprom.

In the following question, the students were interrogated about the general perception they had in relation to the integration of ICT in its studies. As it shows **Figure 5**, three fourth parts of the Barineses university students consider that the technology is little or partially integrated in the pensum of their careers (75.31%). Hardly a 24.69% considered that the ICT was well integrated in their university. When this variable was examined, discriminating by institution, were substantial differences among universities. In some of them the opinions of the students about the integration level of ICT, clearly they were divided. Like in the cases of the IUTAC and the UNELLEZ, where to the total of students who thought that the ICT was partially integrated in the pensum, these institutions contributed to 32.79% and 30.84% respectively. As well, these same universities contributed to 27.72% and 20.79%, to the total of students who considered that the ICT was well integrated in the studies.
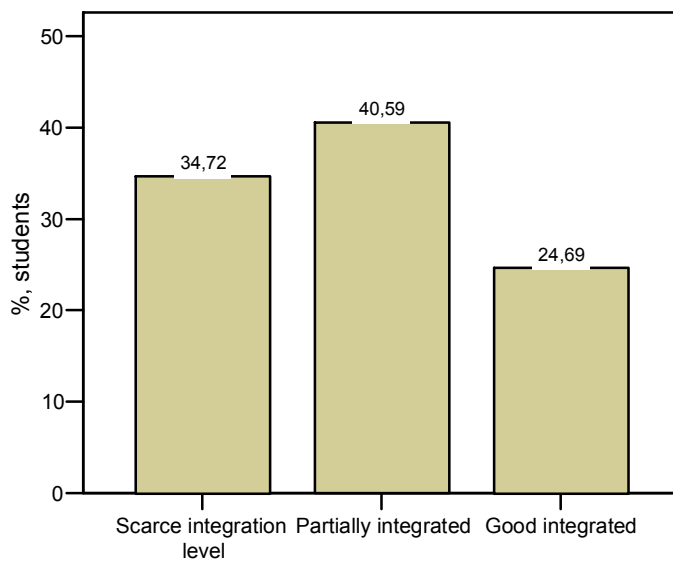
**Figure 5. Integration levels of ICT in the universities ,
according to the students' perception. Variable: v47.**

The confidence of the students in the use of ICT in the studies, varied among universities, although in all, the majority of the students was in the two higher levels of the indicator **(Figure** 6); and students' percentages that proved to approach to the technology with Little or a Lot of suspicion, turned out to be very small – so much among the owners of PC like among not owners -. The UPEL and the UNELLEZ presented students' lowermost percentages with a lot of confidence in technology. It is not a surprise that between 0 % and 20 % of the students yield any apprehension with ICT once their probable deficiency of knowledge about their careers expected by themselves. The confidence in ICT was influenced lightly for the field of studies, with the majority of the scientists and engineers (75.2 %) and to a lesser extent the students of Sciences Health (33 %), reporting high confidence levels in the same.
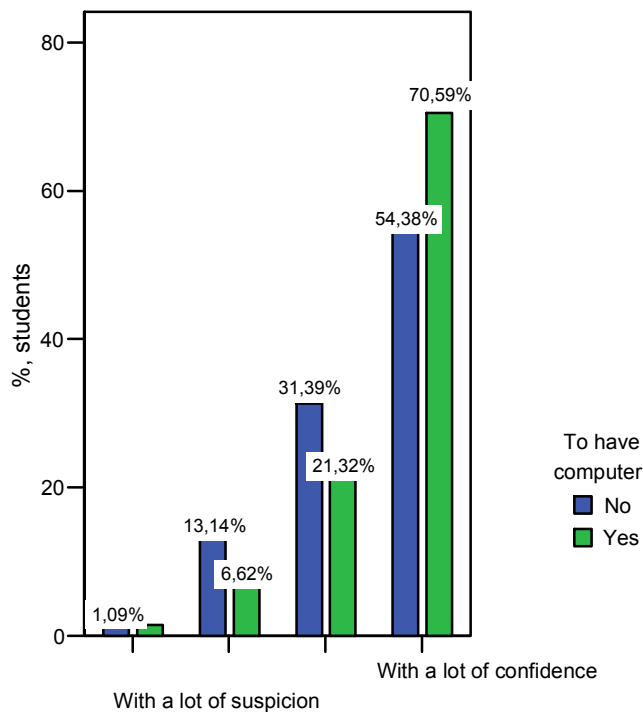
Figure 6. Relationship between confidence in the use of ICT and the availability of computer at home. Variables: v45-v7.

Model of causal relations among educational uses of the ICT, technological skills and academic performance of the Barineses university students

To complete the quantitative analysis of the possible causality relations among the educational uses of ICT, technological skills and the Barineses university students' academic performance, it was used the technique of structural equations modelling with observable variables, by means of the utilization of the LISREL© program. The goodness of fit measures revealed that the *path analysis* proposed (**Figure 7)** represent the empiric data adequately. In fact, the root mean square error of approximation (RMSEA) was to the almost perfect level of 0,000, with a normed fit index (NFI) of 1,00 and a comparative fit index (CFI) also of 1,00.

The path analysis for the local students' technological skills evidenced appreciable effects of the majority of the indicators on the number of applications, that Barineses university students declared themselves to drive independently (**Table 4a)**. The highest effects came, in the first instance, of an aspect pertaining to the surroundings of the student and, in second instance, of indicators that they relate with your individual behaviour in front of ICT. The possibility of having access to Internet from the PC installed at home had the biggest effect in the model (b=.57) [5]. They kept on in order of importance: The confidence in the use of ICT in the studies (b=.35), the experience with e-Learning's elements that the student was having (b=.31), the years using a computer (b=.29), the number of accounts of e-mail (b=.27), the frequency of use of the PC in the studies (b=.20), the fraction of the weekly connection time dedicated to the academic work (b=.18) and the years of experience using the Internet (b=.17). Engaging in *good educational practices* related with technology, that previous researches have highlighted his positive effects on the student success, had also an impact, although modest much more than the previous

(b=.07). It is important to notice that although the loading of this exogenous variable was small, its level of meaning was the highest among all the variables of the model (significant at level .001).

Table 4a: *Structural Equations Model for ICT Skills Index and Academic Performance. Endogenous variable: ICT Skills Index*

Exogenous variables	ICT Skills Index
Technological Equipment of the centers (vetc)	-1.42
	-0.020
Time of weekly connection to Internet (v6)	1.46
	0.17
To have PC at home (v7)	1.03
	0.10
Access to Internet from home (v9)	1.68*
	0.57
Complementary technological equipment household (v12t)	0.58
	0.028
Use of the computer in the studies (v14)	2.00**
	0.20
Experience in the use of the PC (v16)	3.37**
	0.29
Numbers of e-mail accounts (v18)	2.48**
	0.27
Fraction time of weekly connection dedicated to the studies (v21)	2.52**
	0.18
Experience using Internet (v22)	1.75*
	0.17
Academic uses of ICT (vtua)	4.06**
	0.07
Importance perception of ICT in the career (v44)	0.080
	0.049
Confidence in the use of ICT (v45)	2.73**
	0.35
Experience with elements of e-Learning (v46t)	2.64**
	0.31
Level of integration of ICT in the university curriculum (v47)	-0.30
	-0.032

* $p < .10$ (The parameters of the model that proved to be significant to this level, you would have taking them with caution because their significant levels are bigger than the sampling error of 5 %)
** $p < .05$

The part of the path analysis referring to the Academic performance of the Barineses university students revealed effects of, very little relevance, of the indicators considered in the model on this one endogenous variable (**Table 4b**). Thus, indicators related to status socioeconomic of the student, such as: educative and professional level of the father had the strongest effects (b=.014; b=.011). Nevertheless, only the second was significant at level .05. These results seem to support, the often highlighted thing in literature on the subject, in relation to the difficulties found until now by the researchers, to demonstrate the effectiveness of the use of ICT on the results in

the studies; and it again puts in centre of the debate the paradox of the no significance (Russell, 1999).

Table 4b: *Endogenous variable: Pondered Academic Performance*

Exogenous variables	Pondered Academic Performance
ICT Skills Index (v42r)	-1.19
	-0.016
Sex (v1)	1.42
	0.074
Age (v2)	0.22
	0.0054
Dedication to the studies (v3)	-0.42
	-0.022
Origin (v5)	0.67
	0.048
The father's professional level (v23)	2.24**
	0.011
The father's educational level (v24)	1.16
	0.014
The father's income (v25)	0.035
	0.0086
Academic uses of ICT (vtua)	0.81
	0.0037

$p < .10$
** $p < .05$

A possible explanation of this result can be deduced if we reviewed the findings found by Wenglinsky (1998), who used models of structural equations to explain the results in the mathematical subject in students of fourth and eighth degree of basic school in the U.S.A. He found, among other important findings, that the effect of the ICT use on the academic performance can be very different in students immersed in a rich atmosphere in technology than on those in more conventional surroundings. According to that premise, since it doesn't fit to the reality to say that the Barineses student university are habitually in atmosphere highly techno, we can assume that the impact of ICT on the results in the studies, can be attenuated by the conditions technological of the context.

In agreement with the previous reasoning, the technological equipment of the university centres (intervener variable) did not have a significant effect on the technological skills of the students (b=-0.020). Based on this result, it is considered that it is not the same that all the students have a computer in their classrooms or that they share a PC among several or there is computer science laboratory in centre, where students go from time to time. In this last configuration, it is expected that the effects of the use of ICT on the results in the studies were weaker than in the first configuration. This situation, in our opinion, is reflected by the causal model.

Figure 7 shows the causality relations among the diverse exogenous variables - indicated in the Tables 4a and 4b - with the technological abilities and the academic performance, reported by the Barineses university students.
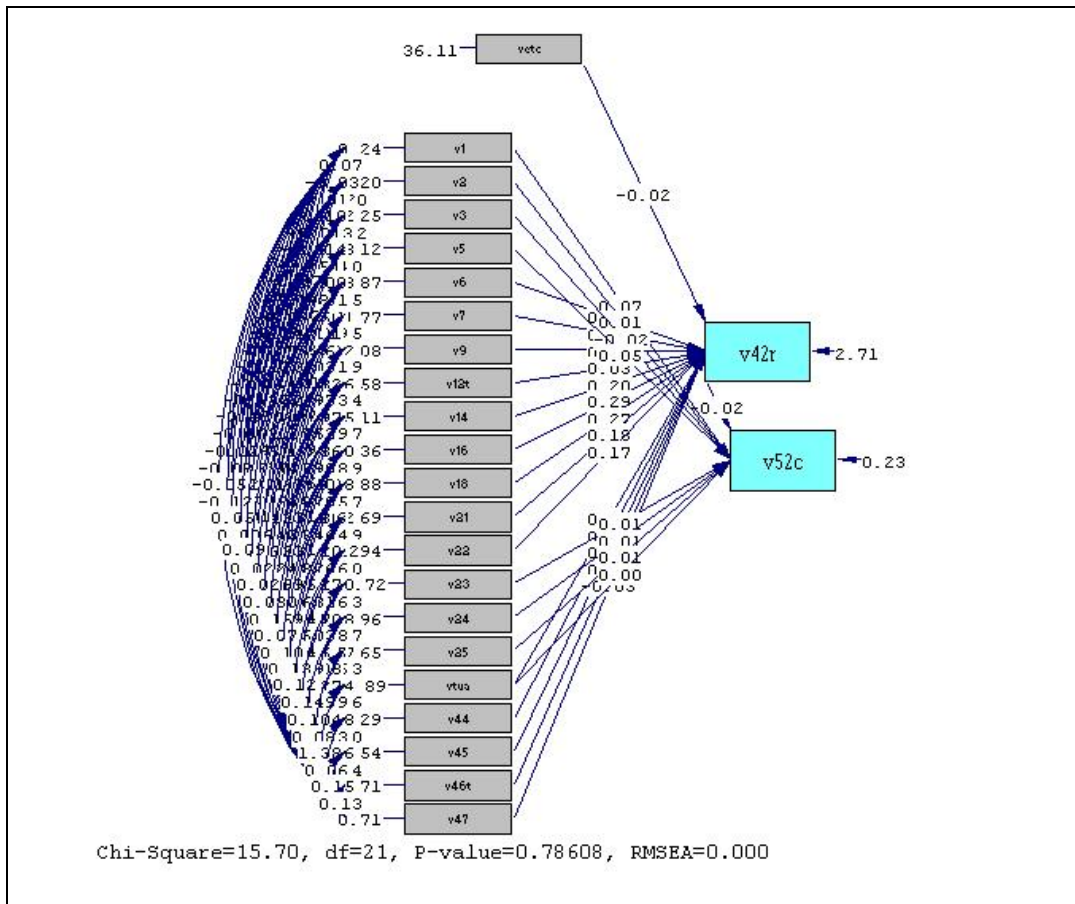
Figure 7: Causality relations among the diverse exogenous variables considered in the hypothetical model and the dependent variables: ICT Skills Index and Academic performance.

Finally, as it is reported in the bibliography, different models can exist and, they can reach statistically consistent results. For it the previous model with a saturated model was confronted, that implies that all the variables included in the model, are related to each other, and a model where all the studied variables establish solely direct influences (they are independent). The results indicate that the proposed model reaches results more excellent than the saturated model and the independent model; the results suggest than the proposed model attains more relevant results than the saturated model and the independent model; for example, when comparing the values of expected cross-validation index (ECVI) [6] of these three models we met than, for the proposed model ECVI 1,44 while that for the models saturated and independent, the values of ECVI were 1,55 and 9,85 respectively. These values contribute to give greater sustenance to the obtained findings.

CONCLUSIONS

The majority of the goodness fit statistics for the hypothetic causal model proposed (Figure **7)**, revealed that the same, represent adequately the empiric data collected by means of the

questionnaire application. These results suggest that the mesh of causality relations in the model was confirmed by the observed data.

The path analysis for the technological skills of the local students, demonstrated appreciable effects of indicators like: a) to have access to Internet from the PC installed at home, b) the confidence in the use of ICT in the studies, c) the experience with certain elements of e-Learning, d) the account number of email that the student had, e) the years using a computer, f) the frequency of use of the PC in the studies, g) the fraction of the weekly time of connection dedicated to the academic work, h) the years of experience using Internet and i) to get involved in good educative practices related to the technology. The indicator referent to the technological equipment of the Barineses university centres did not affect significantly the levels of e-Literacy (scores in the ICT Skills Index) of the students.

The part of the path analysis referring to the Academic performance of the Barineses university students revealed very little important effects of most of indicators considered in the model, on this one endogenous variable. Thus, only an indicator related to socioeconomic status of the student, that is to say, the professional level of the father had a significant effect.

These findings agree with the conclusions reached in frequently mentioned Russell`s work (1999) who has said: "There is nothing inherent to the technology that causes an improvement in the learning.", although, "the process to redesign a course to adapt its content to the use of the technology can improve the course and improve the results". Or, the position somewhat more categorical of Bates (2001, pp. 243 - 244):

> *Most of the teaching staff and of the postgraduates' students usually they begin to evaluate the relative effectiveness of the education based on the technology, compared with traditional direct education. Although this can be necessary to be able to integrate the most reticent professors, this plan concrete of research is frankly loss of time. The results are beforehand known.*

Consequently:

The compound hypothesis of research (H_1) was partially confirmed by the collected empirical data. The part of the hypothetical causal model related to the students technological skills - ICT Skills Index - received the greater amount of empirical sustenance. Contrary, the section of path analysis related with the students Academic performance only was influenced by the indicator: the father professional level.

Finally, we expect that the information collected during this research, and the attained conclusions, have contributed to raise the understanding that one was having about the technology handling, skills and attitudes toward ICT, and the possible relation of these two factors with the results in the studies, in the Barinesa higher education.

Endnotes

[1]   ICT Skills Index means "Indice de habilidades en TIC". Simply, the person is asked about his/her capacity to accomplish determined tasks, alone or with a certain amount of help, using 10 applications software of common use. The punctuations in this index fluctuate in [0, 10]'s interval, depending on if the individual manages none or all applications.

[2]   In general, the term *student engagement* refers to the attitude, needs, desire or obligation of the student of participating and engaging in its own learning process. In Kuh & Nelson

research, and in the present study, it is assumed like: How much the students get involved in true educational effective practices supported in ICT?

3 These *educational effective practices*, they are such like: Using the Internet to be connected with other students and for to find information, to send the professor an e-mail to clarify doubts on an assignment, to coordinate with classmates for telematics media a working party's activities, etc.

4 The notation $\bar{v}_{prom}$ makes reference to the average score obtained by the students in the scale of educational uses of ICT (variables v26 to v41 of the questionnaire).

5 The notation b=.xx it is used for indicate "structural coefficients" that measures the effect of an independent variable (exogenous) over a dependent variable (endogenous). In programs for modeling SEM, like LISREL©, corresponds to the values deployed on the arrows in the proposed model's diagram.

6 Smaller values in the ECVI are indicatives of goodness fit in the model.

REFERENCES

Arkin, & Colton. (1965). *Tables for Statisticians. Fundamentals Statistics in Psychology an Education*. Tokyo, Japan: McGraw Hill.

Bates, A. W. (2001). *Cómo gestionar el cambio tecnológico. Estrategias para los responsables de centros universitarios* (1ra. ed.). Barcelona, España: Gedisa.

Carnoy, M. (2004). *Las TIC en la enseñanza: posibilidades y retos*. Recuperated 15/11/04, from http://www.uoc.edu/inaugural04/dt/esp/carnoy1004.pdf

Godoy, C. (2004). *Usos y Penetración de Internet entre Estudiantes Universitarios venezolanos (El caso de los estudiantes universitarios barineses).* Paper presented at the Edutec'2004, Barcelona, España.

González Martínez, P. (1988). *Indicadores sintéticos de rendimiento estudiantil*. Recuperated 10/06/05, from http://iies.faces.ula.ve/Revista/Articulos/Revista_02/Pdf/Rev02Gonzalez.pdf

Haywood, J., Haywood, D., Macleod, H., Baggetun, R., Harskamp, E., & Tenhonen, P. (2004). A Comparison of ICT Skills and Students Across Europe. *Journal of eLiteracy, 1*, 69-81.

Hernández-Sampieri, R., Fernández-Collado, C., & Baptista-Lucio, P. (2003). *Metodología de la Investigación* (3ra. ed.). México, D.F.: McGraw Hill Interamericana Editores, S.A.

Kerlinger, F. N., & Howard, B. L. (2002). *Investigación del Comportamiento. Métodos de Investigación en Ciencias Sociales* (4ta. ed.). México, D.F.: McGraw Hill Interamericana Editores, S.A.

Kuh, G., & Nelson, T. (2004). *Student Experiences with Information Technology and their Relationship to Other Aspects of Student Engagement.* Paper presented at the Annual Meeting of the Association for Institutional Research, Boston, MA.

Kuh, G., & Vesper, N. (1999). *Do computers enhance or detract from student learning?* Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Quebec.

Medrano, J. D. (1992). *Métodos de Análisis Causal*. Madrid: Centro de Investigaciones Sociológicas.

Pérez Díaz, V. (2006, marzo 18). ¡Estudiando papá! *El Nacional,* pp. A-16.

Pew Internet & American Life Project. (2002). *"The Internet Goes to College: how students are living in the future with today´s technology"*. Recuperated 15/01/03, from http://www.pewinternet.org/reports/toc.asp?Report=71

Russell, T. L. (1999). *The no significant difference phenomenon*. Raleigh, NC: North Carolina State University.

Sancho Vinuesa, T., & Miralles Puig, L. (2004). *Internet y la red de universidades catalanas*. Barcelona, España: UOC-IN3.

SEUSISS PROJECT. (2003). *Survey of European Universities Skills in ICT of Students and Staff - Final Report*. Recuperated 15/01/04, from http://www.intermedia.uib.no/seusiss/

SPOT PLUS. (2003). *Students Perspective on Technology in Teaching and Learning in European Universities - Participation and Learning of University Students*. Recuperated 15/04/04, from http://www.spotplus.odl.org/

TendenciasDigitales, & Cavecom-e. (2005). *Indicadores de Penetración y Uso de Internet en Venezuela*. Recuperated 09/12/05, from http://www.tendenciasdigitales.com.ve/td/documentos/Penetracion_Internet_Diciembre_2004.pdf

Visauta-Vinacua, B., & Maritori-i-Cañas, J. C. (2003). *Análisis Estadístico con SPSS para Windows. Volumen II: estadística multivariante* (2da. ed.). Madrid: McGraw Hill Interamerica de España, S.A.

Wenglinsky, H. (1998). *Does it Compute? The Relationship Between Educational Technology and Student Achievement in Mathematics*. Princeton, NJ: Policy Information Center. Educational Testing Service [ETS].

Wenglinsky, H. (2003). Using Large-Scale Research to Gauge the Impact of Instructional Practices on Student Reading Comprehension: An Exploratory Study. *Education Policy Analysis Archives, 11*(19).

Applications of computer-aided assessment in the diagnosis of science learning and teaching

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ABSTRACT

This paper reports on a qualitative evaluation using questionnaires and interviews in South African Grade 10 classes on the diagnostic value of Computer-Aided Assessment (CAA). A two-stage evaluation was necessary: the first stage involved validation of diagnostic test items; and the second stage evaluated the diagnostic value of data that CAA produces. While results confirmed earlier findings about the advantages of CAA, the diagnostic and remediation potential of CAA data depended upon teachers' capacity to set diagnostic test items particularly in a multiple-choice format, teachers' ability to interpret data produced by CAA, teachers' skills in remedying their classroom as well as learners' problems, the quality of the test items, and the learning as well as the teaching strategies.

Key words: *computer-aided assessment; diagnostic assessment*

INTRODUCTION

Context

This evaluation was conducted in East London, South Africa (SA) during 1998 and 2001, with a science teacher in each of 2 schools, and Grade 10 learners. The number of computers at each school (13 computers in one school and 14 computers in the other school) limited the number of learners who participated to 27. School 1 was private and focussed on science, mathematics and technology, and School 2 was a government formerly whites-only school with a technical-based curriculum. Learners were of mixed races but predominantly used English as a Second Language. These two schools were selected because their curriculum was predominantly science-based, and had over 40 Grade 10 science learners per class. The schools were in the City of East London, and so easily accessible physically and by telephone.

The problems

The poor performance in science in South African schools is a matter of concern (E.g., Ogunniyi, 1997, 2000; Manzini, 2000; McComas, Clough & Almazroa, 1998; Muwanga-Zake, 2000, 2004), but computer technology could help to solve some of the problems in science classrooms. For example, in a survey of 26 senior schools in SA, each of the 42% of teachers surveyed, engaged over 51 learners in a science class (Muwanga-Zake, 2004: 15). Teachers face difficulties in diagnosing learning problems of large numbers of learners (Stiggins, 2001) and CAA could provide a remedy.

Rationale

One of the ways of improving performance in science is to use diagnostic assessment to scrutinise learning difficulties, so that appropriate remedial help and guidance can be provided. CAA has been found to provide data rich enough for diagnosing learners' problems (Bright, 1987).

The rationale of this study was to test the potential of CAA towards easing the labour of diagnostic assessment in classrooms where large numbers of learners per teacher are common, and where reviews of CAA are scarce. Additionally, a new curriculum in SA (the National Curriculum Statement) introduced rubrics as a method of scoring learners' achievements. The rubrics comprise possible or common alternative constructs that learners make, which are too many for paper-pen marking. These alternative constructs are however possible distracters in a Multiple-Choice Question, which are easily set upon CAA.

LITERATURE REVIEW

Assessment

Assessment in the National Curriculum Statement is an integral part of teaching and learning (DoE, 2005: 7), I.e., assessment and therefore, diagnosis appear to be in concert with learning theories (Madaus & Kellaghan, 1992; Gipps, 1996). For example, … *any method used to better understand the current knowledge that a learner possesses* (Dietel, Herman, & Knuth, 1991), is relatively behavioural. Madaus & Kellaghan (1992: 120) gives a similar definition. On the other hand a process-oriented, and therefore possibly constructivist definition is *… a systematic collection of information about learning and other variables associated with particular learning experiences* (Tamir, 1996: 94). In this paper I will take assessment to be a measurement of learning achievements against the objectives of a course.

Behavioural assessment seeks measurable objective knowledge and skills (Hannafin, Kim, & Kim, 2004: 13) under stated rules such as time (Birenbaum, 1996: 6). Each question and answer deals with one simple low cognitive concept (Scott, in association with Dyson & Gater, 1987: 19; Fuchs, 1995: 1-2; Gipps, 1996) and the item mark has to correlate positively with the total score, other wise it would be discarded (Gipps, 1996: 252-253). Similar statistics mean the same thing and so, behavioural results can be compared (Hannafin, Kim, & Kim, 2004: 13).

Higher order items fall into the cognitive assessment category, and differ from behavioural items in finding out the quality of an individual's cognitive constructs (i.e. criterion-referenced), under relatively *unregulated conditions* that do *not produce 'well-behaved' statistics;* it aims at improving instead of *sentencing* a learner (Wood as cited in Gipps, 1996: 255). Similar views appear in Jonassen, Howland, Moore, & Marra (2003: 228). Such assessment arises naturally in situations that an individual has experienced (Salviati as cited in Cunningham, 1991: 15), and so suffers invalidity on account of cognitive development in different environments and cultures (Mwamwenda, 1993).

Similarly but more subjectively, constructivists desire a lesson-integrated and contextual assessment that measures a learner's processes, interpretations and constructs (Hannafin *et al.,* 2004: 13; The Maricopa Center for Learning & Instruction, 2000; Pachler & Byrom, 1999: 126; Birenbaum, 1996: 6 – 7), for example, from practical tasks (Ryan & DeMark, 2002: 67). Think-aloud protocols or dialogue with the learner, asking a learner what s/he is doing and why, could be used. Jonassen *et al.* (2003: 230-232) recommends a rubric, which *takes the form of* learner-teacher well-defined negotiated *sets of scales* of expected performances for constructivist assessment.

The question of motivation

Assessment should not be intimidating and should rather motivate learners (Stiggins, 2002). However, there are fears of learner de-motivation when it is informal (Hickey, Kindfield, Horwitz, & Christie, 2003: 529).

Diagnostic assessment

There are a wide variety of definitions of diagnostic assessment, possibly as many as the number of definitions of learning, although most of the definitions concern identifying learning potential and difficulties (E.g., Lawton & Gordon, 1996: 88; Tuckman as cited in Fraser, 1991: 5; Bright, 1987: 71; Fuchs, 1995: 1). Additionally, Hein & Lee (2000: 3) and Bright (1987: 83) suggest conceptual pre and post diagnosis when planning a lesson. Such diagnosis identifies and analyses abilities, difficulties, and incorrect conceptions, and then provide appropriate remediation to learners (e.g., Hein & Lee, 2000: 3; Linn, 2002: 40; Harlen, 2000; Little & Wolf, 1996: xi). I however, derive a definition for this paper of diagnostic assessment from Black & Dockrell (as cited in Fraser, 1991: 5) and the Maricopa Center for Learning & Instruction (2000): Diagnostic assessment is a means by which a teacher and a learner iteratively and mutually agree to collaborate in monitoring a learner's conceptions and in deciding upon subsequent remediation. The definition takes recognition of Pollitt's (1990: 879) advice of integrating diagnostic assessment with teaching and attempts to ensure that gaps in teaching and learning are filled.

Amir & Tamir (1994: 94) suggest that *descriptions of* popular *misconceptions are very important starting points* during diagnosis, and such descriptions could derive from *interviewing a small number of students.* However, ensuring that standards and conceptions are appropriate and that the conceptions are tested at an acceptable standard and in prescribed ways entail validating the test items. Items must focus on just one aspect of learning at a time and should have a high degree of sensitivity with regard to the variety of possible misconceptions or alternative conceptions. Furthermore, a number of questions on a single aspect of learning could be used to pinpoint misconceptions and isolate the most popular ones, while at the same time ascertaining that a 'wrong' or 'right' answer is not by chance through guessing, errors (consistent pattern of mistakes [Bright, 1987: 72]) or mistakes (incorrect answers [Bright, 1987: 72]), but are respectively due to lack of, or adequate understanding.

Validation of diagnostic items

Since diagnostic assessment assumes that test items are valid, Linn (2002: 27) as well as Ryan & DeMark (2002: 67) believe that validity is the most important consideration in evaluating the quality of the uses, and interpretations of test results. Among many others, I have considered Haladyna's (2002: 94) and Linn's (2002: 28-33) description of validation as a process that evaluates the degree to which theory and evidence support the interpretation or purpose of a test-score. In concert, this paper considers validity to be the extent to which a test accurately measures what the users understand and want it to measure. That is, test items should be of appropriate standards and be presented in a way acceptable to most of the stakeholders concerned about a learning exercise to the extent that the inferences from test results should support the purposes of a test. This requires users to set priorities or pose the most critical validity questions (Linn, 2002: 46), which in this study were limited to:
o **General validity:** accuracy of items and scores; roles of participants; aims for the test (Ryan & DeMark, 2002: 67; Linn, 2002: 27-46; Haladyna, 2002: 94).
o **Construct validity**: the extent to which a test measures an intended characteristic or construct (Gay & Airasian, 2000: 169).
o **Content validity' or curricular validity'**: teaching methods; the Outcomes justified & accurately assessed (e.g., content, Grade) (Gay & Airasian, 2000: 163).
o **Face validity (Fairness)**: items *appears to measure what it claims* (Gay & Airasian, 2000: 164); not biased; e.g., gender, language and values concerns (DoE, 1998)*; relevant & adequate coverage* (Taiwo, 1995: 7)

o   **Technical validity:** refer to the appropriateness of the technology used in presenting the test. For instance, the test is technically valid if it affords the learners freedom of starting with any question.

Computer-Aided Assessment

There are terminologies some times synonymously used with Computer-Aided Assessment. These include: (1) Computer-Assisted Assessment; (2) Computer-Mediated Assessment (CMA); (3) Computer-Based Assessment (CBA); (4) e-assessment; and (4) online assessment, which is simply assessment which requires the use of the internet (Wise & Plake, 1990; Sandals, 1992; Thelwall, 2000; Gretes & Green, 2000; Bojic, 1995). Computer Assisted Assessment is used in similar ways with CMA and refers to any application of computers within the assessment process; these are therefore synonyms with a newer buzz word, e-assessment, where information technology is used for assessment-related activities. The computer plays no part in the actual assessment but merely facilitates the capture and transfer of responses. Computer-Based Assessment refers to assessment via the computer (Bojic, 1995). The computer does all processes such as marking, recording, feedback, and analyses (Gretes & Green, 2000: 47). Thus, Thelwall (2000: 38-39) adds that CBA is used for examinations and diagnostic assessment. Bojic (1995) defines Computer Aided Testing as the use of technology *to manage or support the assessment process.*

This study uses the term Computer-Aided Assessment (CAA) to include the administration, marking, storing, and processing of learners' assessment records, arguing that the term 'aided' signifies the computer's role as an aiding tool besides other tools of assessment such as dialogue between a teacher and a learner.

CAA software

Authors such as Oliver (2000: 2) and the Internet (e.g., *Software Reviews*) provide links to commercial and free CAA software along with reviews. This evaluation used Question mark (QM) *Designer* 1993 that could run on Windows 3.11 platform and later Window versions. Question Mark has been evaluated (for example, Knight & Brown, 2000: 2, 5; Gretes & Green, 2000: 47; Thelwall, 2000, 46-47; Croft, Danson, Dawson, & Ward (2001: 53) before but, as with other CAA software results were inconclusive.

CAA software might be the answer to saving time and energy for teachers to make assessment effective and efficient, as well as about enabling learner self-assessment. Most of the CAA software provides immediate self-assessment and feedback opportunities that enable learning or teaching diagnosis (Oliver, 2000: 1; Thelwall, 2000: 40, 45, 46; Gretes & Green, 2000: 46; Croft *et al.*, 2001: 62; Hickey, *et al.*, 2003: 531; The New Zealand Council for Educational Research, 2001). QM, in particular, has two diagnostic facilities: QM Designer provides shells for a range of Multiple Choice Questions (MCQs), including hot spot, word-match, and multiple choices, with options on repeating, showing marks, and the duration and time the test is done; and, QM Reporter, which instantly analyse performance for every learner, class, item, and test, and shows choices each learner makes in a MCQ (Thelwall, 2000: 41), whatever the number of learners.

However, in applying CAA, the evaluator has to watch for computer anxiety or attitudes or lack of computer skills among learners and teachers, and the difficulty to assess higher order thinking skills besides, high cost of computers and of CAA software, as well as computer system quality and maintanance (Thelwall, 2000: 40; Oliver (2000: 2).

Using CAA for diagnosing

Bright (1987: 75) explains that using computers to diagnose is *most appropriate* when a learner *has repeatedly been unable to learn,* such that there is suspicion of *fundamental misunderstanding* that needs to be corrected, presumably by the use of CAA. Bright (1987: 77-79) advises that diagnosis is made easier because CAA can match particular responses with errors that were pre-identified and stored in the program, thus CAA allows remediation using records of the learner's performance.

Multiple-Choice Questions (MCQs)

The definition of MCQ is adopted from the Department of Computer-Based Education, University of Cape Town (2000, section 2.1); a question in which [learners] are asked to select one alternative from a given list of alternatives in response to a 'question stem'.

Why focus on MCQs?

SA uses MCQs extensively in assessing science for their advantages (E.g., the Department of Computer-Based Education, University of Cape Town, 2000: section 2.2; Tamir, 1996: 96) such as:
a.   Assessing very large numbers of candidates;
b.   Reducing problems due to language, since answers are normally either provided or short;
c.   Easier to incorporate into CAA, and to analyse statistically
d.   Possibility of dealing with a wider range of topics and cognitive levels in a short time; and
e.   Easier and accurate marking, as well as administration.
For example, a science Matric examination can comprise 25% MCQ worth of marks. MCQ comprised a stem with more than one possible answer.

THE STUDY QUESTIONS

The main question of concern was: **What kind of diagnostic information does computer-aided assessment (CAA) provide on learners' current understanding of the science concepts at grade 10 level**? I unpacked this question into the following subsidiary questions:

i. How technically sound is the test?
The test set and presented by use of CAA is in this paper called the Computer-Aided Test (CAT). This excludes CAA uses besides the technical aspect of CAA presenting a test. In this study, technical aspects were limited to screen design, computer capacity, graphics, method of responding, and time limits (Sandals, 1992: 75-76). The CAT was presented to an Instructional Designer expert for technical validation.

ii. What is the quality of data that CAA provides?
The quality of data that the CAA provides was examined using three questions (Table 1).

Table 1: Questions, methods, and respondents

Questions	Primary Source	Data collection methods and Respondents	Analysis of interview data
i. What are the learners' results on the CAT?	The CAT	Learners did the CAT; interacted with learners while they did the CAT; and interviewed a focus group of learners afterwards	Constant comparative / some discourse analysis
ii. What information does CAA provide that is useful for diagnosing learners' knowledge?	CAA Reporter	Interviewed the 2 Teachers about CAA reports on learners' performance	
iii. How well do the results indicate the problems that learners have with the topic tested by the CAT?	Analysis of CAT results by CAA Reporter	Interviewed the 2 Teachers about CAA Reporter analyses	

It should be noted that the study had to use validated test items. Therefore, the study comprised two levels of evaluation; validation of test items, and the evaluation of data provided by CAA. These are outlined below in the respective order.

THE FIRST LEVEL OF EVALUATION: VALIDATING DIAGNOSTIC MULTIPLE-CHOICE QUESTIONS (MCQs)

Setting the first test items

Teacher 1 set Test 1. The analysis of the teacher's test, on the basis of Bloom's taxonomy of learning objectives and its content is shown in Table 1 below. Table 1 shows that the test covered a wide variety of concepts; it looked like a revision for the years' work.

Table 2 below indicates that the test comprised mainly recall such as Question 1 and 2 below.
1. *The following statement on electrification is not true:*
    a. *It occurs according to the Law of Conservation of charge;*
    b. *It occurs through friction*
    c. *It occurs when electrons are transferred from one object to another*
    d. *It is the result of creation of some charges and the destruction of others*

2. *The factor that does not influence the resistance of a conductor is _____*
    a. *Mass* b. *Temperature* c. *Diameter* d. *Type of material*
    Answers: 1) d 2) a
 # Note the use of negative terms in both questions.

Table 2: Test 1 set by the science teachers at East London: Table of specifications (e.g., Taiwo, 1995: 41)

Cognitive Domain	No. of items	Marks	Roots	Cell structure	Acids	Electricity	Electrostatics	Decomposition	Force / Pressure
Knowledge	7	14	(9), (10)	(8)	(6)	(2)		(5), (7)	
Comprehension	1	2					(1)		
Application	-	0							
Analysis	2	4							(3), (4)
Synthesis	-	0							
Evaluation	-	0							
Total	10	20	2	1	1	1	1	2	2

Note: numerals in brackets indicate the numbering of the question

Validation processes

Revising Test 1 items to produce Test 2
The teachers and I improved Test 1 to Test 2. We followed principles (e.g., in Croft *et al.,* 2001: 58) as follows: English was at a level for Black learners; Each item dealt with one clearly stated problem; Short stems; Negative stems were avoided, and highlighted if used; The alternatives were clearly correct with attractive distracters; and clues were avoided. For example, Questions 6 below replaced Questions 1 and 2 in the above. Test 2 also had 15 items.

> **Select THREE factors, which influence electrical resistance of a conductor from the following**: Diameter, type of material, strength of electrical current, strength of potential difference, temperature, mass

The class teachers and I validated the test items by doing Test 2, and then I gave Test 2 to the Subject Adviser from the South African Department of Education for further construct and content validation. The test items were accompanied by questionnaire about the validity of Test 2 items. I held an interview with the subject adviser on collecting the questionnaires, specifically focussing on answers the subject adviser provided to the questionnaire. The interview also sought ideas for improving the test items.

Findings by the subject advisor
The subject advisor found Test 2 to cover content well and to be very accurate, with suitable English vocabulary, for 15 – 16 years age range, and for Grades: 8 – 10. He complained of the high proportion of recall items.

Test 2 results
Learners did Test 2. Results from Test 2 indicated more conceptual problems in electricity than in other areas. Therefore, the teachers and I set a diagnostic Test 3 on electricity.

Setting diagnostic items on electricity

We identified learner problems about electricity by checking for errors and mistakes by allowing learners to do many questions about electricity that tested for understanding at different difficulty levels (Tamir, 1996: 96-97, 107) as follows:

- Using misconceptions from Test 2 and processes that learners might have used for constructing distracters, on the basis of *'correct – best answer'* with some *factually correct information*
- Ranking items and giving reasons for the ranking - candidates were provided with possible reasons in the defence of their reasoning and understanding
- Using paired-problem-solving activities, in which for example, a concept is needed before calculations.
- Penalising by awarding a negative mark for ludicrous choices that show complete misunderstanding
- In 'confidence in chosen response'; learners were asked to choose the best answer, state how sure they were, and then to choose the second best answer, etc. Each confidence level was given a different mark. E.g., Correct sure = 2 points; Correct not sure = 1 point; etc.
- Ask learners to give justification for their choice
- Providing data for learners to describe (analyse, and evaluate).

A sample of diagnostic questions, which the teachers and I set in Test 3

Battery A is marked 8 Volts and sends out 2 Coulombs in one second, Battery B is marked 4 Volts and sends out 4 Coulombs in one second, and Battery C is marked 16 Volts and sends out 2 Coulombs in two seconds. From the list below, select FOUR statements that are true.

a. *Coulomb in Battery C has more energy than a coulomb from Battery A and Battery B. (3)*
b. *Battery C is pushing out the lowest current*
   (1)
c. *Battery B could be experiencing the lowest resistance*
   (2)
d. *Battery B is the smallest in size because it is producing the lowest Volts*
   (0)
e. *Battery B will be most powerful after an hour*
   (-1)
f. *All batteries produce the same amount energy in one second.*
   (0)
g. *The three batteries are producing the same power*
   (4)
h. *The current is highest through Battery C because it has the highest Volts*
   (0)

In a higher resistance fewer charge pass through, and so the potential difference across that resistor will have to be low.
a. *Strongly agree (-2); b.   Agree (-1); c.   Disagree (1); d. Strongly disagree (2)*
b. *Neither agree or disagree (0)*

Conclusion on the first level of evaluation

The first level evaluation which involved validation of test items, revealed incapacity of teachers to set diagnostic science test items at Grade 10 level, especially in the MCQ format. For example, Test 1 was short of diagnostic test question, and included negative statements, against

recommendations of setting MCQs. The Subject Advisor alluded to the teachers' incapacity in the complaint about a high proportion of memory test items in Test 2. I had to provide guidance to these teachers in setting diagnostic test items in Test 3. Thus, it might be necessary to train teachers further about diagnostic assessment.

THE SECOND LEVEL OF THIS EVALUATION – THE DIAGNOSTIC VALUE OF CAA

Test 2 and Test 3 were used in the CAT – i.e., were typed into CAA and given to learners to do. The second level of evaluation started with learners doing the CAT, by which the values teachers attached to CAA were accessed. Therefore, the rest of this paper is about this second level.

Methodology used in the application of a CAT in two schools

QM documents the procedures to install and use at http://www.qmark.com/. Some of the aspects of technical validity are controlled by QM Designer, which we used to set the CAT with the following options:

- Learners were free to start with any question, or skip questions and could browse through the test back and forth, including the freedom to change answers.
- Captions: The screen showed the user's name, the name of the test, number of questions attempted so far, and time left.
- Other settings: A time limit of one hour, a user could escape from the test at any time, and answers were automatically saved upon the hard drive.

The teacher responsible for the computer laboratory, the science teacher and I loaded a validated Test 2 on the LAN and learners did the test. We made Test 2 available to learners on a Local Area Network (LAN) as advised in Oliver (2000: 1), Thelwall (2000: 39), and Gretes & Green (2000). Learners 'logged-on' school computers in a laboratory to do the Computer-Aided Test (CAT). Test 3 on electricity was set on the basis of QM reporter data, which revealed learners weaknesses in electricity in Test 2.

Test 3 appeared high levelled to learners (and to the teachers) that we had to discuss and help learners as they did the test. We also set QM Designer to allow learners to attempt the test any number of times, and to show correct answers and marks after the first attempt. With reports on Test 3 from QM Reporter, I interviewed the teachers about the data, their experiences with the CAT and on how they could use the QM reports. I also interviewed learners after they had finished doing the test for face validity.

Findings and analysis of findings

Technical validity of the CAT
An ID expert found that the CAT was technically valid except for the lack of dialogue boxes to help in case of need, and the fact that QM filled the whole screen without room for accessing other computer activities.

Face validity (Fairness) of the CAT
All participants were asked to check for gender sensitivity in terms of language, design aspects, and contexts used. Teachers and a focus group of learners after they did the CAT approved the CAT.

Data produced by QM reporter
Among the numerous reports that QM reporter produces a test report (summary and list report), item analysis report, and learner report are relevant for diagnosis. I give examples below.

i) **An example of a Summary Report**

Summary Report *2000/10/25;   Test name: College; _____; Number of users: ____;*
Score: Maximum - 75 %;   Minimum - 33 %;   Average: 49 %;   Standard deviation: 14.00
%;
Time to complete test: Maximum: - 19:55;   Minimum: 0:03;   Average: 14:50

ii. **An example of a List report**
On addition to the information below, QM reporter included the time and duration of doing a test by each learner. QM also kept a record of every attempt each learner made.

List Report *2000/10/25*

Score	Test name	User name	Date
Duration (minutes)			
33 %	*College*	*L1*	*2001/10/25*
18.33			
33 %	*College*	*L2*	*2001/10/25*
14.16			
73 %	*College*	*L13*	*2001/10/24*
10.03			
75 %	*College*	*L14*	*2001/10/25*
13.43			

QM arranged the report according to a teacher's needs; for example, according to the marks obtained (as in the above), name of test, alphabetical order of the learners, date, and time.

An example of a response item analysis by QM (Test 2 Question 6)
The QM item analysis includes 'facility' and 'discrimination' that are important in setting diagnostic questions:
Facility is the difficulty level of the question, ranging from 0.0 to 1.0, and is calculated as the average score for the question divided by the maximum achievable score. A facility of 0.0 indicates a very hard question (no-one got it right), while a facility of 1.0 shows a very easy question (no-one got it wrong). Questions that have facilities of more than 0.75 or less than 0.25 are less effective in differentiating users. An ideal facility is 0.5.

Discrimination ranges from -1.0 to +1.0, and is a Pearson product-moment correlation between the item and the test score. A correlation close to +1.0 means that the question is measuring the same thing as the test. A low correlation shows that getting the question right is not related to a good test score. A negative correlation means that getting the question right associates with a low-test score. Users who answer correctly questions with a discrimination of less than 0.25 up to -1 do not necessarily do well in the test as a whole.

Table 3: Test 2 Question 6: Select THREE factors, which influence electrical resistance from the list below:
Number of times question answered: 14; Average score: 3.43; Maximum: 6; Minimum: 2; Standard deviation: 1.22

% of learners	Score /choice	Choice
21%	4	"3 items selected: Diameter, Type of material, The strength of electrical current"
7%	6	3 items selected: Temperature, Diameter, Type of material"
29%	2	"3 items selected: Temperature, Mass, The strength of electrical current"
29%	4	"3 items selected: Temperature, Type of material, The strength of electrical current"
7%	2	"3 items selected: Type of material, Mass, The strength of electrical current"
7%	4	"3 items selected: Temperature, Diameter, The strength of electrical current"

Note that only 7% got this question correct, and that overall the rest (i.e., 93%) believed that 'the strength of current' influenced resistance". This data supported us in focussing upon electricity in Test 3.

Table 4: Test 3 Question 4 - First attempt:
*Multiple Choice - " **The Ohm is the unit of** -----"*
Number of times question answered: 14
Average score: 1.60   Maximum: 2   Minimum : 0
Standard deviation: 0.84   Facility: 0.80   Discrimination: 0.65

% of learners	Score /choice	Choice
80%	2	Resistance
10%	0	Charge
10%	0	Potential difference

The item analysis also shows the change in choices and improvement as learners repeated the test, e.g:

Test 3 Question 10 "Siphokazi connects resistors of 4 Ohm and 2 Ohm in parallel, while Olwethu connects resistor of 4 Ohm and 2 Ohm in series. What can you say about Siphokazi's and Olwethu's total resistance?" *Maximum: 3; Minimum: -2*

Table 5: First attempt: Average score: 1.20; Standard deviation: 2.04; Facility: 0.40; Discrimination: 0.49

% of learners	Score /choice	Choice
20%	-2	"The strength of the resistors will depend upon the current"
40%	3	"Siphokazi has the lowest resistance"

Table 6: Second attempt: Average score : 1.67; Standard deviation: 2.16; Facility : 0.56; Discrimination: 0.80

% of learners	Score /choice	Choice
17%	-2	"The strength of the resistors will depend upon the current "
67%	3	"Siphokazi has the lowest resistance"

QM Reporter shows that a lower percentage (17%) of learners chose the wrong answer, while an increased percentage (67%) of learners chose the correct option in the second attempt. The average score improved from 1.20/3.0 = (40%) to 1.67/3.0 = (56%).

In the above, note that learners scored better in a memory Question 4, with an average of 80% (facility = 0.8) (or average mark 1.6 out of a maximum of 2.0) than in a more challenging Question 3 with a score of 40% (Facility = 0.4) (or average mark of 1.2 out of a maximum of 3) in the first attempt.

The learner report

QM Reporter does not show the whole statement of the answers but shows the choices made by each learner, the marks each learner obtained for each question, the total percentage, the maximum mark obtainable for each question, and the overall percentage. For example:

> **Examples of a Learner Report (from Test 2)**
> **User name: L1**   **Score**
> *6 Multiple Response "Select THREE factors, which inf"*
> *Answer given: 3 items selected:*
> *Temperature, Mass, The strength of electrical current*   *2/6*

Teachers' responses to the interview

I have derived three categories of themes below to indicate the sense teachers made of CAA.

i.   Diagnostic values teachers attach to CAA
It is remarkable that teachers avoided the word 'diagnosis', even in questions about the diagnostic value of CAA. The diagnostic value teachers attached to CAA was deduced from their statements as shown below.

Table 7: Diagnostic values teachers attach to CAA

Theme	Statements
1. Identifying problems	• Tells me the errors and mistakes that learners make; immediate feedback; Can show where the problem is and what kind of mistakes
	• Make sure about the problems; help more needy students
2. Reveals learner's thinking	• Can show how the learner thinks
3. Revision	• For revision

ii.   Other values associated with CAA mentioned by the teachers

T2 was more impressed by the self-assessment opportunity that the CAT offered to learners, such that the test can '*be done unsupervised'*. He also noted the possibilities it offered such as testing many learners, while enabling attention to *'only those students who don't understand'*. Responses indicate that the CAT was fun: i.e., the CAT was interesting, exciting to learners, convenient, and made learners relaxed.

Table 8: Other values associated with CAA mentioned by the teachers

Theme	Statements
4. Contributes to motivation	• Interesting, students are excited; more relaxed; encourages learners to do the test
5. Eases the assessment of large numbers of learners	• Is helpful – saves paper, marking time, immediate feedback
	• With few teachers, can cover more ground in big classes; takes burden off the teacher; saves time
6. Self-assessment	• Be done unsupervised; Encourages self-learning
7. Helpful	• Convenient

iii.   Problems teachers associated with CAA

It can be noted that all the problems were raised by T2, who was teaching in a more advantaged school. For example, he stated that computers were not enough to have effective CAA, and that CAA and computers were expensive. Another inhibiting factor was the need for training. Teacher 2 identified the need for skills to structure questions for diagnosis with particular reference to what a teacher wanted to achieve from the diagnostic exercise, and the need for many questions.

Table 9: *Problems teachers associated with CAA*

Theme	Statements
8. Poor training	• Structure questions; Require more questions; how to set questions; need how to interpret and to use data
9. Economic disadvantage	• Computers not enough; Requires a lot money; Requires finance; Need for more computers and CAA software

Learners' opinions after using the cat – was test 2 fair to learners?
A sample of 14 learners' responses to the fairness of Test 2, which they did using computers appear in Appendix IV. This section provides insight regarding the 'face validity of Test 2. As far as the fairness of the CAT was concerned, the following are themes that learners made (individual learners appear in brackets)

1. Good (L1 - good, L8 – nice, L12 – okay): Fairness = Face validity
2. Interesting (L2, L3, & L4) + Enjoyed (L5) + Encourages study (L10): Motivating
3. Required thinking (L2): Diagnostic
4. Difficult (L1, L3, L6, L8, L11, & L14): Invalid (Content & Curricula)
5. It helps one to revise (L5, L9): Diagnostic
6. Very easy (L9) = 1   This particular learner obtained low marks!

There was no apparent relationship between 'fairness', 'time a learner took to complete the test', and the 'total marks' a learner earned. Furthermore, learners tried to respond in English, which was a 'second language' to them such that their vocabulary was limited. I had to probe for clarity, sometimes using vernacular and a 'discourse' besides a constant comparative analysis for some learners' responses.

Learners agreed with their teachers that CAA helped them to revise, and were excited about using the computer, getting marks immediately, being able to re-do the test, and knowing the time left to do the test. However, the most popular theme indicated that learners found the CAT difficult (six learners). Consider this comment in light of an average time of 14.5 minutes (with a maximum mark of 75%, a standard deviation of 14%, and an average mark of 49%) for a test set to be done in an hour.

DISCUSSION

Diagnostic information provided by CAA (QM Reporter)

Note that other methods of assessment such as a pen-and–paper test can yield data for diagnostic assessment. But, similar to Bright (1987:72), I have experienced strenuously the analysis of results from a diagnostic paper-and-pen test in a Carnegie Project at CASME. CASME had to employ somebody to process just over 200 scripts each with five diagnostic questions for a whole year. Secondly, it is important to differentiate between validity of the questions and the contribution to diagnosis that CAA makes. I am commenting on the later.

QM Reporter provided valid and relevant evidence for interpretations of performance (Linn, 2002: 40), especially with regard to identifying learners' problems in electricity. QM Reporter promptly analysed all learners' performances, and provided data that helped in identifying recurring mistakes and errors for each individual learner (The New Zealand Council for Educational Research, 2001). QM Reporter diagnostic data not normally available from a paper-and-pen test

included standard deviation, facility, and discrimination for each question. On addition, QM Reporter indicated the choices that individual learners made, and the number of learners who made a particular choice. However, as one teacher pointed out, it was clear that CAA does not diagnose but only provides data immediately to enhance diagnosis.

The learners' use of CAA to diagnose their problems

Learners realised the usefulness of CAA, mainly because QM provided opportunities for *ipsative* (successive learner performance), and criterion besides norm referencing. Results indicated that learners improved with practice (see item analysis) such that, possibly, the uncontrolled number of testing served recommendations for *regular self-assessment*, and *descriptive* feedback (Stiggins, 2002), which enabled learners to diagnose, and remedy mistakes themselves, through dialogue with or without assistance from the teachers; thus, self-evaluation was a possibility at a pace learners desired (Little & Wolf, 1996: xi; Tamir, 1996: 98-99). Learners also wanted the CAT to reveal answers, which was activated in Test 2. (L2 – '… *answers were not revealed at the end. I wanted to see where I went wrong').* Hence, learners could *watch themselves grow over time and thus feel in charge of their own success,* which they were eager to communicate to their teachers (Stiggins, 2002).

The increase in marks due to repeated item attempts (e.g., of Question 10, Test 3) could have indicated either learning the test or better understanding, not withstanding other factors such as improved familiarity with CAA. Improved performance in subsequent diagnostic tests is more likely to reveal improved understanding, provided that the subsequent tests comprise validated and different items of similar difficulty levels. In this case study, the fact that learners were subsequently able to attempt and score from harder diagnostic items that they had hitherto never done, could have indicated improvements in conceptual understanding, besides the improvements due to learning the test.

Bearing in mind the common enthusiasm learners have to use computers, the freer test atmosphere, instantaneous marking, and the diagnostic nature of test items also supported self-diagnosis and led learners to request for more testing, all of which increased competitiveness and excitement, especially when learners improved. Anything that can motivate learners to self-assessment is desirable and contributes towards self-diagnosis. According to Stiggins (2002) self-assessment *builds confidence* of learners to take responsibility for own learning, and lays foundations for lifelong learning. Similarly, Croft *et al.* (2001: 62) reported positive attitudes towards CAA, and argued that enthusiasm contributed to harder and consistent study*,* and to more knowledge and better performance. However, in this case, one teacher associated learner scores with her own success but failed to mention the possibility that learners could have worked harder.

The capacity of teachers to diagnose using CAA

Teachers alluded to diagnosis indirectly in their answers. For example, T1 said that data could show learner's problems and thoughts (so teachers can focus on learners with problems), and Teacher 2 replied that CAA was 'okay' when commenting on its diagnostic value. T2 indicated that CAA could show problems, errors, and mistakes. Another diagnostic suggestion was that CAA helps in revision and can test large numbers of learners. Besides that these teachers had little time and no reason to attend to this study, their actions and responses did not show capacity to diagnose learners' problems. They were reluctant to interrogate the data that QM Reporter produced such as facility, and discrimination. Teachers were worried about marks, but not the quality of responses their learners chose.

Yet remediation following diagnosis required the teachers to reflect on assessment data and to establish what could have gone wrong in teaching (Bright, 1987: 81). In this case, QM Reporter revealed distracters that were plausible to learners as alternative constructs. Remediation required the use of such distracters in subsequent tests (Tamir, 1996: 97, 107; Maloney, 1987: 510-513), to *inform the moment-to-moment instructional decisions* during the learning process (Stiggins, 1999). A comparison of the frequency of a particular misconception in subsequent tests can be used to measure the success of diagnosis and remediation (see for example, item analysis, question 10 – Test 3). Therefore, the diagnostic value the teachers attached to CAA was compromised by the teachers' reluctance or by incapacity to use data from QM Reporter. Thus, Mann's (1999) suggestion of minding other factors to accurately determine the effects of technology is relevant in this case. It is reasonable to speculate that these teachers required further training on diagnosis, part of which I tried by setting diagnostic items with them.

Diagnosis of learners' problems

Diagnosing learners' problems by these teachers should include dialogue with learners as they did the test. This implies a change in classroom practices towards freer practical oriented constructivist lessons.

In the interview, a statement such as … *'it was put in a difficult manner so that we can not exactly understand the question'* (L14) can indicate problems with language or a higher level of thinking required in answering a question than what the learner was used to. L4 said that 'n*eeded to know your facts'.* Learners who obtained low marks rushed through the test (see the List Report; e.g. L1 & L 2). This implied lack of careful thinking before choosing answers, and showed that processing information was rare. Possibly, learners dealt with tasks as right or wrong facts (Scott *et al.,* 1987: 19), even those that were weighed differently, and did well in recall items than in challenging questions (see item analysis report; e.g., Question 4 (80%), Question 10 (40%)). Learners found the test difficult because previous assessments had not been challenging (Test 1). Thus, although on the one hand the Subject Advisor and I sought to improve test validity by covering science processes well, on the other hand, the introduction of higher-level items reduced the validity of that test to learners (i.e., the test was difficult). My suspicion is that teachers approached science as factual.

Assessment, diagnosis, and remediation proceeded simultaneously in a natural way (Cunningham, 1991: 15) only when learners invited each of us for consultation (Hannafin, *et al.,* 2004: 13). It would have been better if there were opportunities for testing learners' constructs practically.

Diagnosing teaching

From the above, it appears that data can provide insight on the teaching style and problems. The results from the tests indicate that there were problems with teaching. Setting diagnostic tasks as given for example, by Tamir (1996: 97), appeared difficult for teachers, *inter alia* because teachers lacked the necessary depth of conceptual understanding to set such tasks (see Test 1). However, the plausibility of distracters catered for some learners' conception, since each alternative was chosen, but at the same time reflected upon the teaching they received.

Further to the arguments above, 93% of learners believed that the strength of current influences resistance (Question 6, Test 2). Teachers could have been the source of this popular faulty belief (Pollitt, 1990: 885).

Diagnosing, remedying, and learning theories

Empiricists or positivists, as well as constructivists would argue for practical work to avoid errors that learners made in Question 6. Nonetheless, The New Zealand Council for Educational Research (2001) advises teachers to identify the point at which learning faltered, but this might differ with the learning theory adopted in class, since assessment and learning are co-incidental. The first dilemma is that classroom practices and so assessment, diagnosis and remediation are rarely located in a single learning theory. As an example, the questions in Test 2 can be positioned in behavioural, cognitive or constructivist camps for which diagnosis and remedy might be different. A starting point is to see how each learning theory would deal with diagnosis and remediation.

For behavioural tasks (Fuchs, 1995: 2) discrete and single concepts appeared in items such as Question 4 (see item analysis report). Learners did these well to the satisfaction of Tamir (1996) that multiple-choice tests can reveal faulty memories. Behavioural remediation was achieved since learners improved every time they re-did the test - i.e., they eventually identified the correct answers through drill and practice.

Cognitive and constructivist items required teacher involvement with learners at the time they were solving problems (Hein & Lee, 2000: 7). It is unusual for learners to be allowed to talk during a test, and one can argue that these constructivist/cognitive items, which learners considered thought-provoking with the opportunities of instant marking that CAA provided, helped in constructivist diagnosis and remediation.

However, difficulties in diagnosis and remediation emerge with Wood's (as cited in Gipps, 1996: 255) advice to identify levels of 'how well' one understands. Although Test 3 provided multiple distracters that represented some of the learners' levels of understanding (Hannafin *et al.,* 2004: 13), there was an inherent assumption that thinking is systematic and has a road map where the distance translates into different marks or presumably different levels of understanding. The ways I personally think is certainly not linear, and is abstract and haphazard that it requires research; it is hard for anyone to tap into and discover accurately where my thoughts could be stuck. Hence, the way such distracters or personal schema (Tamir, 1996; Piaget cited in Mwamwenda, 1993: 71) were assessed might domesticate constructivism (Greening, 1998: 23-24). It thus raises questions about the practicality of constructivism and the design of rubrics in the new South African science curriculum. Additionally, Harlen (1993: 28-36) raises the issue of the difficulty of demarcating science processes from each other, and therefore, the difficulty in designing rubrics as required by curricula, which assume that each process or outcome can be identified, assessed and remedied. However, I propose that, although Rubrics might be hypothetical, they offer a platform for conjectures about concepts, researching the concepts, as well as possibilities of linking MCQs, rubrics, practical work, and continuous assessment.

Diagnosing science processing

CAA can support such possibilities (Figure 1) because CAA can handle multiple measurements. Figure 1 is my hypothetical example of assessment of some of the science processes involved, for example, in understanding Ohm's Law. Figure 1 also borrows from (Kuiper, 1997) in that no level or construct is wrong. The figure combines the design principles of a rubric, and MCQ, which could also encourage a dialogue between the teacher and a learner. The question would be open-ended and present as many alternative constructs as possible typed in CAA.

Table 10: *Rubric, MCQ or Dialogue?*

Question on Ohm's Law: What do you know about the relationship between potential difference and resistance?

Competency Level	Outcomes/constructs/alternative conceptions in an MCQ	Practical evidence	Score
1	V is proportional to R	Table of readings // V vs. R	2
2	V proportional to R because charge loses more energy across higher resistance		3
3	V proportional to I if R is constant / the rate at which charge passes R is depends on V if R remains the same // simple V=IR calculation).	Table of readings – draws graph // V vs. I. Determines R	7
4	Factors that affect R affect I with V constant (Factors include, temp, state or phase, thickness, length).	Table of readings // V vs. I under different temperatures - Determines R Vs T	10
5	Conductors or resistors whose R changes (due to some factors) do not obey this relationship // gives examples	Table of readings and graph // V vs. I. Explains the graph	13
6	R's in parallel provide more passage to charge and become less effective. Too many Rs allow too many charges to pass thus increasing power consumption or even a short circuit // examples of calculations of current in parallel Rs.	Connects resistors in parallel and records V as well as I.	15

Processes include hypothesising (i.e., rationalism), collection of data (i.e., empiricism), and social negotiations (i.e., social constructivism), bearing in mind that the journey is not terminal and could culminate into research, for example, in the form of project work. CAA provides the capacity to deal with such multiple constructs in form of a rubric (Jonassen *et al.,* 2003: 229), especially in a practical exercise and a dialogue – it reduces the labour, which, as we know, teachers are complaining about when they deal with continuous assessment and rubrics in classrooms with large numbers of learners.

CONCLUSION

These teachers (and learners) confirmed findings about the worth of CAA as claimed by in Oliver (2000), Gretes & Green (2000), as well as Croft *et al.* (2001), that CAA is valuable because it instantly provided volumes data and analyses, which teachers and learners could use to diagnose and remedy problems in teaching and learning. In the course of formulating strategies for diagnostic assessment that would benefit learners and teachers (Stiggins, 1999, 2002), I propose the following action plan for the two teachers:

- Improved conceptual understanding in science, and ability to set meaningful diagnostic tasks. They have to be persuaded probably with incentives such as CAA software and certification about using them to enrol for assessment learnerships in SA.
- Teachers would need to change their teaching styles to fit diagnosis and remedial work.
- A review of the curriculum to accommodate CAA, including reductions in class loads.

- Common misconceptions on each topic in science should be researched and be incorporated into item databases.
- Learners should have access to CAA, with guidance from the teacher, any time.

Other capital problems, such as the costs of computers and of CAA in these parts of the world remain hindrances that are beyond the teachers' influence, and should be addressed by all stakeholders.

REFERENCES

Amir, R. & Tamir, P. 1994. In-depth Analysis of Misconceptions as a Basis for Developing Research-Based Remedial Instruction: The Case of Photosynthesis. *The American Biology Teacher, Volume 56, No. 2, February 1994*. pp. 94-99.

Birenbaum, M. 1996. Assessment 2000: Towards a Pluralistic Approach to Assessment. In Birenbaum, M. and Dochy, F. J. R. C. 1996 (Eds). *Alternatives in Assessment of Achievements, Learning Processes and Prior Knowledge.* London: Kluwer Academic Publishers.

Bojic, P. 1995. What is Computer-Based Assessment? [Online] Available: http://www.warwic.ac.za/ETS/interactions/Vol2no3/links.htm. [6th October 1999].

Bright, G. W. 1987. *Microcomputer Applications in the Elementary Classroom. A Guide for Teachers.* Boston: Allyn and Bacon, Inc.

Croft, A. C., Danson, M., Dawson, B. R. & Ward, J. P. 2001. Experiences of Using Computer Assisted Assessment in Engineering Mathematics. *Computers & Education 37 (53-66).*

Cunningham, D. J. 1991. Assessing Constructions and Constructing Assessments: A Dialogue. *Educational Technology. May 1991. Volume 31 (5).*

Department of Education, South African Government. 23rd December 1998. Vol. 402, No. 19640. No. 6397 No. R. 1718. Government Notice, Department of Education. National Education Policy Act, 1996 (ACT NO. 27 OF 1996). Assessment Policy in the General Education and Training Band, Grades R To 9 and Abet. [Online] Available: http://www.polity.org.za/govdocs/regulations/1998/reg98-1718.html [18th July 2000].

Department of Education, South African Government, 30 November 2005, *National Curriculum Statement Grades 10-12 (General) Learning Programme Guidelines Physical Sciences*

Dietel, R. J., Herman, J. L., and Knuth, R. .A. 1991. *NCREL, What Does Research Say About Assessment?* [Online] Available: http://www.ncrel.org/sdrs/areas/stw_esys/4assess.htm [2000, July 31]

Fraser, W. J. 1991. Basic Considerations in the Construction of Classroom Tests. In Dreckmeyr, M. & Fraser, W. J. (Eds.). *Classroom Testing in Biology and Physical Science.* Bloemfontein. HAUM Tertiary.

Fuchs, L. S., 1995. *Connecting Performance Assessment to Instruction: A Comparison of Behavioral Assessment, Mastery Learning, Curriculum-Based Measurement, and Performance Assessment*. [Online] Available: http://ericec.org/digests/e530.htm [2001, March 23].

Gay, L. R. & Airasian, P. 2000. *Educational Research. Competencies for Analysis and Application. Sixth Edition.* Columbus, Ohio: Merrill.

Gipps, C. 1996. Assessment for Learning. In Little, A. & Wolf, A. (Eds.). *Assessment in Transition. Learning, Monitoring, and Selection in International Perspective*. Oxford. Pergamon.

Greening, T. 1998. Building the Constructivist Toolbox: An Exploration of Cognitive Technologies. *Educational Technology / March-April 1998, (23-35).*

Gretes, J. A. & Green, M. 2000. Improving Undergraduate Learning with Computer-Assisted Assessment. *Journal of Research on Computing in Education.* Volume 33. Number 1. Fall 2000.

Haladyna, T. M. 2002. Supporting Documentation: Assuring More Valid Test Score Interpretation and Uses. In Tindal, G. & Haladyna, T. (Eds.). 2002. *Large-Scale Assessment Programs For All Students. Validity, Technical Adequacy, and Implementation.* Mahwah, New Jersey. Lawrence Erlbaum Associates, Publishers. (Pages 89-108).

Hannafin, M. J., Kim, M. C., & Kim, H. 2004. Reconciling Research, theory, and Practice in Web-Based Teaching and Learning: the Case for Grounded Design. *Journal of Computing in Higher Education. Spring 2004, Vol. 15(2), (30-49).*

Harlen, W. 1993. *The Teaching of Science*. London. BPCC Wheaton Ltd.

Harlen, W. 2000. Assessment in the Inquiry Classroom. [Online] Available: http://www.nsf.gov/pubs/2000/nsf99148/lcd/ch_11.htm [25th April 2001].

Hein, G. E. and Lee, S. 2000. Assessment of Science Inquiry. [Online] Available: http://www.nsf.gov/pubs/2000/nsf99148/lcd/ch_12.htm [25th February 2000].

Heinecke, W. F., Blasi, L., Milman, N. & Washington, L. 1999. New Directions in the Evaluation of the Effectiveness of Educational Technology. Paper given at Papergiven at *The Secretary's Conference on Educational Technology-1999.* [Online] Available: http://www.ed.gov/Technology/TechConf/1999/whitepapers/paper8.html [30th October 2002].

Hickey, D. T., Horwitz, P., D. T., Kindfield, A. C. H., & Christie, M. A. T. 2003. Integrating Curriculum, Instruction, Assessment, and Evaluation in a technology-Supported Genetics Learning Environment. *American Educational Research Journal. Summer 2003, Vol. 40, No. 2, (495-538).*

Jonassen, D. H., Howland, J. L., Moore, J. L., & Marra, R. M. 2003. *Learning to Solve Problems with Technology. A Constructivist Perspective. Second Edition.* Upper Saddle River: Merrill Prentice Hall.

Knight, M. & Brown, A. 2000. Computer based Assessment. [Online] Available: http://ctiweb.cf.ac.uk/HABITAT/HABITAT4/compass.html [14th December 2001].

Kuiper, J. 1997. Quirks and *Quarks*: Changing Paradigms in Educational Research. *Meeting of the Association for Research in Mathematics, Science and Technology Education. 22-26 January 1997. University of Witwatersrand, Johannesburg. (530-534).*

Lawton, D. & Gordon, P. 1996. *Dictionary of Education.* Second edition. London: Hodder & Stoughton.

Linn, R. L. 2002. Validation of the Uses and Interpretations of Results of State Assessment and Accountability Systems. In Tindal, G. & Haladyna, T. (Eds.). 2002. *Large-Scale Assessment Programs For All Students. Validity, Technical Adequacy, and Implementation.* Mahwah, New Jersey. Lawrence Erlbaum Associates, Publishers, (27-66).

Little, A. & Wolf, A. (Eds.) 1996. *Assessment in Transition. Learning, Monitoring, and Selection in International Perspective*. Oxford. Pergamon.

Madaus, G. F. & Kellaghan, T. 1992. Curriculum Evaluation and Assessment. In Jackson, P. W. (Ed.) 1992. *Handbook of Research on Curriculum.* (119-154). New York. Macmillan Publishing Company.

Maloney, D. P. 1987. Ranking tasks. A New Type of Test Item. *Journal of College Science Teaching*, May 1987, (510 – 515).

Manzini, S. 2000. Learners' Attitudes Towards the Teaching of Indigenous African Science as Part of the School Science Curriculum. *Journal of the Southern African Association for Research in Mathematics, Technology and Science Education. Volume 4, Number 1, (19-32).*

McComas, W., Clough, M., & Almazroa, H. 1998. The Role and Character of the Nature of Science in Science Education, (3-39). In McComas, W. F. (ed.) 1998. The Nature of Science in Science Education. Rationales and Strategies. Science & Technology Education Library. London. Kluwer Academic Publishers.

Muwanga-Zake, J. W. F. 2000. Is Science Education in South Africa in a crisis? The Eastern Cape Experience. *Journal of the Southern African association for Research in Mathematics, Technology and Science Education. Vol. 4 (1), (1-11)*

Muwanga-Zake, J. W. F. December 2004. PhD Thesis. University of KwaZulu-Natal, South Africa. *Evaluation Of Educational Computer Programmes As A Change Agent In Science Classrooms.*

Mwamwenda, T. S. 1993. *Educational Psychology. An African Perspective.* Durban: Butterworth Publishers (Pty) Ltd.

New Zealand Council for Educational Research. 2001. [Online] Available: http://arb.nzcer.org.nz/nzcer3/nzcer.htm [21th February 2002].

Ogunniyi, M. B. 2000. Teachers' and Pupils' Scientific and Indigenous Knowledge of Natural Phenomena. *Journal of the Southern African Association for Research in Mathematics, Technology and Science Education. Volume 4, Number 1, (70-77).*

Ogunniyi, M. B. 1997. Multiculturalism and Science Education Research in the New South Africa. *Proceedings of the Fifth Meeting of the Southern African Association for Research in Mathematics and Science Education. 22-26 January 1997. University of Witwatersrand, Johannesburg, (50-53).*

Oliver, A. 2000. Computer Aided Assessment – the Pros and Cons. [On Line] Available: http://www.Herts.ac.uk/ltdu/learning/caa_procon.htm [14th December 2000].

Pachler, N. & Byrom, K. 1999. Assessment of and through ICT. In Leask, M. and Pachler, N. (1999). (Eds.) *Learning to Teach Using ICT in the Secondary School*. London: Routledge.

Pollitt, A. 1990. Diagnostic Assessment Through Item Banking. In Entwistle, N. (Ed.) 1990. *Handbook of Educational ideas and Practices.* London and New York: Routledge.

Question Mark. [Online] Available: http://www.qmark.com/ [9th September 1999].

Ryan, J. M. & DeMark, S. 2002. Variation in Achievement Scores Related to Gender, Item Format, and Content Area Tested. In Tindal, G. & Haladyna, T. (Eds.). 2002. *Large-Scale Assessment Programs For All Students. Validity, Technical Adequacy, and Implementation.* Mahwah, New Jersey. Lawrence Erlbaum Associates, Publishers. (Pages 67-88).

Sandals, L. H. 1992. An Overview of the Uses of Computer-Based Assessment and Diagnosis. *Canadian Journal of Educational Communication, Vol. 21, No. 1 (67-78).*

Scott, P., in association with Dyson, T. & Gater, S. 1987.*A constructivist view of learning and teaching in science.* Leeds. Centre for Studies in Science and Mathematics Education, University of Leeds. Leeds LS2 9JT.

Stiggins, R. J. Summer 1999. Teams. *Journal of Staff Development*, Summer 1999 (Vol. 20, No. 3) [Available] 22nd July 2006. Online. http://www.nsdc.org/library/publications/jsd/stiggins203.cfm

Stiggins, R. J. 2001. *Student-Involved Classroom Assessment.* 3rd ed. Upper Saddle River, NJ: Prentice-Hall, Inc.

Stiggins, R. J. 2002. Assessment Crisis: The Absence Of Assessment *FOR* Learning. *Phi Delta Kappan*. http://www.pdkintl.org/kappan/k0206sti.htm [Available] 22nd July 2006.

Taiwo, A. A. 1995. *Fundamentals of Classroom Testing.* New Delhi: Vikas Publishing House PVT LTD.

Tamir, P. 1996. Science Assessment. In Birenbaum, M. and Dochy, F. J. R. C. 1996 (Eds.). *Alternatives in Assessment of Achievements, Learning Processes and Prior Knowledge.* London: Kluwer Academic Publishers.

The Department of Computer-Based Education, University of Cape Town. 2000. [Online] Available: http://www.uct.ac.za/projects/cbe/mcqman/mcqchp2.html [21st November 2001].

The Maricopa Center for Learning & Instruction, Maricopa Community Colleges, 2000. What is assessment of learning? [Online] Available: http://www.mcli.dist.maricopa.edu/ae/al_what.html [20th March 2001].

The New Zealand Council for Educational Research. 2001. [Online] Available: http://arb.nzcer.org.nz/nzcer3/nzcer.htm [2001, March 20].

Thelwall, M. 2000. Computer-Based Assessment: a Versatile Educational Tool. *Computers & Education 34 (2000)* (37-49).

Weiss, C. H. 1998. Evaluation. *Methods for Studying programs and Policies.* New Jersey: Prentice Hall.

Wise, S. L. & Plake, B. S. 1990. Computer-Based Testing in Higher Education. *Measurement and Evaluation in Counselling and Development / April 1990 / Vol 23.*

Original article at: http://ijedict.dec.uwi.edu//viewarticle.php?id=226&layout=html

Education and human resource development in post-independent Eritrea:
An explanatory note*

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ABSTRACT

Education is a lifelong process. Twentieth century has witnessed the miracles of Human Resource Development (HRD) activities reflected through increase in GNP and overall productive activities. The Government of Eritrea offering both formal and informal training programmes at different levels in order to develop the human resources. This prosperity in education is obviously a great thing for Eritrea, and the dream to make Eritrea a technological-oriented and advanced nation would become real, because the cumulative effort done so far in the human development is noteworthy. As Human Resource Development Programmes concentrate much on the category of major raw human resource to be processed into the work force and its role in reconstructing the economy. An attempt is made in this article to analyse the educational and human resource development after independence. This article also provides detailed account of technical and vocation education with special reference to skill development programme.

Keywords: *Education, Human Resource, Development, Eritrea, Technical education.*

INTRODUCTION

Education plays a dominant role as an effective instrument for large-scale achievement and revolution in all spheres. Purposeful education enables the individual to understand and study the real life situation and to develop an opportunity for creating confidence in the minds of younger generation, and provide a strong base for rational and value-oriented and nation-building progress (Myers & Harbison, 1965; Mingat and Tan, 1986). Technical and vocational courses in higher education play a significant role in this context. Therefore, a close introspection of the trend of technical and vocational courses in higher education is essential, not only for making them attractive, but also in shaping them to be economically and socially relevant in Eritrea (Rena, 2004). Two highly commendable features, industriousness and steadfastness characterize the people of Eritrea. The Government is investing heavily on human resources development in the conviction that among its best resources are its people. Obviously, the courses in technical and vocational education are considered as utility-oriented subjects; however they involve heavy cost to the national exchequer of Eritrea (Government of Eritrea, 1996).

The World Bank (2000) acknowledged the importance of technical and higher education for countries not to be left behind in a global economy based on knowledge. Criticizing an analysis that measures the benefits of higher education solely in terms of incremental earnings accruing to individuals, higher education is regarded as 'simultaneously improves individual's lives and enriches wider society' (World Bank, 2000: 37). Further, education is a lifelong process. What a student obtains from the school and college is only a small part of the education that needs for the economic and social life of human being. Thus, both in the case of man who is determined to reach the summit, and the man who wants to make a complete success of his life, additional education is imperative to develop the special skills. Therefore, the education must be constant and continuous programme **(**Myers & Harbison, 1965; Bacchus, 1992, Rena, 2005c).

The twentieth century has witnessed the miracles of Human Resource Development (HRD) activities reflected through increase in GNP and overall productive activities in industrially developed countries. Even Eritrea has experienced the GNP growth rate of 7 per cent during 1994-1997. However, it decelerated due to border conflict with Ethiopia. Details are presented in subsequent paragraphs of this article. Human resource development (HRD) in itself can be understood in different ways: HRD in its broadest sense is an all-inclusive concept, referring to the process of 'increasing the knowledge, skills and capacities of all people in a society' (Tseggai, 1999: 216), encompassing in economic terms the accumulation of human capital, in political terms preparing people for participation in democratic political processes, and in social and cultural terms helping people to lead fuller lives, less bound by tradition (Tseggai, 1999). The dominant human capital theory has, however, narrowed HRD down to its economic aspects, or its human capital component (World Bank, 1995).

The role of higher education within the national HRD strategy broadly follows the pattern advocated by Thompson and Fogel (1976) for educational development in developing countries, in which higher education is strongly embedded into the national community as a whole instead of being an elitist institution which is removed from the realities of the majority of the population. The role of the university herein is that of a 'developmental university', an institution first and foremost concerned with the "solution" of the concrete problems of societal development' (Coleman, 1994: 334). Such a university sets out to 'ensure that the development plans of the university are integrated with or linked to national development plans' (Coleman, 1994: 343).

In Eritrea, having understood these phenomena, efforts have been intensified to accelerate the development process through different forward-looking activities including various human resource developments (Tseggai, 1999; Rena, 2005c). The Ministry of Education (MoE) has been playing very prominent role in re-building the economy through successful implementation of HRD plans depends substantially upon relevant policies and practices of other developed and developing countries apart from its own internal policies and constraints (Bacchus, 1992; Todaro, 1994). The noble achievement of this kind has been witnessed through the present educational programmes and reforms in the country. The MoE has its own frame work for the operation offering both formal and informal training programmes of different level notably the human resource development programmes.

Profile of the Country

Almost one year after the declaration of Education For All (EFA) at Jometien, Thailand in March 1990, Eritrea got its independence on May 24 1991 after thirty years freedom struggle. It has an area of 46,770 sq mi (121,144 sq km) and has an estimated population of 4,670,000 (2005 est.).[1] It is located in the Horn of Africa, bordered in the North and West by Sudan, in the South by Ethiopia and Djibouti and in the East by the Red Sea. Its capital is Asmara. The population is composed of nine ethnic groups and the country divided into six administrative regions.[2] The population is about equally divided between Christians and Muslims. Like many African economies, the economy of Eritrea is largely based on subsistence agriculture, with more than 70 per cent of the population involved in farming and herding. It has the GDP (purchasing power parity) per capita income of $900 (2004 estimates). The country's agricultural products include sorghum, wheat, corn, cotton, coffee, and tobacco. Cattle, sheep, goats, and camels are raised, and hides are produced. There is a fishing industry and some pearl fisheries remain in the Dahlak Archipelago. The country's natural resources include gold, copper, potash, zinc, iron, and salt, but they have not yet been exploited. Offshore oil exploration was begun in the mid-1990s. Eritrea has little manufacturing beyond food processing, textiles, and building materials. Many Eritreans work outside the country, and their remittances substantially augment the GDP.[3] Imports (consumer goods, machinery, and petroleum products) greatly exceed the value of exports

(livestock, sorghum, and textiles). The country's main trading partners are Ethiopia, Saudi Arabia, Sudan, and Italy (Rena, 2006).

The Ethiopian-Eritrea war in 1998-2000 severely hurt Eritrea's economy. GDP growth fell to zero in 1999 and to -12.1 per cent in 2000. The May 2000 Ethiopian offensive into northern Eritrea caused some $600 million in property damage and loss, including losses of $225 million in livestock and 55,000 homes. The attack prevented planting of crops in Eritrea's most productive region, causing food production to drop by 62 per cent. The erratic rainfall keeps the cereal production well below normal, holding down growth in 2002-04. Even during the war, it is observed that Eritrea developed its transportation infrastructure, asphalting new roads, improving its ports, and repairing war damaged roads and bridges. Since the war ended in 2000, the government has maintained a firm grip on the economy. Eritrea's economic future depends upon its ability to master social problems such as illiteracy, unemployment, and low skills, and to open its economy to private enterprise so the Diaspora's money and expertise can foster economic growth (Rena, 2006). Since its independence, the country has been undertaking number of developmental programs in rebuilding its war damaged economy particularly education sector.

There are five levels of education in Eritrea, pre-primary, primary, middle, secondary, and tertiary. Education is as natural a right as the right to breathe. However, Eritrea pledged to achieve the universalisation of primary education and to increase the national literacy rate. The literacy rate is reported to be 57 per cent (Rena, 2005a). There are nearly 700,000 students in the primary, middle, and secondary levels of education (MoE, 2006). There are about 1100 schools and more than12, 000 teachers in Eritrea and two Universities (University of Asmara and the Eritrea Institute of Technology) as well as several smaller colleges and technical schools. One of the most important goals of the Eritrea's educational policy is to provide basic education in each of Eritrea's mother tongues as well as to develop self-motivated and conscious population to fight poverty and disease.

The methodology used in preparing this paper is both qualitative and quantitative in nature where the data has been collected from different reports, books news papers etc. The data mainly obtained from the reports of the World Bank, Ministry of Education, the government of Eritrea, and some Journals, newspapers articles published in etc. The paper is purely descriptive and analytical in nature. The organization of the paper is as follows: the first part discusses the introduction, importance of Human Resources and profile of the country. Second part provides Human Resource Development in Eritrea. Third part deals with the department of technical education and vocational training and the skill development programme in Eritrea. The final part provides concluding remarks of the study.

HRD IN ERITREA

Before the independence of Eritrea, it is observed that the *Derg* regime had systematically dismantled the education infrastructure and the education system consequently degraded the education standard to one of the lowest even by African standard. It has acted as stimuli for rebuilding and resurrecting the overall nation's infrastructure and other facilities from the clutches of devastated and war ravaged economy and successive hostile colonial rule as well. Amidst severe fighting for freedom, the Eritrean People's Liberation Front (EPLF) had trained its members in different technical fields under apprentice programme. It is a clear indication that the GoE has had developed such a tendency to cater and by which the available human resource could be molded up to take up the struggling economy into the fruits of 21st century. The lack of regular maintenance of the infrastructure also meant that all institution buildings were in a state of disrepair (GoE, 1996; Tseggai, 1999; Rena, 2005b). It is difficult to believe some of the outdated,

rigid and unfair system introduced by the consecutive colonial Governments is still maintained by an independent Eritrea.

Even after having started from the scratch, Eritrea has been unlucky in all aspects including its talented human resource as all most had fled into other countries because of 30 years bloody war. But still Eritrea has been trying its best to produce better human resources. It was mentioned in the Macro Policy Document in 1994, as in the long term, "Eritrea will be producing "knowledge intensive" goods and services able to penetrate the world market." The Government of Eritrea (GoE) has a strong, clear conviction that the key to rapid and sustainable long-term economic development rests with the development of human resources. The government emphasized the pivotal role of human resources in the development of Eritrean economy in the Macro-Policy Document (GoE-1994). The document details of the objectives and relevant policies of the major HRD issues: education and training, health, social welfare, rehabilitation of war victims and other vulnerable and disadvantaged members of the society, gender, youth, and population.

It is been realized that the country's most valuable asset is its people and the social solidarity present in Eritrean society, a society characterized by a high sense of community as well as a strong commitment to development (World Bank, 1994). Furthermore, it is intended to produce a society that is equipped with the necessary skills to function with a culture of self-reliance in the modern economy. The education system is also designed to promote private sector schooling, equal access for all groups (i.e. prevent gender discrimination, prevent ethnic discrimination, prevent class discrimination, etc.) and promote continuing education through formal and informal systems. Barriers to education in Eritrea include: traditional taboos, school fees (for registration and materials), the opportunity costs of low-income households, most institutions are still in the process of renovation and expansion; and lack of professionals to run the existing institutions properly is a serious drawback in the country (Rena, 2005c). Therefore, the main plan in developing its qualitative human resources in the country, at present, the majority of secondary education takes place in the academic line, so a first step is to have more technical and vocational secondary education. As far as higher education is concerned, after secondary school, students are supposed to go to junior colleges and only a very small number of students would go to the university for their degree (Muller, 2004).

Within the centralized HRD planning in Eritrea, this has certain implications for the workings of the university: after having passed the matriculation exam, subjects of study are allocated, and students' priorities are given only cursory concern in this process. According to these predictions, it is then decided how many students should be admitted to which department. For postgraduate studies the university draws up staff development plans and facilitates to send students abroad for education at Master's or Ph.D. level. In that way it hopes to assure that the country's human resources are used in the most efficient way. The success of such a strategy depends largely on a shared vision between the goals of the official policy side, embodied by the government and the university administration on one hand, and the people, the individual students, on the other. Without such a shared vision 'brain drain', which plagues many African countries including Eritrea that see their university graduates leave for the industrialized world where salaries are considerably higher, is difficult to avoid (Muller, 2004).

In line with this, the government is embarking to introduce a new education system that is firm and fair as well as flexible and of the highest standard. Thus, the Government has opened and planning to open many colleges in the country such as: a college of nursing and Orroto School of medicine[4], agricultural College, a technical school in Massawa, and the Eritrean Institute of Technology at Mai Nefhi etc. In 2005, a Cabinet Ministers meeting, underlined the need to strengthen the colleges of science and technology in the country, but expressed no concern over the future of Asmara University. "We have tried to link the various colleges with the related

development sectors. For instance, the College of Marine Biology has work relation with the Ministry of Fisheries and is located in Massawa, Northern Red Sea Region," the Minister of education Osman Saleh stated on the eve of University graduation day in July 2006. The number students enrolled in degree and diploma programs is presented in *Table1*. Dramatic increase in the diploma programs in the colleges is noted. In terms of student population, at its peak the University of Asmara (UoA) had a student population of about 6,000, while the current total number of students at the tertiary level is about 12,000. In just a period of four years, the student population has doubled (Rena, 2005a ; MoE, 2006).

It is apparent that, the important assets of a country are its human resources. The effective utilization of its human resources is the crucial factor in determining the growth and prosperity of the economy of the nation. Further, the skill and talent of the individuals decide the optimal utility. Realizing the human factor in the national economy, the GoE has geared up all the possible ways to heighten up the level of required skilled employees for its thirsty economy. The immediate output which Eritrea bring forth through its visualization is found and experimented with the answer of planning and implementing clear cut and fast targeted HRD policies to ensure the optimization of available resources and developing them for the future challenges. This perhaps would mean formal and informal education, Technical and Vocational training, Industry-Institution linkage and inter-changeability of faculty etc. and these will have to be implemented to cope up with the fast changing social, economic and technical advancement (Rena, 2005b; Rena and Kasu, 2006). It is observed that, most of the HRD programmes of Ministry of Education (MoE) are being systematically and successfully carried out by the concerned institutions i.e. University of Asmara and Department of Technical Education and Vocational Training (DTEVT), which have been playing predominant role in the human resource development of Eritrea.

University of Asmara

Since independence, the University of Asmara has been consistently raising the education standard and successfully introduced several new courses. In an effort to raise the educational standard to that of the international level and enable the university to introduce new courses, the GoE has spent millions of dollars. The University of Asmara offers various diploma and degree courses including Sciences, Arts and Language Studies, Business and Economics, Agriculture and Aquatic Sciences, Engineering, Education and Law *(see table-1)*. Additionally, postgraduate courses in Literature, Agriculture, Business and Economics, Sciences and General Science offered beginning with the academic year 2004. The university can accommodate more than 2000 full -time degree students and about 700 evening diploma students. The University of Asmara had graduated students for the 14th time in 2006. Since independence, about 10,160 students of which 7096 in degree, 183 in advanced diploma, 2234 in diploma and 601 in certificate, have graduated from this higher institution of learning.

In an effort to alleviate overcrowding and enable the University of Asmara to introduce new courses, the GOE has spent 12 million Nfa in building a new campus at Halhale in Zoba Debub. This new campus at Halhale accommodates 1,000 students, offering up to seven different diplomas and nine certificate courses. This institute, for the first time has produced 434 graduates in numerous fields in 2004.

Sending students for higher education (Bachelors, Masters, and Doctoral Degrees) for upgrading their capabilities and expertise to other countries such as South Africa, India, Europe etc. is found to be high priority in the country. At present, Eritrea depends on expatriate teachers both at high school and higher educational institutions, however, to reduce the number of expatriate teachers at all levels is one of the important objectives of Eritrea. In line with this they are developing their own teachers by sending to other countries.

Table 1: Enrolment of Students, by Gender and Type of Course from 1991/92 to 2002/03

Academic Year	Students' Enrolment in University of Asmara											
	Degree			Diploma			Certificate			Total		
	F	M	T	F	M	T	F	M	T	F	M	T
1991/92	223	1619	1842	224	551	775	-	-	-	447	2170	2617
1992/93	348	1248	1596	173	391	564	-	-	-	521	1639	2160
1993/94	252	1824	2076	113	249	362	-	-	-	365	2073	2438
1994/95	338	2496	2834	59	186	245	-	-	-	397	2682	3079
1995/96	317	2526	2843	29	81	110	-	-	-	346	2607	2953
1996/97	252	2474	2726	37	329	366	15	52	67	304	2855	3159
1997/98	360	2304	2664	29	343	372	5	55	60	394	2702	3096
1998/99	471	2832	3249	32	537	569	37	139	176	540	3490	3994
1999/00	519	3074	3593	31	386	417	42	83	125	592	3543	4135
2000/01	596	3407	4003	20	422	442	45	138	183	661	3967	4628
2001/02	636	3897	4533	19	505	524	84	365	449	739	4767	5506
2002/03	613	4201	4814	74	515	589	86	445	531	773	5161	5934

Source: University of Asmara – Different Records

There is a Distance Learning Program, which was begun in 2002, when the University of Asmara signed a memorandum with the University of South of Africa (UNISA) to jointly set up this program. It is to be noted that as a part of HRD in Eritrea, the Eritrean Human Resource Development Program (EHRD) is awarding the scholarships to some of the eligible and deserved candidates. Currently, there are about 300 students for undergraduate courses and about 50 students for postgraduate courses are on the rolls. However, the programme is not successful due to the financial problems of Eritrea. As a result, less than 50 students have completed their studies in all levels.

It is to be noted that, for the first time in the country, the Ministry of Education has started open distance learning in March 2006 with the cooperation of the University of Asmara. It is reported that the program started for about 600 junior school teachers holding certificates and to upgrade them to diploma level. These teachers have come from all the six zones of the country. This is three years program, which aimed to upgrade the proficiency of teachers and offer quality education. It is to be noted that about Nacfa 40 million is allocated for the first batch. The second

batch of the open distance-learning program is expected to start in 2007, will target the remaining 1,400 certificate holding junior school teachers.

Asmara Commercial College

Asmara Commercial College (ACC) under MoE, which offers advanced diploma and certificates programmes, was established in 1996. Although still based at Red Sea Secondary School Campus, this college offers various Diploma Courses including Accounting, Banking and Finance, Business Management, and Secretarial Science & Office Management to both regular and evening students. Since its establishment, 672 students in six batches were graduated (Rena, 2004). It is observed that the students who had completed their diploma from ACC, many of them are continuing their extension (evening) degree programme with the University of Asmara, however, it is very expensive process. Therefore, as part of the human resource development programme, the ACC can be updated to a degree level and/or affiliated with the Eritrea Institute of Technology (EIT) or University of Asmara. Thus, MoE and University concerned officials can consider the thought and resolve the problem. Therefore, the officials concerned have to be rolled out the welcome mat for the ACC advanced diploma graduates who are strongly aspiring to continue their higher education.

Eritrea Institute of Technology (EIT)

EITis considered as Eritrea's biggest boarding educational institute in a post-independence period of Eritrea. It is situated about 28 Kms south-west of the country's capital Asmara. It possesses more than 10,000 students and 350 faculty members (expatriates mainly from India, Eritreans of Diaspora, Graduate Assistants and the students of University service) (Rena, 2005c). It has a number of new and emerging departments; indeed, it is hoped that, EIT makes an institute of its own kind that will boost Eritrea's educational, technical and developmental standards manifolds in the coming years. This will certainly contribute towards nation building to meet the Millennium Developmental Goals (MDGs) set by the United Nations. It is observed that the institute is offering degree, diploma programs in numerous advanced disciplines that will serve the needs of Eritrea with its own human resources in the near future. Since it is a new institute, so far not produced any graduates however, there are an urgent need for the establishment of library and laboratories to equip the nation's youth with science and technology to enrich the institute to serve the nation better. [5]

DEPARTMENT OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING (DTEVT)

Technical Education and Vocational Training as one of the components of HRD are strongly believed to be the base for all the improvement process in the Eritrea's economy. In recent past, the DTEVT has proved itself as a change agent with the guidance of latest plans and policies, which was redefined in March 1997 as per the requirement of the Macro-economic policy of GoE in the TEVT Sector (Rena and Kasu, 2006). Its work is said to be tremendous and remarkable by rocketing the number of Technical and Vocational Institutes offering Advanced, Intermediate and Basic level of training programmes as Eritrea had only one Technical Institute in 1960's. At present, there are more than 20 Technical and Vocational Training Institutes including 8 Skill Development centers. Massawa Technical and Commercial School started functioning during the academic year 2005-2006 (Rena, 2005a).

Table 2: *Graduates of TVET at Intermediate Level Institutions of Eritrea by Gender During the Period 1991/92 to 2004/05*

Year	Number of Graduates		
	Male	**Female**	**Total**
1991	115	18	133
1992	120	23	143
1993	86	7	93
1994	205	31	236
1995	182	19	201
1996	130	12	142
1997	177	21	198
1998	164	25	189
1999	126	22	148
2000	252	44	296
2001	263	57	320
2002	443	80	523
2003	492	179	671
2004	434	90	524
2005	409	121	530
Total	**3,598**	**749**	**4,347**

Source: Dept of Technical and Vocational Education – Various Reports.

It is necessary to mention the clear-cut structure and the level of DTEVT for different category of training needs as such being followed in industrialized countries. The basic technical and vocational training level is to offer technical training to those who have completed the primary or junior secondary school and/or those who are not eligible to enter to senior secondary school. The main aim of this programme is not to throw even a single person out the National human resource employment frame (GoE, 1996). The skill development programmes fall in this category (Rena and Kasu, 2006). The intermediate level comprises of a formal training course devised for those who have successfully managed nine years of schooling. This level has given formal sitting to the students for two years in principle, but depending upon the types of courses, the MoE may decide to extent to three years. At intermediate level, there are 3 institutes including Winna Technical School, situated in Nakfa, the threshold in victory of EPLF during freedom fighting. Thirdly, the advanced level training programmes, the alternative for the University, accommodates students who have completed their Matriculation with more than 2 GPA. In this level, the DTEVT offers technical and commercial stream with well-tailored curricula and teaching methodology. The DTEVT at its level best has been turning out the caliber and well-matched human resource to the needs of the Eritrean Economy through all the possible efforts since 1991 (MoE, 2006). It can be supported by a statistical data of MoE, which reveals the sustainable improvement of DTEVT's capacity in producing the technical and commercial graduates increased tremendously.

Table 3: *Graduates of TVET at Advanced Institutions of Eritrea by gender during the period 1991/92 to 2003/04*

Year	Number of Graduates		
	Male	Female	Total
1991/92	0	0	0
1992/93	0	0	0
1993/94	0	0	0
1994/95	0	0	0
1995/96	0	0	0
1996/97	39	16	55
1997/98	0	0	0
1998/99	98	46	144
1999/00	139	58	197
2000/01	55	20	75
2001/02	87	20	107
2002/03	165	67	232
2003/04	160	32	192
2004/05	0	0	0
Total	**743**	**259**	**1002**

Source: Dept of Technical and Vocational Education – Various Reports

Note: There are two colleges at Advanced level- they are: Asmara Technical Institute and Asmara Commercial College, both these colleges did not produce any graduates during the academic year 2004/05 due to the government policy and restarted during the academic year 2006-2007.

It is during June- September that Eritrea harvests its fruit of educated manpower, from different educational institutions. During the academic year 2003-2004 as many as 724 students were graduated from various schools and colleges under the DTEVT. In the technical filed, Pavoni Technical Institute produced 22 graduates; Asmara Technical School - 166; Wina Technical School - 86; Maihabar Technical School - 122; and Don Bosco Technical School - 42. Whereas in the filed of agriculture, Hamelmalo Agricultural School and Hagaz Agricultural School produced 54 and 75 graduates respectively [6] *(see table-2 and 3).* Further, Asmara Teacher Training Institute produced about 525 trained teachers and Mainefhi Mother Tongue Teachers Training Institute has commemorated the Graduation of its 336 students. Asmara School of Music also graduated 26 students. The Tourism and Hotel Training School, established in 1998 has so far trained 657 personnel in basic tourism and hotel service skills. Uniquely, in Mekerka, Gash Barka about 300 females who attended a three-year course given by the Ministry of Justice, after completed their courses successfully graduated (Rena, 2005b). All these graduates are equipped with profound skills and knowledge in various technical and vocational fields relevant to the immediate need of the nation and entered in to the world of work. Further, education and in-service training for teachers and other professionals are being organized systematically in different fields. Generation of skilled manpower, in a balanced mix of general, technical/vocational education appropriate for the development needs of the country is the guiding principle in the ongoing developmental programs in the Eritrean education sector. This prosperity in education is obviously a great thing for Eritrea and its citizens, and the dream to make Eritrea a technological-oriented and advanced nation would become real, because the cumulative effort done so far in the human development aspects is becoming fruitful.

Skills Development Programme

Enabling citizens through education and skill enhancement is more critical today than at any other time. There is fairly well founded concern that in the next decade the country could find itself performing a difficult balancing act: catering to the needs of a significantly growing population while trying to find opportunities for a newly emerging workforce of youth that does not have marketable skills. However, no nation can be exempted from the sufferings of illiteracy and unemployment. The degree of suffering may be different but their existence in an economy is unavoidable and uncontrollable (Rena, 2004). Unless a nation knows the ways to manage this ailment in a proper way, it would crop up as a major problem showing up an economy to the external world as a bad example. Having understood these consequences, the DTEVT has been making strenuous efforts in embracing the major portion of Eritrea's human resources like marginalized youth, returnees, ex-combatants, unemployed and unemployable communities (Rena, 2005c; Rena and Kasu, 2006).

Skill development programmes, are like converting raw human resource into the usable labour force transmitting the present ailing state into the very healthy one. Skill development programmes are the notable achievement of MoE, which successfully operates through different skill development centres all over Eritrea. It offers eight courses in the discipline of Productive Technology like building technology, wood technology, electrical technology, surveying, machine shop etc., Agriculture, Catering and home science and commerce with the flexible system of admitting students and length of training as well for about six months or even more. Once the student has successfully completed, S/he will be given opportunity to participate in Internship programme as a partial fulfillment of their training programme. Mai Habar Vocational Training Centre for the Disabled is one amongst the best centres in performing along with other formal technical training programmes.

It is observed that thousands of youth enter the workforce each year in Eritrea without the benefit of a high school education and most have no skills for the job market. However, most of them work under national service for a meager salary of Nakfa 450($30) per month. This must come as a sobering reality to those who are euphoric about the nation development. There is yet hope that the skills gap that separates knowledge workers from the school dropouts can be bridged with some innovative strategies and the political commitment to see them through (Rena and Kasu, 2006). Experts who participated in the United Nations Educational, Scientific and Cultural Organisation symposium on knowledge societies in Geneva endorsed the potential of Information and Communication Technologies (ICT) to take the education agenda forward in developing countries like Eritrea. ICT is more than just the Internet and encompasses the traditional mass media such as radio, television and even the telephone, which can deliver educational video and data. With such tools available, not a day can be lost in chalking out a national strategy for the labour pool (UNESCO, 2002; Yusuf, 2005).

The imparting of skills largely depends on the Industrial Training Institutes (ITIs) and/technical schools that have a base in the public and private sectors in Eritrea, besides, the State-run programmes, and NGO efforts. These are simply not equal to the task. The ITI system, despite some attempts at a revamp, is viewed as insufficient, its efficiency weighed down by factors such as a limited range of skills taught, outdated technology, high cost, and the requirement that those entering the system possess at least a high school qualification.

Some Challenges in Education

Education in Eritrea has seen several challenges before attaining its present status. The Italians, the British and the Ethiopians have left their respective marks. The extensive educational reforms currently taking place at all levels is aimed at structuring education to respond to the development

needs of the country and to enable Eritrea to participate appropriately in this 21st century characterized by globalization and widespread knowledge based activities (MoE, 2006). The Eritrean education system faces challenges that are fairly common to other education systems in Sub-Saharan Africa. These are limited access; low quality; doubtful relevance; inefficiencies; inadequate financial and non-financial resources; and poor delivery capacity. The Government's vision for addressing these pressing challenges is well- articulated across key policy documents (Government of Eritrea, 2003:8).

Further, the challenge before the State, therefore, is to build on the existing infrastructure of ITIs, schools, colleges, institutions in the private sector, and NGOs. Computers and multimedia make it possible to learn in an interactive manner and these have to form the core of the new strategy. The potential of multimedia to train both literate and illiterate youth makes it all the more attractive. One vision of an ICT movement is to have a national network of vocational training centres, adopting the franchise model to extend coverage. Courses in the service sector areas such as tourism and health care could be taught at such centres, besides the existing schools and colleges. In a report on development choices for the 21st century, UNESCO and the International Labour Organisation point out that technical and vocational education is best served by a diversity of public and private providers, with the Government acting as a facilitator (UNESCO, 2002; Rena and Kasu, 2006).

It is believed that the government expenditure on education is expected to provide economic benefits in such as i] providing the basis for poverty reduction, overall human capital development, and accelerated economic growth; and ii] rationalization of public expenditures for the welfare of the people in Eritrea.

i) Poverty reduction and economic growth. Education is a key element of the government's strategy to reduce poverty. Weak system capacity, including inadequate physical infrastructure, insufficient numbers and untrained teachers, and limited management capacity for service delivery, has been one of the key factors responsible for unsatisfactory education sector performance, reflected in low enrollment ratios and poor education quality. Hence, the Government of Eritrea focuses on capacity enhancement for education service delivery at elementary, middle, secondary, and tertiary levels. The construction and rehabilitation of classrooms will enhance the physical capacity of the system to absorb more children into formal education. Strengthened teacher-training programs would enhance the human capacity of service delivery. Curriculum reforms are aimed at improving the relevance and quality of the education system. In the meantime, resources invested in strengthening the institutional capacity at the center and Zoba (province) level to ensure more effective and efficient system management. Thus, strengthening Eritrea's education system capacity is important from the perspective of economic growth.

ii) Rationalization of public expenditures. The Government's total spending on basic and secondary education was US dollar 33.9 million, 34.9 million and 26.8 million in years 1998, 1999, and 2000.[7] As stated earlier, between 2000 and 2001, MoE recurrent expenditure increased by 8 percent. Social and economic progress requires a broad-based education and training sector reform with the establishment of sustainable sector financing accompanied by an adequate planning and budgeting process (World Bank, 2003). Furthermore, it is envisaged that the education sector development program is also incorporated in the Interim Poverty Reduction Strategy Plan and integrated into the Medium Term Expenditure Framework prepared in 2004.

CONCLUSION

The future questions to be addressed are whether the nation-centred education policies pursued by the Eritrean government in the context of its HRD strategy can succeed in a global world where opportunities for social mobility abound (at least for qualified young people with a university degree); and what consequences these policies might have for the level of social solidarity within Eritrean society. What can be witnessed in Eritrea is partly the result of a shift in the way education is conceptualized within the process of development. In shifting from a 'social-demand approach' to a 'manpower-demand-approach' the Eritrean government overlooks the fact that this will transform the values of Eritrean society towards more individualist ambitions (Muller, 2004). While a social-demand approach towards education entails the notion of cultivating social solidarity and forging national citizenship, a manpower- demand approach views education predominantly as a factor in advancing the nation in terms of international competitiveness. Overall, the HRD strategy pursued by the Eritrean government is in line with the human capital approach, the bottom line of which regards education as an investment which will eventually lead to increased productivity to benefit individuals and ultimately society. Education is herein seen as a panacea for development, which in increasing human capital will lead to other developmental gains (Muller, 2004).

Hence the development of relevant HRD policies must rely on well-researched and studied needs assessment of all sectors of the economy. Education, therefore, place the most vital role in developing the Eritrea's intellectual and creative power. Education is viewed as a strategic toll for development; therefore the content of the educational system is to be reviewed carefully and thus develop the human resources. Still Eritrea depends largely on the technicians and professionals from abroad. Thus, the education system in Eritrea must be geared up not only at raising the general, social and scientific knowledge of the individual but is must also equip the individual with skills that would enable one to lead a productive sustainable life. A well-thought-out policy has to be prepared to attract the Eritrean professionals in the Diaspora to return home.

As Human Resource Development Programmes concentrate on the varied categories of raw human resources to be processed into the work force, no one can deny and underestimate its valued role in reconstructing the economy. In line with this the relations between national and international actors in HRD have to be developed. Moreover, it is an inescapable fact that in respect of total manpower dispersion in business organizations whether productive or service, the bulk of the personnel are skilled labour force working at operative level. This force is instrumental in transforming raw materials into the products. It is this level at which major share of human resource investment and working capital are consumed. This is the force which produces quality and which ultimately affects the organizational image and the economy of Eritrea. The MoE/DTEVT can accomplish the desired objective through the skill development programmes that can build the skilled manpower and the economy of the country. Certainly, Eritrea would have a sound and healthy economy if it exploits and develops its natural and human resources that enables and boosts the economic development of the country. It can be viewed that the skills and knowledge that can and will change the shape of Eritrea's future.

Endnotes

*	This article is a revised version of the Paper submitted (in absentia) for the IAABD International Conference held at Accra, Ghana, by the Ghana Institute of Management and Public Administration (GIMPA) from 23-27 May 2006.

1	The population of Eritrea includes about 350,000 refugees from the Sudan. Every year hundreds of these refugees have been coming back to their homeland – Eritrea.

2 Eritrea has nine ethnic groups. They are: Tigrigna, Tigre, Saho, Afar, Bilein, Hidareb, Kunama, Nara and Rashaida. All these ethnic groups have their own languages and cultures. There are six administrative regions: Anseba, Debub, Maekel, Gash Barka, Southern Red Sea, Northern Red Sea.

3 This is anecdotal evidence that about 1 million Eritreans living in Diaspora are sending more than 500 dollars per annum. Some of these are studied in their home country. In this way, HRD is providing economic benefits to the country.

4 The Orotto School of Medicine, which opened in February 2004, produced some 83-health professionals by January 2006 and an enrollment of 1,200 students in the same year.

5 The eight new Colleges in Eritrea, offering university level programs (diploma and Bachelor of Science or Bachelor of Arts degree) started to be established commencing from the 2003/4 academic year. The first established one was the Eritrea Institute of Technology (EIT) located at Mai Nefhi. The EIT has three colleges, which are the colleges of Education, Engineering and Technology, and Science. The other new colleges are, the college of Agriculture in Hamelmalo (near Keren), the college of Health Sciences and the Orota School of Medicine in Asmara, the college of Marine Sciences and Technology in Hirgigo (near Massawa), the college of Arts and Social Sciences to be located in Adi Kieh, and the college of Business and Economics to be located in Massawa.

6 All these figures are clubbed in the table hence the table does not represent the respective institutes mentioned in the text.

7 See *Eritrea Education and Training Sector.* It is to be noted that spending for basic and secondary education includes spending by the MoE and all other line ministries who are involved in education activities.

Acknowledgements

REFERENCES

Bacchus, M.K. (1992). Meeting the Higher Educational Needs of small States: Financial and Management Implications, *Journal of Educational Planning and Administration, 6(.4), 373-400.*

Coleman, J. (1994). *Nationalism and development in Africa. Selected essays.* Berkeley, CA: University of California Press.

Government of Eritrea (1994). *Macro Policy Document*, Asmara, Eritrea: Government Press.

Government of Eritrea (1996). *Strategy for Human Resource Development – A Project for Capacity Building*, Asmara: Office of the Human Resource Development.

Government of Eritrea (2003). *Education Sector Improvement Project (ESIP) Environmental And Social Management Framework* (ESMF), Document No. E737, Asmara: The Government of Eritrea.

Mingat, A., and J.P.Tan (1986). Financing Public Higher Education in Developing Countries: The Potential role of loan schemes, *Higher Education 15, 283-297.*

Ministry of Eritrean Education- *Various Reports and Statistical Bulletins*.

Ministry of Education (2006).Tertiary Education in Eritrea: Issues, Policies, and Challenges. (13 (56 and 57) (Part- I and II on 20 and23 September). *Eritrea Profile p2-3*.

Mu¨ller, T. (2004). Now I am free'—education and human resource development in Eritrea: contradictions in the lives of Eritrean women in higher education, *Compare, 34* (2), 215-229.

Myers, C. and Harbison, F., (1965). *Education, Manpower and Economic Growth: Strategies of Human Resource Development*. New York: McGraw-Hill.

Rena, Ravinder (2004). Educational Development in Eritrea, Asmara: *Eritrea Profile 11*(12), p.6.

Rena, Ravinder (2005a). Gender Disparity in Education – An Eritrean Perspective*,* USA: *Global Child Journal* 2(1),43-49.

Rena, Ravinder (2005b). Eritrean Education – Retrospect and Prospect, Nairobi (Kenya): *Eastern Africa Journal of Humanities and Sciences,.5(2).1-12.*

Rena, Ravinder (2005c).Financing of Education in Eritrea – A Case Study on Zoba Maakel, *Albany (USA): The African Symposium, 5(3)* 113-128.

Rena, Ravinder (2006). Eritrea's Economy has a Long Way to go, *Nicosia (Cyprus): The Middle East Times,* (posted on 20 January 2006), Accessed on 21 June 2006 at http://www.metimes.com/articles/normal.php?StoryID=20060120-042913-9028r

Rena, Ravinder and Biniam, Kasu (2006). Labour Market Needs and Development of Technical and Vocational Education in Eritrea – An Analytical Study*,* New Delhi (India): *Manpower Journal 41*(4).

Thompson, K. & Fogel, B. (1976). *Higher education and social change. Promising experiences in developing countries.* New York: Praeger Publishers.

Todaro, M.P. (1994). *Economic Development of the Third World.* New York: Long man Publishers.

Tseggai, Araia (1999). Human Resource Development: Priorities for Policy. In Martin Doornbos and Alemseged Tesfai (Eds.), *Post-conflict Eritrea: Prospects for Reconstruction and Development,* Trenton (pp.215-238). N.J.: Red Sea press.

UNESCO (2002). *Information and Communication Technologies in Teacher education: A Planning Guide*, Paris: UNESCO.

World Bank (1994). *Eritrea. Options and strategies for growth,* Washington DC: World Bank.

World Bank (1995). *Priorities and strategies for education: a world bank review,* Washington DC, World Bank.

World Bank (2000). *Peril and promise: higher education in developing countries,* Washington DC.: World Bank.

World Bank (2003). *Eritrea: Education Sector Report,* Washington, DC.: World Bank .

Yusuf, M. O. (2005). Information and Communication Technologies and Education: Analyzing the Nigerian National Policy for Information Technology. *International Education Journal 6* (3), 316-321.

A neomillennial learning approach: Helping non-traditional learners studying at a distance

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ABSTRACT

Relying on text-based instruction may be disenfranchising many students, whilst technology enhanced environments can provide significant advantages to a growing market of non-traditional learners. This paper reports on research investigating the perceptions of first year distance education students studying a foundation communications course using a multimodal learning environment. It demonstrates higher levels of engagement are possible when a neomillennial learning approach is adopted for designing course materials catering to a diverse student body, whilst maintaining a balanced environment for more traditional learners. A strong acceptance was moderated by a desire to still receive some print-based materials. However, students reported a preference to receive an electronic version when given a choice.

Keywords: Transmodal delivery; neomillenial, multimodal design; multimedia; learning styles.

INTRODUCTION

The University of Southern Queensland (USQ) is a dual-mode institution with 'triple-option' teaching modes (on-campus, distance education, and online). It is currently the second largest distance education provider in Australia (see Table 1), with 75% of its students studying in this mode, with almost 90 nationalities represented. At USQ, as with many other institutions in Australia, distance education course materials have traditionally been delivered via static print-based packages. However, advances in technology and the greater use of multimedia in education have provided an opportunity for course leaders and designers to enrich students' learning experiences by providing technology-based learning resources that comprise a range of multimedia and online components. A range of forces including, pedagogical, opportunistic, pragmatic, and psychological motivations, have encouraged many educators to adopt these educational technologies to enhance the delivery their courses (Sankey & Birch, 2005). However, it has become increasingly clear that maintaining so many different approaches is economically unsustainable. Aligned with this concern is the increasing demand from off-campus students to be provided with more than simply a correspondence model.

This paper seeks to demonstrate that higher levels of student engagement are possible, and that course materials can be designed to cater to learners with a range of different learning modalities and backgrounds. It also investigates the implications of catering to a wide range of students, proposing that one approach is to consider the notion of a neomillennial learning approach. 'Neo-' in this context meaning 'new', 'millennial' referring to the learning modality required for the new millennium. This should be done whilst considering the ever increased growth of non-traditional learners in our universities and the problems associated with these students accessing an ever increasing quantity of internet based materials. It is proposed that this approach may initially be facilitated by giving students the opportunity to discover their preferred learning modality and by the integration of a range of multimodal learning and teaching strategies. This hypothesis will be supported with a summary of key points from research conducted on the first iteration of the Transmodal delivery of a first year foundation communications course, *CMS1000: Communication and Scholarship*, provided to off-campus students at USQ. This study

investigated students' perceptions of this new multimodal delivery approach during Semesters 1, 2 and 3 of 2005. In researching CMS1000 a combination of qualitative and quantitative approaches were employed, an approach that has given the researchers, and more importantly the University, a clear indication of how students perceived this new multimodal approach to course delivery, that draws on students' comments and their perceptions of these environments.

Table 1: The top 10 providers of distance education in Australia for the year 2004

BIG TEN		
Distance Ed Providers 2004	Distance Ed students	% of total
1 Charles Sturt University	21,213	18.5%
2 **University of Southern Queensland**	**15,433**	**13.4%**
3 The University of New England	11,863	10.3%
4 Deakin University	9,788	8.5%
5 Monash University	7,963	6.9%
6 Central Queensland University	5,682	4.9%
7 Southern Cross University	4,274	3.7%
8 University of South Australia	3,700	3.2%
9 Queensland University of Technology	3,245	2.8%
10 The University of New South Wales	3,126	2.7%
Other Universities	28,650	24.9%
Total	**114,937**	**100.0%**
Source: DEST; Ian Dobson (Vergnani, 2005)		

DIFFERING APPROACHES TO LEARNING

Taylor (2004) argues that traditional approaches to learning and teaching will not have the capacity to meet the escalating demands of higher education in the future. This is primarily due to the significant societal and technological developments that have resulted in major changes taking place in the field of higher education (Jochems, van Merrienboer, & Koper, 2004). These changes have not been restricted to individual institutions, but have occurred on a more global level, with institutions increasingly competing in the international marketplace for their students. This has required fundamentally new approaches to be considered in the delivery of course materials across the board (Kellner, 2004).

In addition to this it is also known that, increasingly people learn in very different ways. For example, Oblinger and Oblinger (2005) tell us that 'Net Geners' (those who have grown up with computers, usually under 25) spend so much time online, it seems reasonable to expect that they would have a strong preference for Web-based courses, however, 'the reverse is actually true' (p.2.11). Conversely, older students (Matures and Baby Boomers) are much more likely to be satisfied with fully Web-based courses than are traditional-age students. Oblinger and Oblinger also state that, 'at the same time that colleges and universities are graduating their first Net Generation learners, most campuses are experiencing an influx of non-traditional students. Three-quarters of all undergraduates are 'non-traditional', according to the National Center for Educational Statistics' (p.2.8). Non-traditional learners being those who may: come to university later in life, only attend part-time, hold full- or part-time jobs, have dependants, may be single parents, or may not enter with an appropriate tertiary entrance qualifications. This is a very similar demographic to that of USQ. Either way, the need for universities to cater to a range of students with different experiences and backgrounds has never been greater, which is one reason why

USQ has opted for a move develop a strategy for creating course resources based on a hybrid model, or what has become known as 'Transmodal' delivery.

TRANSMODAL DELIVERY AT USQ

Transmodal delivery at USQ has its genesis in the principles of hybridised learning environments. The term 'hybrid' in the educational context embraces a range of approaches to learning and teaching that integrate a number of delivery media, mainly facilitated by the proliferation of information and communication technologies (Parsons & Ross, 2002). This approach was deemed necessary as USQ study materials are delivered in many different contexts; on campus in Toowoomba, Wide Bay and Springfield; for students studying at preparation level through to postgraduate; to international agents and partners; to independent and corporate groups of students. More importantly Transmodal delivery was designed to complement the University's new directions for learning and teaching articulated in its 'Leading Transnational University' vision (Lovegrove, 2004).This approach to course delivery has allowed considerable expansion of support mechanisms for both on- and off-campus students and has made them available *en masse* (Cookson, 2002).

Associated with this is the increased reliance on the Internet for information retrieval, though currently restricted by the inconsistency of broadband technologies across the full range of diverse student bodies (Bruch, 2003). These issues, at present, have made a CD-based resource the most viable option for the provision of resource rich course materials for foreseeable future. Therefore, in the context of USQ, Transmodal delivery is seen as the provision of a resource-rich learning environment. This environment is then further supported by different combinations of teaching support integrated with the universities learning management system USQ*Connect*, as illustrated in Figure 1. For this to be the case, learning environments would need to be designed that were both consistent in their approach to navigation while at the same time be able to provide students with access to significant quantities of electronic resources.
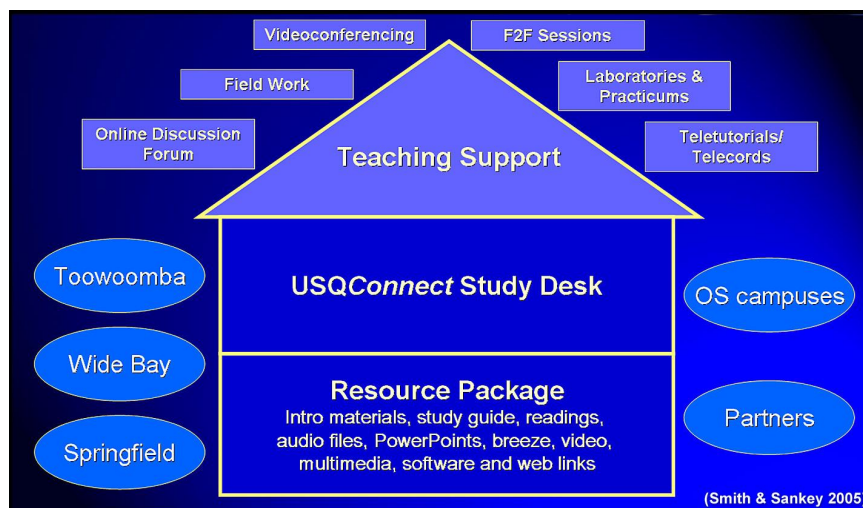
Figure 1: The Transmodal delivery model: context specific support for the resource-rich learning package

This approach does not deny the perceived need (primarily of academic staff) to also provide easy access to a more traditional print-based resource, if preferred. The CD-based approach is also used to provide students with their traditional print based resources; in the form of PDF files (see Figure 2). However the HTML based environment allows for significant multimedia enhancements (see Figure 3), support software, USQ information publications, and hyperlinks to additional resources to be provided on the CD. Printed resources are also made available for purchase from the USQ Bookshop if student prefer this option. However, as it will be seen, given the choice the majority of students would prefer to print their own from the PDF files provided on the CD.
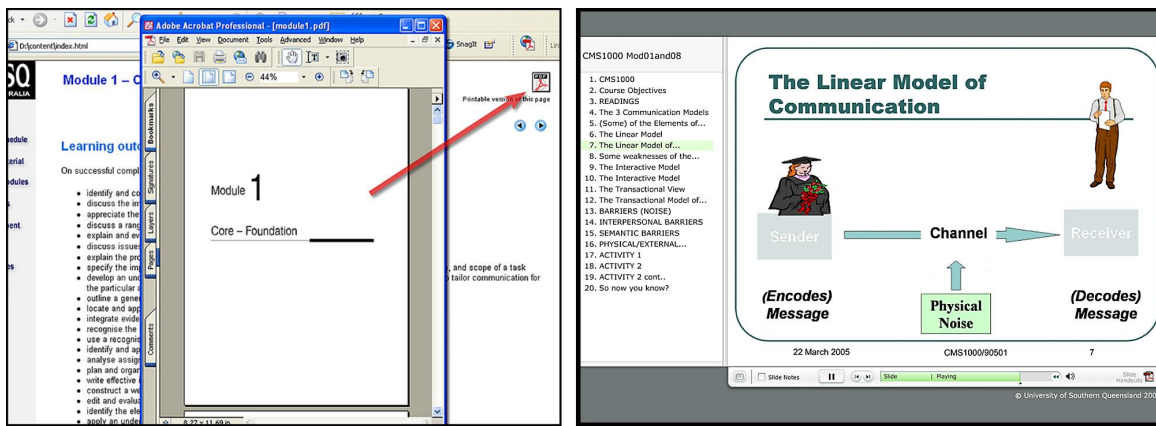
Figures 2 *(left) and **3** (right): Two screen captures of the CMS1000 Transmodal environment showing the printable version of the materials and a multimedia enhancement (Breeze presentation)*

As the CD-based materials for courses are formatted in such a way as to permit them to be viewed as HTML pages, this allowed a range of navigation features to be incorporated. These features not only give course leaders additional options as to what they can provide (in the forms of links to additional resources both on the CD and on the internet), but it gives students a greater level of control over how they accesses these resources. With additional hyperlinked options students are presented with a choice (or level of control) as to whether or not they access an alternate representation of the material. This level of control has been seen by Ainsworth and Van Labeke (2002) to significantly improve the learning opportunities for students. Therefore, if a student prefers to listen to, or view a particular concept, as opposed to read it (or do both), they may. This aspect of these environments has been seen by the majority of students to be very helpful . It was also seen to make the process of learning (for many) more enjoyable, which in turn made the materials (for some) easier to learn (Sankey & St Hill, 2005). Previous research conducted by Anderson (2001) would support this claim. From her research Anderson believes that this approach causes students to actively think about the structure of the information being presented.

As it is USQ policy that all students have access to the internet to fully participate in their courses, CD delivery may be further supported by activities housed on USQ*Connect*. This provides each student with their own electronic 'Study Desk' with links to each course they are enrolled in. This environment offers the opportunity for the course leader to establish and use either asynchronous

or synchronous discussion forums to enable students to interact and communicate with each other and the lecturer. Announcements and updates may also be made available where appropriate. This environment also provides links to all library services, the USQ Bookshop, to USQ*Assist* where students may find answers to questions related to USQ systems and individual courses, and USQ*Admin* where students can enrol, change personal details, access results and other resource materials related to their course or enrolment. These systems offered on USQ*Connect* play an extremely important role in student support and communication, with students interact both with each other and with the university.

Integral to the design of the Transmodal course CMS1000 is the premise that students learn in different ways and that each student has a preferred learning modality (Sarasin, 1999). When this considered, and materials are designed to cater to multiple sensory channels, information processing can become more effective (Kearnsley, 2000). Fundamental then to the design of the Transmodal courses are the principles of multimodal design. Multimodal information being, 'information presented in multiple modes such as visual and auditory' (Chen & Fu, 2003, p.350). This is based in research demonstrating that students prefer to learn in environments that reflect the cognitive style in which they are most comfortable (Hazari, 2004). Transmodal delivery makes this possible as information can be presented in ways that utilise multiple sensory channels to enhance both students' enjoyment of the learning. Chen and Fu (2003) state that, 'multimodal information presentation makes people feel that it is easy to learn and they can maintain attention, which will benefit the learning process and increase the learning performance' (p.359).

In this context, the use of images is highly important, particularly for those entering higher education straight from school, the 'Net Geners.' This is also true in computer based environments where 'visual, displays are frequently useful for representing relationships amongst elements that are difficult to explain verbally' (Shah & Freedman, 2003, p.317). Even though visual images are proven to be an integral part of human cognition, they have tended to be marginalised and undervalued in contemporary higher education (McLoughlin & Krakowski, 2001). This is also true when utilising multimedia in learning and teaching environments to match students' different learning modalities (Ellis, 2004). For example, if material such as verbal texts (audio), diagrams, drawings, photographs, and videos are all regarded as texts to be read, they can be applied to the development of new inclusive curricula (Roth, 2002). It is therefore necessary to develop strategies for the multiple representation of a whole range of instructional concepts to cater to the diversity of learners we have today.

The use of multiple representations, particularly in computer-based learning environments is recognised as a very powerful way to facilitate understanding (Moreno, 2002). For example, when the written word fails to fully communicate a concept, a visual representation can often remedy the communication problem (Ainsworth & Van Labeke, 2002). Figure 4 presents a simple illustration of this concept. Where Representation 1 may cater to a couple of learning modalities, it may not cater to others, so by including Representation 2 the other learning modalities may be accommodated. Examples of multiple representations include, using point-form text with video and audio (mini lectures introducing each topic in a course), animated diagrams with voiceovers, interactive graphs and forms, audio explanations of concepts, and still images. The type of multimodal learning approach established for Transmodal delivery provides a unique opportunity to bridge both generational and cultural factors, providing the face-to-face contact requested by Baby Boomers, the independence preferred by Gen-Xers, and the interaction and sense of community for the Net Geners. (Hartman, Moskal, & Dziuban, 2005). Jona (2000) asserted that this kind of learner choice represents the paradigm shift that needs to occur in higher education.
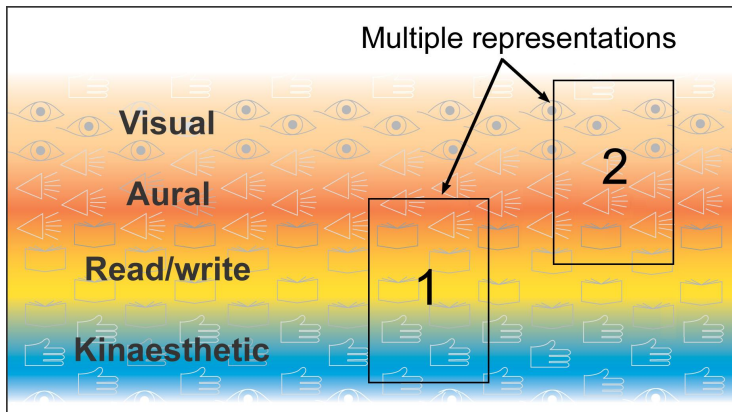
Figure 4: The multiple representation of a concept

Although it has been seen that there is a real need to design learning environments for a range of different learning modalities to aid student cognition, considering issues of students meta-cognition is equally necessary. This may be achieved by facilitating student's understanding of his/her own preferred learning modality. To assist students with this a number of Transmodal courses have encouraged students to complete a VARK learning styles inventory (Fleming, 2001) early in their semester. VARK stands for Visual, Aural, Read/write and Kinaesthetic. This strategy, as it will be seen later in this paper, has been found to be particularly helpful to students. Coffield, et. al., (2004) state,

> *"A knowledge of learning styles can be used to increase the self-awareness of students and tutors about their strengths and weaknesses as learners. In other words, all the advantages claimed for meta-cognition (ie being aware of one's own thought and learning processes) can be gained by encouraging all learners to become knowledgeable about their own learning and that of others. According to Sadler-Smith (2001), the potential of such awareness lies in 'enabling individuals to see and to question their long-held habitual behaviours,' individuals can be taught to monitor their selection and use of various learning styles and strategies (Coffield, Moseley, Hall, & Ecclestone, p. 37)*

An Important consideration in applying a strategy, such as the VARK inventory, is to also make available to students a series of study tips based on their modal preferences.

THE APPLICATION TO CMS1000

CMS1000: *Communication and Scholarship,* is a first year core undergraduate course offered by the Faculty of Arts at USQ, with enrolments varying between 1000-1500 students per year. Due to high external enrolments in this course it seemed an ideal choice for CD-based Transmodal delivery. CMS1000 offers students the opportunity to gain understanding of the academic and psychological dimensions of communication. Academic writing, critical thinking, research, oral communication, interpersonal, group, nonverbal communication and barriers to communication form the basis constructs of the course. The course refers to different models of communication, but highlights the importance of the transactional process. This model reflects the dynamic nature of communication and describes how different channels of communication can be effective in different contexts. It was therefore appropriate that the course should itself use these different channels.

Although there were some initial problems associated with the production, mainly because the lecturer had to come to terms with some new technology, the benefits of the CD medium became quickly apparent. The more the lecturer became familiar with the possibilities, the more she wanted to include features that would engage the external student (Sankey & Kiernan, 2005). Table 2 lists the range of multimedia based enhancements that were used in the CMS1000 Transmodal learning package. One element that was found to be particularly helpful for students was the mini lectures using the *Macromedia Breeze* software (PowerPoint presentations with a voiceover).

As this change in delivery represented a substantial shift in the provision of the CMS1000 course resources (previously only a print-based course), it was seen as critical to understand how the students perceived these resources. It was also important to gain a clear understanding of how effective the multimedia elements had been in aiding student understanding of the core concepts within the course. A brief explanation of how this investigation was conducted and a summary of the results are shared below, the findings of which will be used to help guide both the future development of this course and of Transmodal delivery at USQ.

Table 2. The Transmodal package for CMS1000

CMS1000 students in S1, 2 & 3 of 2005 received	
Print based	Book of selected readings (also on CD as PDF's)
CD-based	Introductory materials Study modules Assessment items Mini lectures using '*Breeze*' (multimedia) Harvard referencing tool (multimedia) Animated diagrams (multimedia) Icons and supporting images
LMS based (USQ*Connect*)	Discussion forums Additional documents Library PowerPoint presentations

METHOD

Over Semester 1, 2 and 3 of 2005, 188 external students enrolled in CMS1000 voluntarily participated in a 20 question online survey evaluating their perceptions of the CD-based Transmodal environment. More specifically this investigation sought to understand whether they:

- Liked the CD-based materials and liked the ability to navigate the materials;

- Would prefer a print or CD-based version, or a combination of materials;

- Found the multimedia based enhancements helpful, suiting their approach to learning;

- Experienced technical problems (to what level);

- Appreciated the discussion forums.

The research model adopted for this study is a 'Concurrent Triangulation Strategy' (CTS) as defined by Creswell (2003). A visual representation of this model can be seen in Figure 5. This

strategy allows the collection of both qualitative and quantitative data with a view to triangulating these data. The qualitative measure was administered to provide students with the opportunity to give a more in-depth account of their encounter with the learning environment (Barker et al., 2002). The survey consisted of 11 questions using a five point Likert type scale (strongly agree / agree / no opinion / disagree / strongly disagree), and three questions using a two point scale (yes/no) for collecting the quantitative data. Six open-ended response questions were used to collect the qualitative data.
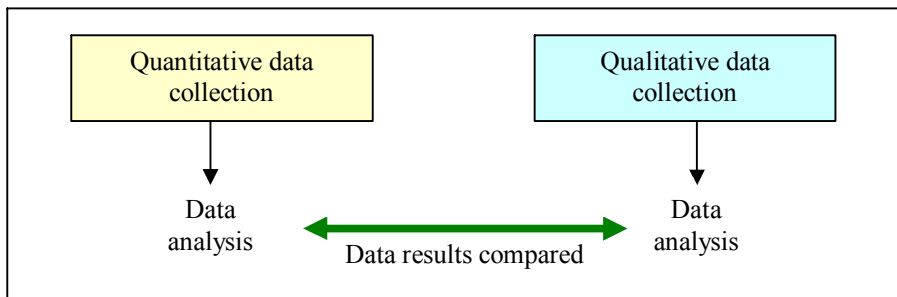
Figure 5: The Concurrent Triangulation Strategy. Adapted from Creswell (2003)

Punch (1998) suggests that both qualitative and quantitative methods have strengths and weaknesses and that an 'over reliance on any one method is not appropriate' (p.241). This is particularly important for this style of mixed methods study, where perceptions (qualitative) are being compared to responses of a more quantitative nature. A summary of the data drawing on key findings follow. However, as only limited data may be displayed in this paper a more complete summary of these data are viewable at: http://www.usq.edu.au/users/sankey/cms1000/

Of the 188 students responding to the survey 73% were female and 27% male, aged between 18 – 54 years, all studying externally. These figures are reasonably consistent with the demographic of the student body at USQ, where approximately two-thirds of the external students are female. Each of these students were supplied with a Transmodal CD containing all the study modules in an HTML format enhanced with multimedia elements and a PDF version of the materials. They also received a printed book of selected readings (also supplied ad PDF files on the CD) and were required to purchase a textbook. In addition, discussion forums for the course were hosted on the USQ*Connect* portal, providing also an environment for announcements and answering of questions.

FINDINGS AND DISCUSSION

Liked the CD-based materials and liked the ability to navigate

In commencing this analysis it was deemed important by the research team to consider two fundamental aspects. First, did the students like the CD-based material? And second, were the html-based materials easy for students to use? Question 11 in the survey addressed the first of these two aspects and asked students, '*Did you like the CD based materials*?' The data indicates that 79% of students responded in the affirmative (Figure 6). This sentiment was confirmed by the qualitative analysis. The following two students' comments provide a sense as to why there was such a positive response:

"I thought the CD media an excellent choice for study material. The various audio and visual presentations provided variety and a much needed reprieve from the traditional method of reading text cover to cover and it made the learning experience fun."

"Now that I have moved on to another subject, without a CD, I'm realising just how useful the CD was and how difficult I am finding it to learn solely from text. Thank you for the CD!!!"
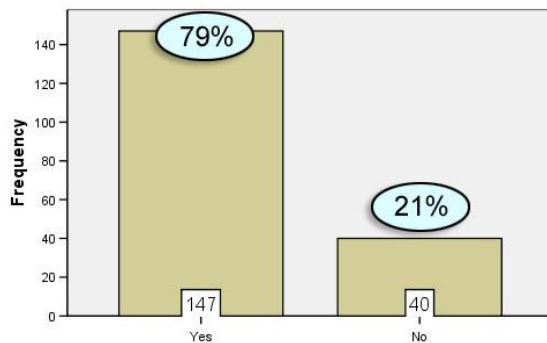
Figure 6: Responses to question 11; 'Did you like the CD based materials?'
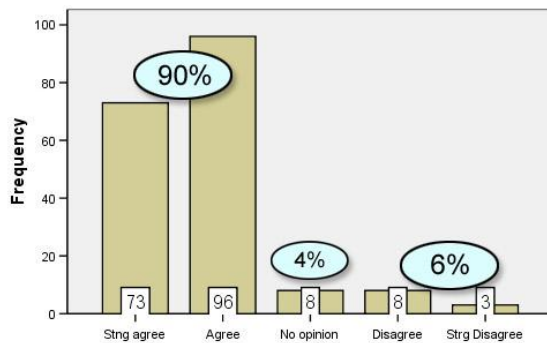
Figure 7: Responses to Question 1; 'I found the CD based materials were easy to navigate.'

The second of the two fundamental aspects, related to navigation, was addressed in Questions 1 (quantitative) and 16 (qualitative) of the survey. Question 1 sought a response to the statement, '*I found the CD-based materials were easy to navigate.*' Ninety percent of students either agreed or strongly agreed with this, with only 6% disagreeing (Figure 7). This was a very strong response and one that can be further supported by the qualitative data (feedback) received to Question 16. Typical responses include:

"The CD-based learning materials format (e.g. hyperlinking) were very helpful in helping me to locate/access related learning elements - faster/direct access provided. Yes, I would like to see the same in other courses."

"I found them to be effective as opposed to another course I did that only had print. Could access what I wanted easier, instead of looking through print to find what I need."

However, liking the materials and the ability to navigate is one thing; reading off the computer screen is quite another and a perceived concern of many lecturers. It was therefore important to gauge to what level students used the html based materials as their primary way of accessing the learning materials. Question 6 of the survey addressed this and asked students to indicate their response to the following statement: '*I used the navigation features on the CD as my primary way of accessing the course materials.*' Figure 8 illustrates that 68% of the students either agreed or strongly agreed with this statement with 20% disagreeing and 12% chose to express no opinion.
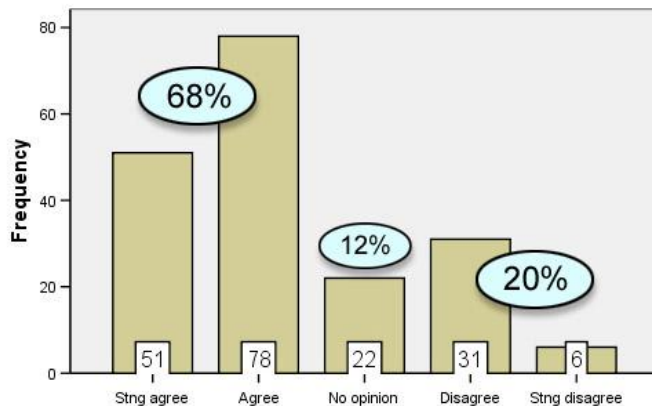
Figure 8: *Responses to question 6; 'I used the navigation features on the CD as my primary way of accessing the course materials'*

This high agreement rate was a surprise to the research team as it was anticipated that students would prefer the more traditional print-based approach; however, the opposite was observed. The qualitative data clearly shows that students were self selecting what they wanted to print, and only printing off what was necessary. This is demonstrated in the following comment: "*I feel that the CD, with the printable option was excellent. It was great to access it on the CD and then print the necessary documents.*" Further, students saw other benefits to providing the materials in this way, as this comment indicates. "*The CD reduces the amount of information supplied on paper which is great for the environment and information is easier to access and find on the CD.*"

In making these observations it should not be overlooked that some 20% of the students did not use the CD as their primary way of accessing the materials. However, it is believed the following two comments give a good initial summary as to the sentiment being expressed by these students: "*I feel the CDs are an excellent resource, although I also believe that the course booklet is a viable learning material as well.*" And: "*I like to have paper in front of me to read through so I can do it anywhere while looking after children etc.*" The sentiments expressed by these and other students revolve around the convenience of (or lack of) access to their preferred way of accessing information. This will be investigated further in the following section.

Would prefer print, CD, or a combination of materials

As mentioned above, the ease of access to printed materials was a perceived concern of the research team. However, when students were asked in Question 10 to comment on this statement; '*The study materials viewable on the CD, with links to other aspects of the course, are more useful than a printed version*,' they were (in a sense) being asked to directly compare the

two mediums, CD and print. In response it was seen that the majority of students (54%) agreed or agreed strongly with this statement (Figure 9), with 29% disagreeing and 17% choosing to express no opinion. The qualitative analysis clearly supports this, but also indicates that students want to retain some access to print for three main reasons:

1. For portability; for example, they can read printed materials on the bus.
2. So they could use a highlight pen for important points, and
3. To save them having to use the computer at home all the time; as many also used computers all day at work.

On the other hand, students expressed their satisfaction with the CD-based materials for four main reasons:

1. The use of the additional media (presentation in a variety of forms / multiple representations) made the materials more dynamic/interesting/fun,
2. It is less for them to have to carry around; more compact, less paper,
3. It made it easy for them to access information quickly, and
4. The use of navigation and hyperlinking was regarded highly.
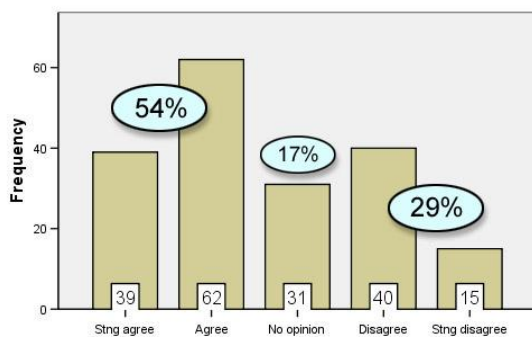
Figure 9: Responses to Question 10; 'The study materials viewable on the CD, with links to other aspects of the course, are more useful than a printed version'
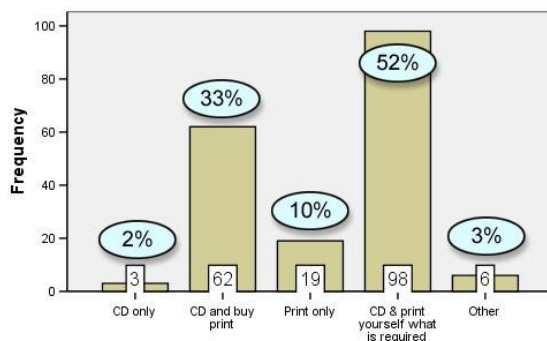
Figure 10: Responses to Question 14; 'Please choose your ideal combination of learning materials'

This is supported by the many comments made in response to Question 19 (qualitative) that asked students: *'What advantages or disadvantages did you find in having your study materials supplied to you on CD? How do you think this affected your learning of the materials?'* As the case for navigation and access have already been made above, the following two comments give a summary of the benefits in relation to the use of additional media (the benefit mentioned most often):

> *"I thought the CD media an excellent choice for study material. The various audio and visual presentations provided variety and a much needed reprieve from the traditional method of reading text cover to cover and it made the learning experience fun."*

> *"The CD is a link to the university in a special way. How? Well the CD has a lecturer speaking to use [audio]. Books are good and very useful; however they can sometimes be dry and rather static. Is not any learning, especially for one's career, supposed to be DYNAMIC?"*

Even though some students identified their preference to print out certain aspects of the materials it is seen that the advantages of what is supplied on the CD (by way of additional media) outweighed the disadvantages of having to print certain aspects of the materials. This point will be investigated in more detail in the following section.

Having established there was a strong support for the CD-based materials this analysis will now investigate the responses to Question 14 that asked students to, *'Please choose your ideal combination of learning materials.'* Figure 10 demonstrates how the students responded to this question. The majority of students (87%) chose to receive the CD and to either print what they required for themselves (52%), or purchase the printed version from the bookshop (33%). Ten percent of students identified wanting to receive 'only print materials', while 2% chose to receive the CD only. The research team believes this clearly supports the case being made above; that the use of additional media in the CD-based environment provides sufficient advantage to the students, enough to warrant them printing for themselves, or buying, a printed version of the materials from the bookshop. This being the case, the following section seeks to understand what it is students found so appealing about the use of this additional multimedia.

Found the multimedia based enhancements helpful, suiting their approach to learning

The interactive elements used on the CD (such as *Breeze* presentations and the multimedia based tools) were very highly valued. In Question 7 of the survey students were asked to respond to the statement*, 'The multimedia introductions (using PowerPoint and audio) used for each module; assessment and course overview really helped my understanding of the course content.'* Seventy seven percent of students either agreed or strongly agreed that these elements had helped them to learn the content, with 7% indicating they hadn't found them helpful and 16% choosing to express no opinion (Figure 11). This sentiment may be summed up in the following two comments: "*Sometimes reading is not enough to get it into your head and it needs to be spoken, the CD completes that need effectively."* And, *"Yes. Presenting material in a variety of formats and ways facilitates and stimulated my learning."*

In relation to the point made earlier about helping external students feel less isolated, one student offered this assessment of the multimedia features: *"I found them extremely helpful - made me feel more a part of the class as well*." This sentiment is expressed on at least 10 occasions in the qualitative data. One student commented: *"The different ways of learning catered for my specific needs very well and I appreciated the time taken to include all the different learning methods."* This is a very pleasing result and worthy of further investigation.
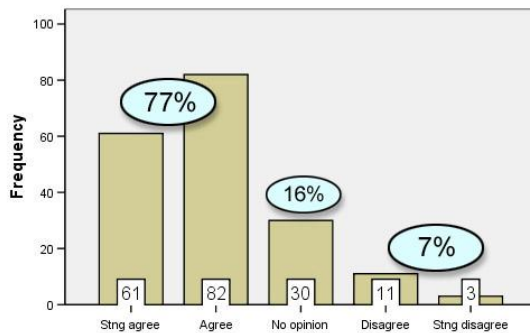
Figure 11: Responses to Question 7: 'The multimedia introductions (using PowerPoint and audio) used for each module; assessment and course overview really helped my understanding of the course content'
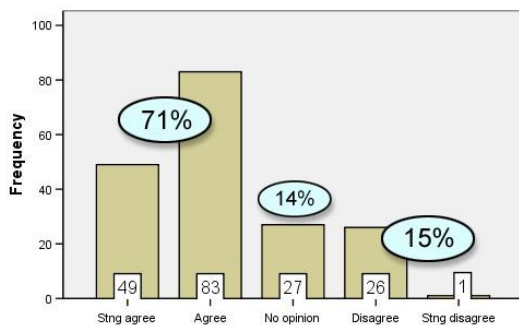
Figure 12: Responses to Question 9: 'The multimedia introductions on the CD (using PowerPoint and audio) catered for my approach to learning'

Question 9 of the survey (Figure 12) sought then to extend this understanding by asking students if these multimedia features had suited their approach to learning. The analysis of this question clearly demonstrates that this was the case with 71% of the students agreeing or strongly agreeing with this. 15% disagreed and 14% chose to express no opinion. It should be noted that in this course students are given the opportunity to gain a basic understanding of how they prefer to learn by completing a learning styles inventory and then asked to reflect on the outcomes. This weight of positive sentiment is confirmed by the comments made by students in response to Question 17 (qualitative) of the survey. For example:

"I found the PowerPoint's [Breeze presentations] particularly helpful. Being an external student, it is hard to study without actual contact with the lecturer, but by listening to the lecturer on the PowerPoint, it made it seem a bit more real. My learning style reflects the need to listen as well as read to gain the best insight into what I am studying."

"These may seem like optional extras however I believe they enhance the learning process, by using more of the learning faculties that each person has at their disposal; a whole brain approach, including emotion and humour, which is particularly helpful for off-campus students."

"PPT with audio was a huge advantage in learning the material. As an external student it was great to be able to have a 'lecture' at home to reinforce what I'd been reading in the text."

This last comment makes mention of these presentations being used to reinforce what was being read, this was also specifically mentioned by a further eight students in the qualitative data.

Experienced technical problems

One particular area of concern was that 22 students experienced some form of technical problem with the CD that they could not easily fix themselves. However, eventually most of these problems were resolved satisfactorily with the help of the Distance and e-Learning Centre support services. Even though students were asked to explain the nature of the technical problem there is little indication in the data as to what these may have been. This is an area that will also need further investigation in future studies.

Appreciated the discussion forums

The final area covered in this summary of the analysis is the students' use of discussion forums on the USQ*Connect* portal; an essential part of the course design. This was addressed in Question 3 of the survey (Figure 13) and asked students whether they had found this aspect of the course helpful. In response 68% agreed or strongly agreed that they had been helpful, 5% disagreed and 26% chose to express no opinion. Interestingly, there seemed to be a notable difference in the way males and females responded to this question, 72% of females were in agreement as against 59% of the male sample. However, due to the small numbers of male respondents (51) this study should not draw any strong conclusions from this finding; rather, this may be an area for further investigation.
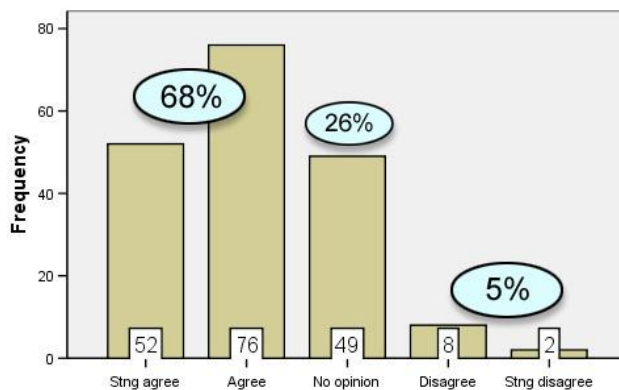
Figure 13: *Responses to Question 3: 'The discussion forums on USQConnect (WebCT) were helpful'*

The strategy of using discussion forums, in this case, was clearly seen as being successful, but it may be suggested that its success, at a first year level, depends almost entirely on the active participation of the course leader in this environment; modelling good and appropriate behaviours. This is supported by the following comment: *"Since the lecturer was always on hand for assistance (on discussion desk) and with fast helpful responses it worked very well. If the lecturer was not as approachable I don't think it would work as well."*

As noted above, there were only 5% of students who did not find these discussion forums helpful; however, there were a significant percentage of students who chose to express no opinion (26%). Even though there in no qualitative data to draw on to give an indication as to why this may be it may be suggested, based on anecdotal evidence from the course leader, that many of these students simply did not use this aspect of the course.

DISCUSSION

There was an unmistakably strong endorsement of Transmodal materials, though they clearly did not suit everyone. Having said that, those who did not use the CD were happy to either print for themselves what was required or purchase a printed version from the bookshop. The use of technology, particularly the *Breeze* and multimedia presentations, was seen to help the students' understanding of the course concepts and to help break down some of the barriers that may make external students feel more isolated. Of some concern was that a few students did not have easy access to, or sufficient understanding of, the technology. This may require USQ to either make the access to print materials easier, or ensure clear communication of the options. Even though the results suggest the Transmodal delivery of this course was successful overall, and that it did serve to complement or replace the print materials, further consideration must still be given to the different learning styles of students. For example, print materials must be made available for students who have a read/write learning preference. The potential to make learning more interesting (and sometimes fun) for external students is clearly demonstrated in this study.

THE WAY FORWARD

The first iteration of the Transmodal delivered in 2005 of CMS1000 was received well by most students, and based on the feedback received the lecturer saw great potential to develop these materials even further. The lecturer for this course was extremely pleased with the responses made by the students and has seen a distinct advantage in improving course materials in this way (Sankey & Kiernan, 2005). As a result she has rewritten aspects of the materials to take full advantage of the available technology. It was also seen that it is extremely important for the lecturer to make the expectations for using the CD-based environment as clear as possible to students. Explicit instruction will need to be given to students on how to access the printed version from the bookshop, or the most effective strategy for printing for themselves. One possible strategy is to alert students to the options up front by placing a statement on the course specifications; as students are expected to access these prior to enrolling in a course.

Through many sessions of brainstorming to explore possibilities for further interactive multimedia enhancement, the lecturer and instructional designer have developed a number of further possible inclusions:

- A series of video interviews with experts talking through elements of the content will be created. For example, an actor/director discussed communication barriers between actors and stage management staff; and a psychologist talked about the benefits and problems of self-disclosure. It is hoped that by sharing different viewpoints students' will realize the there are many different ways of interpreting communication.
- More interactive exercises will be developed.
- A series of formative quizzes and activities will be added to the CD to help students revise modules and self-test their understanding of key concepts.

- Sample assignments will be animated and narrated. This will make it possible to highlight key points and tie this in with relevant voiceovers explaining their function.

- More images, icons and colour will be integrated into the environment. This will make the materials more engaging (particularly for visual learners) and visually attractive. It will also serve to break up what can become lengthy pieces of text.

The student response to the next version of the Transmodal CD will be vital in determining if the above approach has been warranted and a potential way ahead. If they respond more favourably than students in the previous three semesters when the CD had less features, then there could be an even more creative blend of technology and traditional academic processes proposed for future iterations.

CONCLUSION

This paper has attempted to demonstrate that there are distinct advantages (for students) in providing course resources designed to suit a range of different learning modalities and backgrounds. The findings from this research project investigating the Transmodal delivery of CMS1000 indicates that students had positive attitudes toward, and value, the multimodal course materials along with the additional multimedia components. It was seen in the feedback that higher levels of student engagement were possible when utilising imbedded multimedia elements as these were seen to cater to the students' preferred way of learning. In particular, students agreed that they enjoyed using the course CD, found it easy to use and navigate, and also agreed that the course materials had assisted their performance in the course. This was primarily achieved by providing a more complete representation of the information being presented, thereby increasing the opportunity of students to engage with their learning materials. Importantly, this was achieved whilst maintaining a balanced environment for more traditional learners, while at the same time integrating a range of multimedia based enhancements for those who learn in non-traditional ways. Clearly further research into this form of delivery is required and this paper has identified at least two; the areas of technical problems with the CD; and the use of the *Breeze* software to present lecture style presentations. It is hoped that the findings of this study may encourage more educators to consider the adoption of educational technology for the purpose of designing and delivering distance education courses, starting at a first year level. However, in doing so there are important issues relating to how the implementation of these new technologies can be best integrated before the full benefits to the learning community can be realised. Ultimately, what this paper is suggesting is that, designing for multimodal learners may reduce the impact of providing course materials to a very diverse and an increasingly non-traditional student body. This new approach for this new millennium (neomillenial) has seen USQ develop what it now calls Transmodal delivery.

REFERENCES

Ainsworth, S., & Van Labeke, N. (2002). *Using a multi-representational design framework to develop and evaluate a dynamic simulation environment.* Paper presented at the International Workshop on Dynamic Visualizations and Learning, Tubingen, Germany.

Anderson, M. D. (2001). Individual characteristics and web-based courses. In C. R. Wolfe (Ed.), *Learning and teaching on the world wide web* (pp. 45-72). San Diego: Academic Press.

Barker, C., Pistrang, N. and Elliott, R. (2002) *Research methods in clinical psychology: An introduction for students and practitioners,* John Wiley & Sons Ltd, West Sussex.

Bruch, A. (2003, October). *A treatise on the new skills needed for the creative student to be able to operate as successful practitioners in the new economy.* Paper presented at the Create.ed 2003: eLearning for the Creative Industries, RMIT, Melbourne.

Chen, G., & Fu, X. (2003). Effects of multimodal information on learning performance and judgement of learning. *Journal of Educational Computing Research, 29*(3), 349-362.

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Should we be using learning styles? What research has to say to practice.* London: Learning and Skills Research Centre.

Cookson, P. (2002). The hybridization of higher education: Cross-national perspectives. *International Review of Research in Open and Distance Learning, 2*(2), 1 - 4.

Creswell, J. W. (2003) *Research design: Qualitative, quantitative, and mixed methods approaches*, SAGE Publications, London.

Ellis, T. (2004). Animating to build higher cognitive understanding: A model for studying multimedia effectiveness in education. *Journal of Engineering Education, 93*(1), 59-64.

Fleming, N. D. (2001). *VARK: A guide to learning styles.* Retrieved 19 November, 2003, from http://www.vark-learn.com/english/index.asp

Hartman, J., Moskal, P., & Dziuban, C. (2005). Preparing the academy of today for the learner of tomorrow. In D. Oblinger & J. Oblinger (Eds.), *Educating the net generation* (pp. 6.1 - 6.15). Boulder, Colorado: EDUCAUSE.

Hazari, S. (2004). Applying instructional design theories to improve efficacy of technology - Assisted presentations. *Journal of Instruction Delivery Systems, 18*(2), 24-33.

Jochems, W., van Merrienboer, J., & Koper, R. (Eds.). (2004). *Integrated e-learning: Implications for pedagogy, technology and organization.* London: Routledge Falmer.

Jona, K. (2000, December). *Rethinking the design of online courses.* Paper presented at the ASCILITE 2000: Learning to choose, choosing to learn, Coffs Harbour, Australia.

Kearnsley, G. (2000). *Online education: Learning and teaching in cyber space.* Belmont, CA: Wadsworth/Thomson Learning.

Kellner, D. (2004). Technological transformation, multiple literacies, and the re-visioning of education. *E–Learning, 1*(1), 9-37.

Lovegrove, W. (2004, 20 December). *USQ: Australia's leading transnational educator.* Retrieved 30 July, 2005, from http://www.usq.edu.au/planstats/Planning/USQAustsLeadingTransEdu.htm

McLoughlin, C., & Krakowski, K. (2001, September). *Technological tools for visual thinking: What does the research tell us?* Paper presented at the Apple University Consortium Academic and Developers Conference, James Cook University, Townsville, Queensland, Australia.

Moreno, R. (2002). Who learns best with multiple representations? Cognitive theory implications for individual differences in multimedia learning. Paper presented at the *EDMEDIA 2002 Conference*, Denver, Colorado, USA.

Oblinger, D., & Oblinger, J. (2005). Is it age or IT: First steps toward understanding the net generation. In D. Oblinger & J. Oblinger (Eds.), *Educating the net generation* (pp. 2.1-2.20). Boulder, Colorado: EDUCAUSE.

Parsons, P., & Ross, D. (2002). *Planning a campus to support hybrid learning*. Retrieved 6 April, 2004, from http://www.mcli.dist.maricopa.edu/ocotillo/tv/hybrid_planning.html

Punch, K. F. (1998) *Introduction to social research: Quantitative and qualitative approaches,* Sage Publications, London.

Roth, W.-M. (2002). Reading graphs: Contributions to an integrative concept of literacy. *Journal of Curriculum Studies, 34*(1), 1-24.

Sankey, M., & Birch, D. (2005, 28-29 October). *Researching transmodal delivery at USQ: Different horses for different courses.* Paper presented at the New Researchers for New Times conference, Queensland University of Technology, Brisbane.

Sankey, M., & Kiernan, E. (2005, 10 August). *Reviewing the first CMS1000 Transmodal CD: A report on what students thought.* Paper presented at the Faculty of Arts Learning and Teaching Enhancement Committee Research Forum, University of Southern Queensland, Toowoomba.

Sankey, M., & St Hill, R. (2005, 11-12 July). *Multimodal design for hybrid learning materials in a second level economics course.* Paper presented at the Eleventh Australasian Teaching Economics Conference: Innovation for Student Engagement in Economics, University of Sydney, Australia.

Sarasin, L. C. (1999). *Learning styles perspectives: Impact in the classroom*. Madison, WI: Atwood Publishing.

Smith, A. & Sankey, M. (2005) Transmodal delivery: Issues and approaches. *USQ Academic Staff Development Workshop.* University of Southern Queensland, Toowoomba. Also available online at http://www.usq.edu.au/users/sankey/Resources/Transmodal.pdf.

Shah, P., & Freedman, E. G. (2003). Visuospatial cognition in electronic learning. *Journal of Educational Computing Research, 29*(3), 315-324.

Taylor, J. C. (2004, February). *Will universities become extinct in the networked world?* Paper presented at the ICDE World Conference on Open & Distance Learning, Hong Kong.

Vergnani, L. (2005, 8 June). Learning to enjoy e-learning. *The Australian,* p. 31.

Pattern of usage of various electronic media by higher education students

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ABSTRACT

This paper provides an analysis of the different investment-centric educational media from the perspective of the student users in urban and rural areas of Tamilnadu in India. Points of feedback have been derived on both mass and personalized media namely radio, TV, internet, compact discs and teleconferencing. Field-experts' observations supporting the utility of various media have been presented. As primary data, the respondents were requested to provide information on the frequency, timing, and place of usage of each media and were asked to report their feedback on the usefulness of these media. The various demographic variables are associated with media usage patterns. The main findings of the analysis suggest that the internet is comparatively more-utilized among the media. Radio and TV are under utilized because of lack of awareness and non-availability of signal.

Keywords: *Educational media; Gyanvani; Gyandarshan; CWCR; Internet; Usage pattern; Possession of media; Mode of Study; Anna University.*

INTRODUCTION

On the one hand, there have been *huge investments* by the educational sector on the establishment and maintenance of educational media for students. On the other hand, there has been *very little and sporadic knowledge* about the usage of such media in education. There is a need to understand the *opinions* of the target group on the functioning of the educational media and to elicit their *suggestions* towards the improvement of educational media in terms of content, duration, timings and methods available through them. Media had to be viewed on a comparative note in order to identify the more effective ones among them.

While the growth of the electronic media of radio and TV in terms of reach, popularity and variety has been phenomenal, there has not been a corresponding growth in their education-related usage. Lack of publicity about the contents and timings of the programs, inability of one's electronic equipments to receive the signals and lack of interactive nature of their programs have contributed to the under-utilization of these educational media. In the case of internet, the problem has been one of access and affordability. Rural students are said to have less familiarity on the availability and contents of various media inputs. Similarly, the students of distance education and regional language medium classes also have been facing limitations in their utilization of educational media resources compared to regular streams and English medium classes.

The objective of the study included identifying the variations among the students of different demographic characteristics in terms of their media usage.

REVIEW OF LITERATURE

As part of the study on various media usage patterns among the students of the state, the researcher carried out an extensive review of literature to identify the various issues and perspectives with regard to the area of focus.

Radio is playing a significant role in reaching, informing and educating people. Radio is still a dominant medium with wide access. Computers and internet have started influencing the way we learn. All these media are very powerful to reach, teach and enrich. But learning from them is quite different from reading a book according to Singhal and Rogers (2001).

Reports confirm that educational Radio programs have been tried out in a wide range of subject areas in different countries. In Thailand, the radio is used to teach mathematics to school children Galda (1984) and for teacher training and other curricula Faulder (1984); In Mexico, radio was used for literacy training and other programs Ginsburg and Arias-Goding (1984); In Nigeria, radio was used for management courses for the agriculture sector Shears (1984); The Philippines used the radio for nutrition education Cooke and Romweder (1977); The Dominion Republic used radio in support of primary education White (1976); Paraguay used radio to offer primary school instruction according to the Academy for Educational Development (1979).

Radio in education can provide useful answers with diverse learners to solve easily, according to McLeish (1999). Mason (1994) has stated that radio can be valuable in distance learning milieus ranging from schools, colleges and universities, from commerce and industry to public sector organizations. Moreover, radio programs can provide flexibility and openness, and easy accessibility to knowledge as well as better higher-order thinking and skill improvements with high-tech learning environments. Radio can create new distance milieus in which learners are able to take greater responsibility for their own learning and constructing their own knowledge according to Resta (2002). Moore and Tait (2002), focusing on the use of new communication technologies in distance education systems such as e-learning, stated that educators and trainers give up working with radio as a low-tech educational tool. Radio has a unique power to create better interactive distance education environments itself than do emerging communication technologies, which can empower the capacities of radio when being used together in distance education systems. Radio, moreover, provides life-long learning, professional updating, in-service training and community education from a cradle-to-grave position, which is independent of not only place but time as well. Mason (1994) Learners, for that reason, can gain knowledge about themselves without feeling any digital diversity to share and exchange their experiences with others to promote their understanding with other learners from different culture.

Learners can share and exchange their ideas, beliefs, opinions, knowledge, and information with others in interactive distance educational radio programs synchronously and/or asynchronously according to Crisell (1994). Also, learners and instructors can collaborate with any experts and learners from any places in the world. Synchronous education allows all distance learners taking their educational session at the same time, and interactivity occurs at same time. Synchronous communication in interactive distance radio programs allows live interactions among learners, instructors, experts, resources, etc., as per the views of Bonk and Cunningham (1998).

With the technology growing in leaps and bounds, education does not stop at the borders of the campus and Television (TV) offers another way to reach out into homes and serve people where they live Reddi (1994). Where TV is supposed to be the most effective one. Mohanty and Rath (1990) made an appraisal of Country Wide Class Room (CWCR) TV Programs. Among other things they found that the knowledge objective has been realized to a great extent in all the programs whereas understanding and application objectives have been realized to a great extent in 60% and 52% of the programs respectively. Jaiswal and Goel (1991), referring to the CWCR

programs suggested that different pedagogical fields such as methods, media, techniques, devices, aids and formats have to be well selected.

There are several pointers to suggest that television, if used appropriately would be one of the powerful educational media.

> *"Tests showed that students did significantly better when they viewed the lessons that demonstrated planned visual continuity, contained visual reinforcement, and had been the result of a team approach to make effective use of the TV medium." Chu and Schramm (1967).*

Without the ITV technology students would have limited access to courses" said Garland and Loranger (1996). According to Ranganathan (2002) watching TV is popular among students and not all of them watching TV for entertainment alone. Considerable numbers among them are on the look out for useful and usable information. They seek information that will enhance their general awareness and help them in their educational pursuits. Among the TV viewers there are some who watch CWCR occasionally. Ways to hold on to the existing viewer ship by enhancing viewer interest in our programs and attract others by extending the scope of programs should be found out. It is imperative that the programs are different and contain something special to get noticed among the plethora of programs offered by various channels. The focus ought to be not on undergraduates but all the information and knowledge seekers. It is necessary to produce need based programs such as preparatory courses for those who take the competitive examinations at various levels. Promotion of CWCR through cross channel publicity is absolutely essential. TV expansion in years has been phenomenal. TV covers over 85% of the country's population. Cable TV is largely used for entertainment but it has great potential of being used for education as well according to Yadava (2000).

Saiprasad (1991) carried out a study to elicit opinions and expectations of students and teachers on CWCR programs. The results implied that there is a need to be conscious of the entry skills of the target group, to produce programs which require student participation and to integrate the CWCR programs into the collegiate education. According to a study Saiprasad (2001), higher education students seek information on education, career guidance, career advancement and a host of other areas through the internet.

Research has indicated that computerized learning motivates students to invest more time in a subject-area (time-on-task), in particular when the student can work according to his own pace and time schedule, as described by Worthen, Van Dusen and Sailor (1994). This also happens when the system creates extra possibilities for the student to communicate with other students (through e-mail, bulletin boards and computer conferencing). The enthusiasm of students working with the WWW is a clear illustration of these research findings. Research has shown that using computerized learning can reduce the necessary learning time of students to two-third of the time needed in a conventional course, as per the observations of Kulik and Kulik (1991).

Internet enables citizens to have access to anything and everything of their choice – books, news, bank accounts, shopping, databanks, friends, peer groups and interest groups – and at a time of their choice without stirring out of the comfort of their homes with a flick of buttons on their remote control and computer keyboard. Voice-activated signals may even do away with all this trouble of pushing buttons. But one may have to pay tolls for using internet. 'Unparalleled and unlimited human connectivity and interactivity without stirring out of homes, is set to transform intellectual, cultural, economic and political life' says Yadava (2000).

Internet-based emerging communication tools, such as e-mails, bulletin boards, etc., provide more reflective and useful interactions among learners, instructors and resources according to Picciano (2002). The researcher found that, in the field of education, TV has assumed immense importance not only in terms of its reach but also in improving the quality of education at all levels

and promises to play a major role in educational endeavors, towards upgrading as well as enrichment. Web-based course delivery offers a complex learning and teaching environment. A vibrant learning community can be created using different teaching strategies, activities, and technologies. Thus, review of literature suggests that the number of educational courses that depend on modern educational media, more so in case of distance education. Education has become media technology enabled worldwide.

METHODOLOGY

Methods play a major role in research. This study has adopted the survey method and descriptive research design. The universe or population of the study consisted of the entire set of student population in the graduate level in the state of Tamilnadu. According to the statistical handbook 2005, a total of 7.02 lakhs students are studying of under-graduation (UG) in various colleges in Tamilnadu. A total of 14,000 respondents (2%) of the universe have been covered as the sample. The sample for this study was selected from among the UG students of regular - distance mode and urban - rural students. Samples were drawn from different type of colleges like Arts, Science, Commerce, Engineering and Technology, Medicine and Agriculture. Totally 14 places were selected for this study including seven major cities and seven small towns. Data were gathered using a self-administered questionnaire prepared specially for these purpose. Over 1,000 questionnaires were collected from each place. Based on the average of incomplete responses, the researcher has taken up 840 respondents from each place for the final analysis. The data was collected during the period from January 2005 to March 2006. Total numbers of respondents whose responses were taken up for analysis were 11,760. The chi-square test, simple percentage, Friedman's two-way anova and cross-tabulation were used for the analysis of this study.

Data Experiences

The researcher observed that many of the students had come to know for the first time, about some of the media opportunities available, only at the time of research, by going through the questionnaire. The students expressed regret about the fact that no one had briefed them about the need to use various educational media. The researcher also found that management bodies of many colleges were quite averse to the idea of researching media usage among their students. A notable facet that was exposed during the data collection was that many Principals and faculty members were ignorant about the latest educational media and programs available.

USAGE OF VARIOUS ELECTRONIC MEDIA BY HIGHER EDUCATION STUDENTS

The ensuing part of the article presents the demographic details of the respondents in terms of their place of living, gender, age and academic details like the courses pursued by the candidates and their modes of study.

Sample Composition

Students of regular mode of study and distance-education mode are likely to differ on several characteristics such as time of direct interaction with faculty members, employment status, time available for education and opportunities to keep oneself up to date in their field of study. Considering these differences, the researcher thought it necessary to consider viewing the two modes of study as separate groups for further analysis of their responses. There have been exactly equal numbers of respondents from regular as well as distance education streams. Exactly 50% were students in regular mode of study while the remaining 50% were in distance

mode. Thus, it may be seen that the mode of study has been taken as the prime parameter for the stratification of respondents.

There have been more male respondents than female. (56.90% were male while the remaining 43.10% were female). This percentage, though unequal in numbers, could be stated to reflect the same proportion of men and women enrolling themselves for studies in the universe of the study. Needs and wants of people tend to differ with their age in general. Further, age factor could heighten the level of exposure a person is likely to have. Since all the respondents were students, a vast majority of them would belong to a narrow range of age group, namely 17 to 30. Hence their age groups were grouped at narrow intervals. 6146 (52.26%) belonged the age group 17 – 20, while 4438 (37.74%) belonged to the age group 21 – 25 and the remaining 1176 (10%) were above 25 yrs. Thus it may be seen that the study has covered more of undergraduate students, reflecting their relative proportion in the actual student population.

The researcher felt the need for diversity of respondents in terms of the courses they pursue, so as to bring in the pluralist perspective on the usage of media. Out of the total, 28% have their course of study as B.A. while 33.33% have their course of study as B.Sc., and the rest of them pursued B.E, B.Com and other courses. More than nine of ten respondents 93.33% have had English as the medium of instruction while 6.67% have Tamil as the medium of instruction. Of the respondents, 50% belonged to Institutions located in rural area. While the remaining 50% belong to Institutions located in urban area.

Possession of Various Electronic Media

Educational Media could take multiple forms. They could be either mass-based or personalized, containing materials in audio or visual formats. Using them regularly would require the personal possession of the instruments appropriate for each.

A comparison of possession patterns with respect to different instruments shows that the costs involved in owning an instrument is inversely proportional to the number of people owning them, the only notable exception being TV, which occupies the second position among the instruments owned closely following the radio sets, despite involving a higher initial investment compared to tape recorder or telephone, which are owned by fewer respondents. The appeal of TV as a media could be understood from the emerging analysis. It is noteworthy to find that 90.24% possess radio, 86.43% possess tape recorder and 96.31% possess TV while 71.90% possess telephone. Merely, a 35.24% possess Personal Computer as compared to 61.31% who possess Satellite/Cable connection, 20.95% who have access to Internet and similarly, 49.64% who possess CD player.

USAGE PATTERN OF RADIO BY HIGHER EDUCATION STUDENTS

Distribution of Students by Listening To Radio

From the radio listening group 35.71% of the respondents listen to radio everyday a week, while 5.12% listen to radio 4 to 5 days a week, 8.93% listen to radio once a week and 12.86% rarely listen to radio. It is found that 18.10% never listen to radio. Combining the segment listening to radio every day and at least 4 to 5 times a week, it may be stated that the majority of respondents tend to be frequent radio listeners. However, there remains to be a sizeable segment of nearly one third of the total respondents whose radio usage is almost non-existent to produce any impact.

Approximate Time Spent On Listening To Radio

While 30.36% listen to radio less than 30 min., 27.74% listen to radio 30 – 60 min., 18.10% do not listen to radio, 13.57% listen to radio 60 – 120 min. and 10.24% listen to radio above than 120 min. With regard to the time spent on listening to radio, the emergent data shows a divergence among respondents, with respondents' time ranging from nothing to two hours a week, which could be interpreted to be offering a considerable scope for increase.

Place of Listening To Radio

Summing up the responses, it is found that 87.35% listen to radio at home, 23.11% listen to radio at friends place. Others listen to radio at their office; place of study or at cyber cafes. Data indicate that home is the place where most of the respondents have been listening to radio, thereby suggesting that timing of the educational programs through radio should match with the time when people are at home.

Listening to Radio Programs

With a view to ascertain the purpose of listening to radio, respondents' listening patterns were further enquired. It was found that 37.06% listen to radio for education, 84.30% listen to radio for entertainment and 29.07% listen to radio for Science. 5.23% listen to radio for purpose other than those mentioned above. Analyzing the data on the purpose of listening to radio, there seems to be scope for improvement as the majority of respondents have reported that they do not listen to radio for education or for Science programs.

INTERPRETATIVE ANALYSIS ON RADIO

Listening to Radio and Mode of Study

Table 1: Listening to radio and Mode of study

Listening to radio (per week)	Mode of study		Total	Chi-square value	p value
	Regular	Distance			
Every day	2254 (2100.0)	1946 (2100.0)	4200		
4 to 5 days	672 (889.0)	1106 (889.0)	1778		
2 to 3 days	350 (546.0)	742 (546.0)	1092	363.50	0.000**
Once	504 (525.0)	546 (525.0)	1050		
Rarely	910 (756.0)	602 (756.0)	1512		
Never listen	1190 (1064.0)	938 (1064.0)	2128		
Total	5880	5880	11760		

Note: The value within bracket refers to Expected frequency.
** denotes significant at 1% level
Since p value is less than 0.01 there is a relationship between listening to radio and mode of study.

Hence it can be concluded from Table-1 that there is a significant relationship between listening to radio and mode of study. This means that the two streams would differ in their usage of radio, as they have similar syllabus but dissimilar teaching-interaction process.

Listening to Radio and Area of Institution

Urban and rural milieu of students tend to differ in the available levels of exposure to co-curricular events, access to educational services like counseling and library services. In the absence of multiple forms of educational assistance, there is a greater likelihood of students becoming dependent on the mass media as a one-stop source for the fulfillment of their educational needs. It was with this assumption that the researcher endeavored to examine the association between place of study and the patterns of listening to radio. It was concluded that there is significant association between area of institution and listening to radio. The result of this analysis could mean that media planners would have to focus on the target audience according to their place of study. Programs might have to be tailor made to suit the specific needs of the two categories of students.

Listening to Radio and Medium of Instruction

The medium of instruction in higher education in most of the cases remains to be English, while the mass media offer contents both in regional languages and in English. In order to identify the possibility that mass media like radio caters to students with concerns about the medium of instructions, chi-square analysis was done to find out if there is any association between the two variables.

It can be concluded that there is significant association between medium of instruction and listening to radio, which could indicate that language plays a vital role in out-of-classroom learning. Media planners need to carefully address the issue of medium of instruction used in radio as well. With the help of primary data, it was also concluded that there is significant relationship between course of study and listening to radio. The relationship could be interpreted as arising out of the differing requirements between various types of courses. Whether these differences are also affecting the time spent on listening to radio, is to be analyzed further.

Approximate Time to Listen to Radio

Having established the fact that radio usage is unmatched with the supply, the researcher has undertaken to analyze the various factors that could further influence the increase or decrease in the usage patterns. This analysis is carried out in order to find clues that could be valuable in making students listen more actively to the medium. There is significant association between mode of study and approximate time spent on listening to the radio. The implication of this finding might be that different strategies would be necessary to address the distance and on-campus learners, as far as improving the time spent on listening to radio. Also there is significant association between the area of institution and the approximate time of listening to the radio. Rural and urban students spend different amounts of time listening to radio, and within the attention spans of each of the categories, programs should be able to convey the important messages. In the same manner it was concluded with the help of chi square analysis that there is significant association between medium of instruction and approximate time to listen to radio.

Hence it is felt necessary to look into the familiar lingua franca of the local population if the average duration of listening has to be increased. The study also proved that there is significant association between course of study and approximate time to listen to radio. This implies that the

media planners should conduct audience research and find out the subjects for which the demand for radio programs are higher and broadcast them accordingly.

USAGE PATTERN OF TV BY HIGHER EDUCATION STUDENTS

Distribution of Students by Watching Pattern on TV

TV tends to occupy a coveted position among the media because of its audio visual presentations. The analysis portrays the respondents' viewing patterns.

Table 2: Watching Pattern of TV

Watching pattern of TV	FREQUENCY	PERCENTAGE
Frequency of watching TV (a week)		
Everyday	7686	65.36
4 – 5 days	1498	12.74
2 – 3 days	700	5.95
Once	686	5.83
Rarely	644	5.48
Not watch	546	4.64
Total	11760	100.00
Approximate time spent on watching TV		
> = 5hours.	896	7.62
3hours. – 5hours.	1988	16.90
1hour. – 2hours.	2478	21.07
30 min. – 1hour.	3430	29.17
< = 30 min.	2422	20.60
Did Not watch	546	4.64
Total	11760	100.00
Place of watching TV		
Home	9716	86.64
Study Place	714	6.37
Friends place	2828	25.22
Office	406	3.62
Cyber cafes	616	5.49
Programs generally watching on TV		
News	7840	69.91
Education	3934	35.08
Entertainment	8792	78.40
Other programs	392	3.50

Frequency of Watching TV

Data on viewing time suggest that 65.36% watch TV every day in a week, 12.74% watch TV 4 – 5 days in a week, 5.83% watch TV once a week and 5.48% watch TV rarely and 4.64% do not watch TV (Table 2). From the data on TV viewership, it may be observed that majority of the respondents watch TV every day in a week and that it is a very small segment which abstains from watching TV totally. This response pattern reiterates the general perception about the popularity of TV among people.

Time Spent on Watching TV

In order to verify the dependence on TV, respondents were requested to provide data on the time spent on watching TV. The analysis brings out the data on this question. Since media planners and analysts have divided TV slots into durations closer to 30 minutes, this duration was taken as the minimum period.   20.60% watch TV < = 30 min., 29.17% watch TV from 30 min – 1hour, 21.07% watch TV for a duration between 1 to 2 hours, 16.90% watch TV from 3 to 5 hours and 7.62% watch TV for more than 5 hours (Table 2). A closer look at the data presented in the table shows that the majority of the viewers' spend not less than an hour on an average and this would imply that educational TV programs should also time their programs accordingly.

Place of Watching TV

With regard to the place of watching TV, the response pattern has shown a striking similarity with that of radio. A vast majority of 86.64% of the students watching TV at home (Table 2), 25.22 % watching TV at friends place and the rest of the people watching TV at other places like study place, office or at cyber cafes.

Programs Watched on TV

Analyzing the purpose of watching TV, it is seen that 69.91% watching TV for news, 35.08% watching TV for education, while 78.40% watching TV for entertainment, 3.50% watching TV for other than those mentioned above Table 2. The pattern of data shows that viewing TV for education purposes should be enhanced among the majority of the students.

Types of Material/Content Watched by Students on TV

Respondents expressing opinions on the contents watched on TV were sought with options for multiple responses. Results showed that, out of the total respondents, 68.12% watched subject-based programs on TV, 38.12% watched scientific programs and expert lectures, 46.77% watched interactive programs, while 58% watched career guidance, higher education information on TV as presented in Table 2. Interactive video can improve student attitudes and results in increased participation.

Distribution of Students Watching University Grants Commission – Country Wide Class Room (UGC - CWCR)

Among the educational programs, a pioneering initiative under the aegis of the UGC was its CWCR. Respondents were enquired on their usage of these unique programs. Of TV watching respondents, 14.61% watch UGC CWCR while 85.39% do not watch UGC CWCR. The results show that a vast majority of the respondents do not watch the programs, even though there are specific programs to suit every student group's needs.

Frequency of Watching CWCR

17.95% stated that they watch UGC on DD1 every day in a week, while 11.11% stated that they watch UGC on DD1 4 – 5 days in a week, 14.53% stated that they watch UGC on DD1 2 – 3 days in a week, 13.68% stated that they watch UGC on DD1 once a week and 42.74% stated that they watch UGC on DD1 rarely. It is seen that even among those who watch the programs, majority of them do not watch even twice a week. Only a very small segment is deriving benefits out of the programs, about which there should be some form of interventions from the telecasters.

Reasons for not Watching CWCR

A segment of respondents who stated that the reason for not watching CWCR; opine that they were not interesting. 1063 stated that reason for not watching CWCR as inadequate interaction. 48.15% stated that reason for not watching CWCR was that they received no signal. As high as 74.90% stated that reason for not watching CWCR was lack of periodic information about it.

Knowledge about Gyandarshan (GD) and Receiving

Among the students covered by the study, as large a segment as 82.38% stated that they do not receive GD programs on TV. When compared with other educational programs offered by the Government, very similar results are found with regard to the GD programs. It is evident that there is little awareness about the telecast of GD. Since the percentage of population using the various educational telecasts is small, the focus of the analysis is shifted towards understanding the opinions of the small segment of users, about the effectiveness of these programs. As the programs have rich and varied contents, all the users might not need all the inputs. Hence the respondents were asked to estimate the percentage of programs which they found GD to be helpful.

Reason for not Accessing GD

A total of 1112 stated that they do not access GD due to non-availability of signal while 10684 stated other reasons for not accessing GD.

Format of Presentation Followed Mostly in GD

Expressing opinions on the content of programs, a sizeable segment (44.59%) stated that format of presentation followed in GD is mostly lecture based only. A perceptible section of 33.11% stated that format of presentation followed in GD is mostly lecture with demonstrations only. 4.73% stated that format of presentation followed in GD to be other than those mentioned above. From the data, it is obvious that the major form of presenting lessons has been lecture, which has been vouched as a dependable method for disseminating large quantity of information in a short period of time. However the programs watched by the respondents were apparently confined to lectures not complemented with value enhancing presentations.

Not accessing GD is an area of concern as it could render the investments made in producing educational programs and the costs of telecasting them as unproductive. The reasons for not accessing as stated by the respondents were analyzed, to know if it is due to any faults in the contents of the program. The analysis and results discussed so far have shown that mass media's reach is yet to expand in a significant way among students.

INTERPRETATIVE ANALYSIS ON TV

Watching TV

While both TV and radio are mass media, their audiences tend to differ in terms of their reach and extent of usage. Therefore, respondents' views on television were sought with regard to the same indicators of usage such as frequency, duration and perceived usefulness of the media, as used in the context of radio.

Table 3: Watching TV and mode of study

Watching TV (a week)	Mode of study		Total	Chi-square value	p value
	Regular	**Distance**			
Everyday	4186 (3843.0)	3500 (3843.0)	7686		
4 – 5 days	588 (749.0)	910 (749.0)	1498		
2 – 3 days	238 (350.0)	462 (350.0)	700	671.76	0.000**
Once	434 (343.0)	252 (343.0)	686		
Rarely	392 (322.0)	252 (322.0)	644		
Not watch	42 (273.0)	504 (273.0)	546		
Total	5880	5880	11760		

It can be concluded that there is significant association between the modes of study and watching TV. This association is found to be very much similar to that of radio usage.

Watching TV and Area of Institution

Association between area of institution and watching TV is significant. In respect of this variable too, there is similarity between radio and TV. Consequent to further analysis, it was concluded that there is significant association between medium of instruction and watching TV. Analyzing the result in the light of earlier findings, it is seen that there is inter-media consistency among radio and TV and hence a common approach could be adopted in planning and striving for greater effective usage of the two media.

The study also resulted in the conclusion that there is significant association between mode of study and approximate time spent on TV watching. The difference could possibly be the result of unstructured or inadequate time availability to students belonging to any one of the two modes of study.

Analysis of data showed that there was significant association between the area of institution and the approximate time spent on watching TV. Comparing the results with that of earlier findings, it is seen that differences do exist between the areas of institution on almost every parameter taken up for measuring usage patterns of both radio and TV.

There is significant relationship between medium of instruction and approximate time spent on watching TV. This result adds to the general belief that there must be separately designed programs meant for students belonging to different medium of instruction, rather than merely translated versions.

Watching UGC CWCR

The present study took up the task of examining the viewing practices in Tamilnadu between regular and distance mode, rural and urban areas. There is significant association between mode of study and watching UGC CWCR. Similarly there is significant association between area of institution and watching UGC CWCR. Further, among the respondents viewing the program very frequently, there are more urban students than their rural counterparts. Hence efforts are to be directed towards popularizing the program among rural audience too.

Also there is significant association between medium of instruction and watching UGC, CWCR. From the figures, it is seen that there are disproportionately higher levels of students studying in English medium than the regional language. However the frequency of Tamil medium students watching UGC CWCR is more than their expected frequency. Hence there is a great need to fill the gap by supplying programs in the local language. Watching UGC CWCR was also significantly associated to the course of study pursued by the students. In terms of the frequency, no clear picture can be said to have emerged among the courses as their relationship has not been linear. Initial negative attitude towards educational TV is likely to lessen over time and become more positive or neutral.

Receiving GD Programs

Mode of study can largely be differentiated in terms of the average age groups benefited, the level of expenditure on education and a host of other grounds. However, to eliminate bias, the researcher assumed that there is no significant association between mode of study and receiving GD program on TV.

That there is significant association between mode of study and receiving GD program on TV. This reinforces the initial surmise that the two modes would differ on maximum variables used in the study. Receiving GD program could largely depend on the area in which the place where the respondents mostly watch TV. Earlier the analysis on place of watching TV showed that home is the place most of them used for TV watching. However, in order to verify the data, the relationship between the area of institution and receipt of GD programs was examined. Hence it can be concluded that there is significant relationship between area of institution and receiving GD program on TV.

There is also significant association between medium of instruction and receiving GD program on TV. In this regard too, the emerging data is similar to that of CWCR and TV in general. It also can be concluded that there is significant relationship between course of study and receiving GD program on TV. The programs are not labeled to be meant as exclusively for students belonging to any particular mode of study. Hence it was assumed that the two are not seen as closely related. On a comparative analysis of the various results discussed in relation to watching educational programs CWCR or GD, it is seen that there have been significant relationships established between this dependent variable and all other independent variables taken up for the study such as the place of the institution, the mode of study and the medium of instruction. The results seem to stress the importance that is to be accorded to these variables while planning and implementing educational programs in various media.

USAGE PATTERN OF INTERNET BY HIGHER EDUCATION STUDENTS

Distribution of Students by Internet Usage

Internet being a media of recent origin has evoked the interests of educational researchers and media professionals alike. The various parameters of assessing the reach of this medium, such as favorable opinions on the medium, number of people using it, the frequency at which they use it and the time spent on Internet are analyzed.

Table 4: Distribution of Students by internet usage

VARIABLES	FREQUENCY	PERCENTAGE
Ever used internet		
Yes	10920	92.86
No	840	7.14
Total	11760	100.00
Using internet (a week)		
Everyday	2114	19.36
4 – 5 days	1624	14.87
2 – 3 days	2324	21.28
Once	3150	28.85
Rarely	1708	15.64
Total	10920	100.00
Approximate time to use internet		
> 3hours.	504	4.63
2hours. – 3hours.	602	5.51
1hour. – 2hours.	2002	18.33
30 min. – 1hour.	5110	46.79
< = 30 min.	2702	24.74
Total	10920	100.00
Place of browsing internet		
Home	2464	22.56
Cyber cafes	6832	62.56
Friends place	3206	29.36
Institutions	4508	41.28
Other place	350	3.21

Ever Used Internet

As large as 92.86% have used Internet while 7.14% have not ever used it. Since a vast majority of the respondents have effectively utilized Internet at least once, one could be optimistic about the potential for its growth in the future educational efforts (Table 4). Internet could be accessed at ones' convenient times.

Frequency of Using Internet

It is seen that the usage frequency is widely dispersed, with majority of the users browsing not less than twice a week. Internet usage is unlike that of others. A user is not an owner and is merely allowed access on payment of charges. The frequency of usage could have been influenced most by the interest levels of the respondents followed by the costs involved in using them. 19.36% use Internet everyday in a week, 14.87% use it 4 – 5 days in a week, 21.28% use it 2 – 3 days in a week, 28.85% use it once in a week and 15.64% use Internet rarely as presented in Table 4.

Approximate Time Spent to Use Internet

In using the internet, searching takes a sizeable time. Table 4 reveals that 24.74% use internet approximately for about less than 30 min., while 46.79% use it approximately for about 30 min. – 1hour, 18.33% use it approximately for about 1 – 2 hours, 5.51% use it approximately for about 2 – 3 hours, and 4.63% use it approximately for more than 3hours. The emerging data shows that majority of the respondents have used the net for the optimal time. As the browsing pattern shows that just a small segment comprising of 24% are using it less than 30 minutes, the statistical mode of browsing time is the duration of 31 to 60 minutes. A summary of the analysis on indicators of browsing standards would be that the quantum of browsing within the initial decades of browsing in India could be described as in the right direction. However, the adequacy and quality of browsing would depend on the individual and the connectivity available.

Place of Accessing Internet

Institutional provision of browsing facilities is still in a rudimentary stage. An ideal situation for education related browsing would be before or after the class room sessions, in which case the place of browsing is a significant influence in the benefits of browsing. 22.56% stated that they browse at home as depicted in Table 4. 62.56% stated that they browse at cyber cafes, 29.36% stated they browse at friends places, 41.28% stated that they browse at institutions and 3.21% stated that they browse at other than those places mentioned above.

Purpose of Using Internet

Browsing could be done for different purposes and education is one of them. Table 5 presents the major purposes of usage of the Internet among the student population in Tamilnadu to explain how much share of time online is allocated for education by the respondents.

Table 5: Students according to purpose of using internet

Purpose – internet		Frequency	Percentage
Send mail	No answer	924	8.46
	Rarely	770	7.05
	Sometime	6524	59.74
	Always	2702	24.74
Seek information about education			
	Rarely	1554	14.23
	Sometime	2996	27.44
	Always	4578	41.92
	No answer	1792	16.41
Gather information about study			
	Rarely	1162	10.64
	Sometime	3178	29.10
	Always	4368	40.00
	No answer	2212	20.26
Fun & entertainment			
	Rarely	2142	19.62
	Sometime	3052	27.95
	Always	2996	27.44
	No answer	2730	25.00
Chatting with friends			
	Rarely	2436	22.34
	Sometime	3038	27.86
	Always	2394	21.95
	No answer	3038	27.86

Majority (59.74%) of browsers answered that they use Internet sometimes to send mail and 24.74% use Internet always to send mail (Table 5). With 16.41% having stated that they don't use internet for the purpose of seeking information about education, 41.92% use it always to seek information about education. While 20.26% stated that they don't use for the purpose of gathering information about study, 40% use it always to gather information about study. Whereas 25% stated that they don't use for the purpose of fun and entertainment, 27.44% use always for fun and entertainment, 27.86% stated that they don't use the internet for the purpose of chatting with friends, while 22.34% use rarely for chatting with friends and 21.95% use it always for chatting with friends.

INTERPRETATIVE ANALYSIS ON INTERNET

Frequency of Using Internet

Through the chi-square test there is significant association between mode of study and frequency of using Internet. It is also similar to the association between area of institution and frequency of using internet. This could be understood in the context of unequal spread of internet in India. Frequency of using internet and medium of instruction were also found to be significantly associated. The predominant language medium of the vast majority of web sites would be

English. Further, it was concluded that there is significant association between gender and frequency of using internet. There is significant relationship between course of study and frequency of using internet. It can be concluded that there is significant association between year of study and frequency of using Internet. As years go by, a student tends to be more independent and moves towards a wide range of experiences according to personality theorists like Chris Argyris.

Approximate Time Spent on Internet

There is significant association between mode of study and approximate time spent to use internet. Also there is significant association between area of institution and approximate time spent to use internet. This result could be viewed in relation to the findings of another study described below in which educational media have been found to benefit the rural students than the urban students. Rural students, tested against rural control groups, benefited more than urban students tested against urban control groups as per the writings of Galda & Searle, (1980). The project evaluators hypothesized that radio lessons were particularly effective in raising the level of knowledge of those who knew least, which in this case were the rural students. The findings of the present study could be understood in the light of the earlier finding.

Similarly there is significant association between medium of instruction and approximate time spent on Internet. Approximate time spent to use Internet and course of study were also significantly associated. The analysis resulted in the conclusion that there is significant association between course of study and approximate time spent to use Internet.

A comparative analysis of all the suggestions provided by respondents through their answers to the open ended questions reveals noticeable commonality among the suggestions to the various media, they are the need felt for greater subject-orientation, enhanced exposure to scientific advancements, examination-centered contents, need for user-interface and contribution and the like. As suggestions, the users have provided opinions that more visual, movable content should be available with the facility of interaction. Educational media, when used in classrooms are likely to produce maximum learning then using them elsewhere. This has been the theme of the variables analyzed.

FINDINGS AND CONCLUSION

While data on viewing time suggested that 65.36% watch TV every day a week, 35.71% of those who listen to radio do it everyday a week, only 19.36% of those using internet, do it everyday a week. Majority of the respondents tend to be frequent listeners of radio and TV, while TV has more regular audience than radio.

A vast majority of respondents possess radio sets as well as TV sets. It was found that 37.06% listen to radio for education, 35.08% watch TV for education, while 40% use internet always to gather information about study. Data indicate that home is the place where most of the respondents have been listening to radio, while vast majorities of 86.64% of the students watch TV at home; only 22.56% stated that they browse at home. 41.28% stated that they browse the internet at institutions, whereas only a negligible segment of students use radio and TV at their institutions. Among the less interactive media, 61.62% answered that they need interactive programs in radio, while only 21.86% have answered that interactive programs are needed for educational purpose on TV programs. Majority 66.90% use Internet, which, in comparison to the fact that very few owned computers, is a significant achievement of media planners in higher education.

SUGGESTIONS

Media planners would benefit by basing their interventions based on the comparative standing of various educational media as understood through the viewing patterns presented with the help of the findings of the study. It is suggested that measures be on to improve the viewership, listening frequency, the priority being on the latter, which is found to be the least frequently used educational media among the students in the area of study. Since majority of the respondents have not used any of the media for educational purposes, the top priority is to be given to strengthen the educational usage of the powerful electronic media. Use of electronic media at educational institutions is found to be low. The usage needs to be enhanced in order to facilitate the increased usage of the media for educational purposes, as indicated by the previous suggestion. Creation of awareness among students about educational media should be taken up on a massive scale with a sense of urgency. Local inputs and interaction should be made a regular feature in the educational radio. Programs and contents in regional and locally understood languages should be featured for more duration and frequency than it is being done at present. In order to achieve localization of educational contents of the electronic media, well-equipped media centers carrying out research and producing need based programs should be created in each University. Campus based electronic media systems could be introduced to produce and present programs of specific educational needs.

REFERENCES

Academy for Educational Development (1979). Paraguay using radio for formal education in rural areas. *Academy News, 2*(2), 4*.* Washington, D.C.: Clearinghouse on Development Communication.

Bonk, C. J. & Cunningham, D. J. (1998). Searching for Learner-Centered, Constructivist, and Sociocultural Components of Collaborative Educational Learning Tools. In C. J. Bonk, & K. S. King (Eds.), *Electronic Collaborators: Learner Centered Technologies for Literacy, Apprenticeship, and Discours*e. Mahwah, NJ: Erlbaum.

Chu G.C. and Schramm W. (1967). 'Learning from TV: What the research says'. Washinton, DC: National Association of Educational Broadcasters; Stanford, CA: Institute for Communication Research. (ERIC Document Reproduction Services No.ED914900)

Cooke, T., & Romweber, G. (1977). *Radio nutrition education - Using the advertising techniques to reach rural families: Philippines and Nicaragua.* (Final Report). Washington, D.C.: Manoff International.

Crisell, A. (1994). *Understanding Radio*. Second Edition. New York: Routledge.

Effective Learning (2004). *A practical guide for open and distance learners - IGNOU -* Delhi 2004.

Faulder, D. (March 1984). Learning on air. *Media in Education and Development, 7*(1), 36-39.

Galda, K. (March 1984). Learning Maths by radio. *Media in Education and Development, 17* (1), 40-42.

Garland V. and Loranger. A. (1995-96), 'The medium and the message: Interactive TV and Distance Education Programs For Adult Learners', Educational Technology Systems (24), pp. 249-257

Ginsburg, M.B., & Arias-Goding, B. (February 1984). Nonformal education and social reproduction/transformation: educational radio in Mexico. *Comparative Education Review, 28*(1), 116- 127.

Jaiswal, Kiran; Goel (1991), 'Improving Countrywide Classroom Programmes', University News.

Kulik and Kulik (1991), 'Effectiveness of computer-based instruction: An updated analysis', Computer in Human Behavior, 7, 75-94.

Mason, R. (1994). *Using Communications Media in Open and Flexible Learning*. London: Kogan Page.

McLeish, R. (1999). *Radio Production: A Manual for Broadcasters*. Fourth Edition. Oxford: Planta Tree.

Mohanty, J. & Rath, A., (1990) Country wide classroom TV programmes, An Appraisal study, University News.

Moore, P. E. & Tait, A. (Eds) (2002). *Open and Distance Learning: Trends, Policy and Strategy Considerations*. Paris: Unesco.

Picciano, A. G. (2002). *Educational Leadership and Planning for Technology*. Third Edition. Columbus, OH: Upper Saddle River.

Ranganathan Y (2002), 'Information Based Education in Rural Schools' (P-134 to 136) References (P-142) ICCD 2002, February 6, 2002, Chennai, India.

Reddi, U.V., (1994) *Electronic Media in Education: An Indian Scenario*; Osmania University Journal of Higher Education.

Resta, P. (Ed.) (2002). *Information and Communication Technologies in Teacher Education: A Planning Guide*. Paris: Unesco.

Rowntree, D. (1994). *Teaching with Audio in Open and Distance Learning*. London, UK: Kogan page.

Saiprasad, A. (1991) *National Talk back Experiment* 1991: Final Report, New Delhi : University Grants Commission.

Saiprasad, A., Using Electronic Media and Information Technology, March 2001, EMRC Report, Hyderabad.

Shears, A.E. (1984). Development of management courses for the agriculture sector in Nigeria. *Programmed Learning and Educational Tehcnology, 21*(2), 88-94.

Singhal and Rogers (2001), India's communication revolution – from bullock carts to cyber marts. Sage Publications 2001.

Statistical handbook (2005), Department of Economics and Statistics, Government of Tamilnadu.

White, R. (1976). *An alternative pattern of basic education: Radio Santa Maria.* Paris: Unesco.

Worthen B.R. and Van Dusen L.M. and Sailor P.J. (1994), 'A comparative study of the impact of integrated learning systems on students', time-on-task. International Journal of Educational Research, 21(1), 25-37.

Yadava J.S. (March 2000), 'An Indian perspective, communication of development', Communicator - Oct. - Dec. 1999 - January - March 2000.

Original article at: http://ijedict.dec.uwi.edu//viewarticle.php?id=239&layout=html

Rural schools as regional centres of e-learning and the management of digital knowledge: The case of Newfoundland and Labrador

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ABSTRACT

Small schools in rural Canadian communities have had a special role in the development of e-learning and the management of digital knowledge within customized electronic educational structures. In the provision of education to learners in dispersed sites, particularly for those in small schools in rural communities, the school district digital intranet provides a new educational environment that complements and extends traditional schools. Within this digital structure, new processes, including pedagogical considerations that shape e-teaching, have to be considered. The school district digital intranet challenges the traditional educational practice of teachers and learners interacting in closed learning environments and encourages them to consider the possibilities of engaging in open classrooms that are compatible with a knowledge-based economy.

Keywords: Newfoundland and Labrador; Canada; rural education; e-learning;

INTRODUCTION

It could be argued that a new rural education has developed in Canada over the last decade, based on acceptance of e-learning and virtual classrooms (Stevens and Stewart, 2005). Within the new rural education schools have become regional centres for the management of digital knowledge through which they challenge notions of distance, isolation and rurality. It could be further argued that small schools in rural communities have become templates for other schools through their acceptance of modern educational technologies, collaborative teaching and learning and the integration of onsite and online instruction. Schools that have traditionally been considered small in size, based on the number of students that attend, in person, on a daily basis, have, become, to an increasing extent, large educational institutions when the number of students who attend classes virtually is considered.

Over the last decade the introduction of inter-school electronic networks has added a new dimension to education in Canada that is challenging teachers, learners and administrators. Schools in geographically-isolated communities that have traditionally faced difficulty providing instruction to small numbers of senior students, particularly in specialized areas of the curriculum such as science and foreign languages, can now complement on-site classes with specialized on-line teaching and learning. Many rural Canadian schools have been transformed as virtual classes are integrated with traditional, physical learning spaces.

EDUCATION IN NEWFOUNDLAND AND LABRADOR

With the decline in the provincial fishing industry that has always been the main economic activity in Newfoundland and Labrador's coastal communities, rural schools have become steadily smaller in size as shown in the following table.
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Table 1: Number of Schools By School District 2000-01to 2005-06 *

School District	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Labrador	19	19	19	16	16	16
Western	92	89	85	82	82	79
Nova Central	80	79	79	75	75	70
Eastern	140	134	129	127	125	124
Conseil scolaire francophone provincial	6	5	5	5	5	5
Total	337	326	317	305	303	294

* Department of Education of Newfoundland and Labrador (2006) *Education Statistics – Elementary - Secondary 2005-2006 School Information*

A Decade of E-Learning in Small Schools in Rural Communities

During the last decade a pan-Canadian initiative to prepare people across the country for the Information Age (Information Highway Advisory Council,1997; Ertl and Plante, 2004) has provided impetus for the classroom application of emerging technologies. In rural Atlantic Canada the introduction of the internet and internet-based technologies has had a transforming effect on the capacity of small schools to deliver programs (Healey and Stevens, 2002; Stevens, 2001; 1999a). In other developed countries with substantial rural populations to be educated there have also been major changes in the configuration of small schools in isolated communities. In New Zealand (Stevens, 2000; 1999b), Finland (Tella, 1995), Iceland (Stevens, 2002), Russia (Stevens et al, 1999) and the USA (Dorniden, 2005; Glick, 2005; Schrum, 2005) a variety of communication technologies have been engaged to promote educational opportunities for students and more efficient ways of organizing and managing knowledge in collaborative electronic structures that have implications for regional economies.

The rapid growth and educational application of the Internet has led to a challenge to traditional ways of teaching and learning at a distance (Ben-Jacob et al, 2000) that were based on paper and the postal system. E-Learning is Internet-based and does not require the degree of central control that distance educators have traditionally employed within dedicated institutions. The growth of e-learning in schools has led to pedagogical considerations and to the development of new ways of managing knowledge that enable these institutions to assume extended roles in the regions they serve.

In the last decade two e-learning developments have changed the nature of education in rural Newfoundland and Labrador: (i) the introduction of the opportunity to study online from schools located in remote communities and (ii) the possibility of enrolment in Advanced Placement (AP) courses from rural schools.

Change One: The Opportunity to Study Online in Rural Canadian Schools

As rural schools decline in physical size their viability is often questioned by educational policy makers. The introduction of e-Learning in schools in Canada, as in other developed countries, has been particularly noticeable in rural communities and has been influenced by declining enrolments. The Department of Education of Newfoundland and Labrador (2006) distinguishes between urban and rural on the criterion that cities, towns and metropolitan areas with a population of over 5000 are urban and all other settlements are rural. Table 2 shows a large

proportion of schools in three of the five provincial school districts of Newfoundland and Labrador are classified as rural.

Table 2: *Urban and Rural Enrolment and Schools by School District 2005-06* *

Social District	Urban				Rural				Total Schools	Total Enrolment
	Schools	% Schools	Enrolment	% Enrolment	Schools	% Schools	Enrolment	% Enrolment		
Labrador	6	37.5	2,968	68.7	10	62.5	1,351	31.3	16	4,319
Western	15	19.0	5,685	39.7	64	81.0	8,624	60.3	79	14,309
Nova Central	12	17.1	4,766	34.0	58	82.9	9,246	66.0	70	14.012
Eastern	66	53.2	30,789	70.1	58	46.8	13,131	29.9	124	43,920
Conseil scolaire francophone provincial	3	60.0	83	40.9	2	40.0	120	59.1	6	203
Province	102	34.7	44,291	57.7	192	65.3	32,472	42.3	294	76,763

* Department of Education of Newfoundland and Labrador (2006) *Education Statistics – Elementary - Secondary 2005-2006 School Information*

The search for appropriate new educational structures for the delivery of education to students in rural Newfoundland and Labrador has led to the development of school district digital intranets, within which virtual classes have been organized. In the process of developing e-teaching within school district digital Intranets, several challenges have had to be met. The electronic linking of eight sites within the Vista school district (now part of the Western School District) to collaborate in the teaching of AP Biology, Chemistry, Mathematics and Physics created a series of open classes in rural Newfoundland that became known as the Vista School District Digital Intranet. The creation of the Vista School District Digital Intranet was an attempt to use information and communication technologies to provide geographically-isolated students with extended educational and, indirectly, vocational opportunities. The development of the digital intranet within a single school district involved the introduction of an open teaching and learning structure to a closed one. Accordingly, adjustments had to be made in each participating site so that administratively and academically, AP classes could be taught. The Vista school district initiative challenged the notion that senior students in small schools have to leave home to complete their education at larger schools in urban areas. By participating in open classes in real (synchronous) time, combined with a measure of independent (asynchronous) learning, senior students were able to interact with one another through audio, video and electronic whiteboards. From time to time they met for social occasions and to engage with their science teachers in person.

Change Two: Advanced Placement Courses for E-Learners in Rural Canadian Schools

Advanced Placement (AP) courses enable senior students to begin undergraduate degrees with part of their program completed from high school if their AP courses are passed at grade levels specified by the universities of their choice. The development of Advanced Placement web-based

courses in Biology, Chemistry, Mathematics and Physics took place within a team in each subject area. A lead science teacher in each discipline was paired with a recent graduate in each of the disciplines of Biology, Chemistry, Mathematics and Physics who possessed advanced computer skills including web page design, Java and HTML. The lead teacher and the graduate assistant were advised from time to time by Faculty of Education specialists at Memorial University of Newfoundland in each curriculum area and, where possible, scientists from the Faculty of Science. The extent to which each web-based course was developed by a team of four people varied. Most course development took place through interaction between lead teachers and the recent graduates. Although at times professors had different opinions as to the most appropriate approach to the design of the courses, this model enabled the four courses to be developed over a sixteen-week summer recess period in time for the new school year. Minimum specifications were adopted for computer hardware and network connectivity. All schools involved in the project had DirecPC satellite dishes installed to provide a high- speed down-link. In most rural communities in this part of Canada, digital telecommunications infrastructures do not enable schools to have a high-speed up-link to the internet. Appropriate software had to be identified and evaluated for both the development of the resources and the delivery of instruction within the Intranet. Front Page 98 was selected as the software package. Additional software was used for the development of images, animated gifs and other dimensions of course development. These included Snagit32, Gif Construction Set, Real Video, and similar packages. Many software packages were evaluated and finally WebCT was selected. This package enabled the instructor to track student progress, it contained online testing and evaluation, private E-mail, a calendar feature, public bulletin board for use by both instructor and student, a link to lessons and chat rooms for communication between teacher and student. For real - time instruction, Meeting Point and Microsoft NetMeeting were selected. This combination of software enabled a teacher to present real-time interactive instruction to multiple sites. An orientation session was provided for students in June, prior to the implementation of this project in September. Students had to learn how to communicate with each other and with their instructor using these new technologies before classes could begin.

In eight schools within the rural Vista school district of Newfoundland and Labrador, 55 students were enrolled in AP Biology, Chemistry, Mathematics and Physics courses. While AP courses are a well-established feature of senior secondary education in the United States and Canada, it was unusual for students to be able to enrol for instruction at this level in small schools in remote communities. The advanced nature of these courses requires highly qualified and experienced teachers who are often difficult to attract and retain in small schools in rural communities. Furthermore, small rural schools, because of their size, have few students who are able to undertake instruction at this level. This initiative was significant for rural Canadian education in that it was, as far as can be ascertained, the first time courses at this level were delivered to students who would otherwise not have had access to them because of the size and location of their schools. By introducing AP subjects to small schools in a remote region of Canada, a step was taken toward inclusion of rural people in the emerging knowledge economy. Several graduates of this program were subsequently able to enrol in science and engineering faculties at the local university with a small part of their post-secondary program already completed. Perhaps, more importantly, they entered universities with the knowledge that they could successfully compete academically with students anywhere in North America.

From Closed to Open Teaching and Learning Environments at the Regional Level

The major change for students in the first Digital Intranet in Newfoundland and Labrador was the opportunity to study advanced science subjects and mathematics as members of open classes from their small, remote communities. Students in the Vista school district digital intranet were frequently subject to scrutiny by their peers as they responded to one another through chat-

rooms, audio and video as well as with their AP on-line teacher. The digital intranet provided students with access to multiple sites simultaneously, as well as the opportunity to work independently of a teacher for part of the day. The need to prepare for classes before going on-line became increasingly apparent to both teachers and students if the open, synchronous, science classes were to succeed.

The advent of the digital intranet had implications for students who began to interact with teachers and their peers in a variety of new ways. Many students experienced difficulty expressing themselves and, in particular, asking questions in open electronic classes when they did not know their peers from other small communities. The organization of social occasions for students learning science in open classes in the Intranet helped overcome these problems. As students became more comfortable with one another, inhibitions such as asking questions on-line were overcome. In future, interaction will be both synchronous and asynchronous. The e-teachers had little to guide their practice in teaching at this level for the first time. Each of the four AP science subjects was taught in a different way. For example, the physics and mathematics teachers had little need for video in their interactions with students, but access to electronic whiteboards was critical so that the development of equations and calculations could be managed interactively. For the e-teacher of chemistry experimental work posed a problem because of the dispersed locations of the students. Videos of experiments that were to be conducted in person, at designated sites and pre-arranged times, were found to be useful in preparing students for the laboratory component of the AP course.

In an evaluation of the Advanced Placement experiment rural students commented:
>*"I have been introduced to one of the best teachers I have ever had;"*

This is a significant comment, made by a student about an on-line teacher who was only known at a distance. The highly-esteemed teacher would not have been encountered by this student had it not been for the AP online development. This comment illustrates the possibility of providing rural students with expertise from other than local sources.

Students in the first year of online AP courses in the rural Canadian network were critical of the technical and organizational problems that were encountered. One student noted:
>*"I think these courses are valuable, but there was much confusion early in the year;"*

Other members of the class were critical of the delivery of AP courses within the initial network:
>*"The intranet is unreliable when communicating between numerous sites. There are some slow connections;"*
>*"More use of video would help so that we can see the teacher."*

The experience of working at post-secondary school level through Advanced Placement courses was not, until this development, available to students in small, rural high schools. The intellectual challenge for university-bound students was considered to be useful. One student advised:
>*"If you are planning on doing post-secondary education, do one of these (AP) courses;"*

Another student reported at the end of the school year:
>*"This course has exceeded all my expectations - I believe I have passed;"*

In the process of developing e-teaching and e-learning within digital intranets in rural Newfoundland and Labrador, teachers, learners and administrators had to adapt to a new, electronic educational structure. In the open teaching and learning environment of a digital intranet, participating institutions academically and administratively interfaced for that part of the school day during which classes were taught. This was, for teachers and administrators, a very different educational structure from the traditional and, by comparison, closed educational

environment of the autonomous school with its own teachers and its own students. There was potential conflict between the local school as an autonomous educational institution serving a designated area and schools which become, in effect, sites within electronic teaching and learning networks that, in effect, began to serve a region. Principals and teachers appointed to the closed, autonomous learning environments of traditional schools frequently discovered that the administration of knowledge required the development of open structures within which they were increasingly expected to collaborate with their peers located on a range of distant sites. Many discovered that the positions to which they were appointed in traditional (closed) schools became, in effect, locations within new (open) electronic schools.

The need for increased technical support (Asher, 2005) for the new, open structure became increasingly urgent for teachers and students who were using information and communication technologies to teach and learn across dispersed sites. Both had to be provided with expert advice and instruction in the use of new applications. A particular problem that emerged was difficulty in securing and maintaining instructional design expertise in the preparation and upgrading of courses, although this issue is common in the development of on line courses at high school level (Sweeney, 2005). An essential aspect of the development of open electronic classes was the coordination of both hardware and software between schools. Without synchronized technology, schools cannot fully participate in electronic networks. However, the purchase of appropriate hardware and software was initially a matter of confusion for many Principals, teachers and school boards who had to seek expert advice and support. Many rural schools with open electronic classes realized that the successful administration of a network required shared local technical support. Unless adequate technical support systems could be established, electronic networked classes could, potentially, be curtailed by teachers who argued, with justification, that there was insufficient technical support for their investment in e-learning. While there were doubts by some teachers and administrators about the adequacy and robustness of the technology that was available, the solutions that were sought and the infrastructure that was implemented were at the regional rather than local school district level.

The changes that took place in the closed learning spaces of traditional rural schools in Newfoundland and Labrador with the introduction of a digital intranet and AP instruction online led to a ministerial inquiry into the implications of these developments for the future of rural education in the province. The provincial government, after a ministerial inquiry (Government of Newfoundland and Labrador, 2000) expanded the linking of schools through the creation of the Centre for Distance Learning and Innovation (CDLI) within the Newfoundland and Labrador Department of Education. CDLI (http://www.cdli.ca/) develops and administers online learning that complements traditional classes in schools throughout the province. Since its inception it has considerably extended e-learning throughout Newfoundland and Labrador.

PEDAGOGY FOR E-LEARNING

Pedagogy includes "the complexity of relational, personal, moral and emotional, aspects of teachers' everyday acting with children or young people they teach." (Van Manen, 2002). Teaching in classrooms that are electronically linked to other sites requires different lesson preparation and delivery skills from teaching face to face. For teacher – student interaction in a new electronic structure to be effective, the strengths and weaknesses of the new regional environment have to be understood by everyone who participates. Audio-graphic networking has in the recent past provided schools participating in regional electronic networks with a simple and flexible way of accommodating the diverse needs of learners. Although open Internet-based classrooms may not suit the needs of all students, they provide rural schools with choice in the way they can access educational and, in particular, curriculum opportunities. The student's need to concentrate on the audio lesson to fully participate in it when conducted in an open electronic

class between several sites was noted by several participating schools in earlier research in New Zealand (Stevens, 1994). Students cannot anticipate when they will be asked a question over the audio network, something that encourages preparation for classes conducted with teachers and peers who are not physically present (Stevens, 1998).

Students often have more independence in managing their learning in open electronic classes but most have to be assisted by teachers in the setting of goals, the meeting of deadlines and in evaluating their progress. Teachers are effective in open electronic classes if they can be flexible in ways they enable students to participate in on-line lessons. Strategies and protocols for on-line teaching have to be developed between participating schools if all students are to be able to fully participate. The introduction of a rural school to an open electronic network considerably improves its resource base for both teachers and learners but does not solve all of its problems. A considerable measure of inter-institutional and intra-institutional cooperation is required to develop detailed and effective plans for collaboration. Two new educational professionals have emerged in Newfoundland and Labrador since the Ministerial Inquiry (Government of Newfoundland and Labrador, 2000): e-teachers and m-teachers. E-teachers teach classes across a growing range of dispersed sites through the internet, administered by CDLI. These teachers were initially supported on the sites (or rural schools) within which they provided instruction from a distance by mediating teachers (m-teachers). M-teachers were usually traditional classroom teachers, providing instruction face to face in small schools in rural parts of the province. They liaised with e-teachers about issues on-site that e-learners faced in their courses. Subsequently m-teachers were replaced by m-teams through which on-site technical, pedagogical and personal support was provided. In some rural Newfoundland and Labrador high schools that receive e-learning through CDLI, the Principal and all teachers are the m-team that support both e-teachers and their students.

There are several immediate pedagogical challenges to be considered for effective teaching in a Digital Intranet: Teaching face-to-face and on-line are different skills and teachers have to learn to teach from one site to another. This is fundamental to the success of e-teaching. Teachers have to learn to teach collaboratively with colleagues from multiple sites and have to judge when it is appropriate to teach on-line and when it is appropriate to teach students in traditional face-to-face ways. These judgments have to be defended on the basis of sound pedagogy.

CONCLUSION

The introduction of e-learning at the K-12 level has provided teachers, administrators and, most of all, students with extended teaching and learning options (Dell, 2005; Hawkes and Halverson, 2002). In rural Newfoundland and Labrador a new type of rural education has emerged. An open model now challenges the closed model of schooling by questioning the need for appointing all teachers to schools, rather than to networks of schools. It questions the appropriateness of learners engaging solely with their peers within their own, physical classrooms, and, it questions the notion of the school as an autonomous institution. Awareness that the school is potentially a site within an extended electronic network that can function at the regional rather than local level has economic implications. The school district digital intranet's economic contribution to Atlantic Canada is its demonstration that local intellectual resources can be shared between sites enabling collaborating institutions to provide opportunities for students that would not otherwise be available to them. By developing collaborative pedagogy between electronically integrated learning institutions, small schools in Atlantic Canada have contributed to the regional knowledge economy by providing a template for other sparsely-populated areas of the country, facilitating their participation in a knowledge-based economy.

REFERENCES

Asher, G. (2005) Inadequate Infrastructure and the Infusion of Technology into K-12 Education, in Howard, C., Boettcher, J.V., Justice, L., Schenk, K., Rogers, P.L and Berg, G.A. (eds) *Encyclopedia of Distance Learning,* Hershey, Idea Group Reference, pp: 1061-1063

Ben-Jacob, MG, Levin, DS and Ben-Jacob, TK (2000) *The Learning Environment of the* 21st Century*, Educational Technology Review*, No.13, pp: 8-12

Dell, Laura A.B.(2005) Connecting K-12 Schools in Higher Education, in Howard, C., Boettcher, J.V., Justice, L., Schenk, K., Rogers, P.L and Berg, G.A. (eds) *Encyclopedia of Distance Learning,* Hershey, Idea Group Reference, pp: 374-378

Department of Education of Newfoundland and Labrador (2006) *Education Statistics – Elementary - Secondary 2005-2006 School Information* http://www.ed.gov.nl.ca/edu/pub/stats05_06/SCH_05_2.PDF

Dorniden, A. (22005) K-12 Schools and Online Learning, in Howard, C., Boettcher, J.V., Justice, L., Schenk, K., Rogers, P.L and Berg, G.A. (eds) *Encyclopedia of Distance Learning,* Hershey, Idea Group Reference, pp: 1182-1188.

Ertl, H. and Plante, J. (2004). *Connectivity and Learning in Canada's Schools*, Ottawa, Statistics Canada, Government of Canada.

Glick, D.B. (2005) K-12 Online Learning Policy, in Howard, C., Boettcher, J.V., Justice,   L., Schenk, K., Rogers, P.L and Berg, G.A. (eds) *Encyclopedia of Distance Learning,* Hershey, Idea Group Reference, pp: 1175-1181.

Government of Newfoundland and Labrador (2000) *Supporting Learning: Report on theMinisterial Panel on Educational Delivery in the Classroom*, St John's, NL, Department of Education

Hawkes, M. and Halverson, P. (2002). Technology Facilitation in the Rural School: An Analysis of Options, *Journal of Research in Rural Education*, 17 (3), 162-170

Healey D and Stevens K (2002*)* Student Access to Information Technology and Perceptions of Future Opportunities in Two Small Labrador Communities *Canadian Journal of Learning and Technology / La Revue Canadienne del'Apprentissage et de la Technologie*, Vol. 28, No. 1, Winter, pp: 7-18

Information Highway Advisory Council (1997) *Preparing Canada for a Digital World*, Ottawa, Industry Canada

Schrum, L. (2005) E-Learning and K-12, , in Howard, C., Boettcher, J.V., Justice, L., Schenk, K., Rogers, P.L and Berg, G.A. (eds) *Encyclopedia of Distance Learning,* Hershey, Idea Group Reference, pp: 737-742

Stevens, K.J. and Stewart, D (2005) *Cybercells – Learning in Actual and Virtual Groups*, Melbourne, Thomson-Dunmore Press.

Stevens, K. (2002) Minnkandi heimur -Rafrænt net smárra skóla- Óvænt tengsl Íslenska menntanetsins við Nýja Sjáland og Kanada, (Making the World Smaller -The Electronic Networking of Small Schools – Some Unseen Connections of the Icelandic Educational

Network in New Zealand and Canada), *Skólavarðan Vol. 2,* No. 2, pp: 22-24 [Icelandic translation by Karl Erlendsson]

Stevens, K (2001) The Development of Digital Intranets for the Enhancement of Education in Rural Communities*, Journal of Interactive Instruction Development,* Vol. 13, No. 3, Winter, pp: 19 - 24

Stevens K (2000) Télé-enseignement et éducation en milieu rural en Nouvelle Zélande et à Terre Neuve*, Géocarrefour - Revue de Geographie de Lyon - Espaces Ruraux et Technologies de L'Information,* Vol. 75, No.1 pp: 87 – 92

Stevens, K J (1999a) *A New Model for Teaching in Rural Communities – The Electronic Organisation of Classes As Intranets,* Prism – Journal of The Newfoundland and Labrador Teachers' Association, Winter, Vol. 6, No 1, pp: 23 – 26

Stevens, K. J. (1999b) Telecommunications Technologies, TeleLearning and the Development of Virtual Classes for Rural New Zealanders *Open Praxis* (1).

Stevens, K, Sandalov A., Sukhareva N., Barry M. and Piper T.(1999) The Development of Open Models for Teaching Physics to Schools in Dispersed Locations in Russia and Canada, In: Valerio Grementieri, Andras Szucs and Vladimir I. Trukhin (eds) *Information and Communication Technologies and Human Resources Development: New Opportunities for European Co-operation*, European Distance Education Network, Budapest, Hungary, October 1999, pp: 148 – 154.

Stevens, K.J. 1998. The Management of Intranets: Some Pedagogical Issues in the Development of TeleLearning, In: A. Higgins (ed) *Best Practice, Research and Diversity in Open and Distance Learning,* Distance Education Association of New Zealand, Rotorua, New Zealand, pp: 279 – 286.

Stevens, K.J. 1994. Some Applications of Distance Education Technologies and Pedagogies in Rural Schools in New Zealand, *Distance Education* 15 (4)

Sweeney, C. (2005) Critical Barriers to Technology in K-12 Education, in Howard, C., Boettcher, J.V., Justice, L., Schenk, K., Rogers, P.L and Berg, G.A. (eds) *Encyclopedia of Distance Learning,* Hershey, Idea Group Reference, pp: 481-482.

Van Manen, M. (2002) The Pedagogical Task of Teaching, *Teaching and Teacher Education* Vol. 18 (2), pp 135-138

Tella S (1995) *Virtual School in a Networking Learning Environment,* Helsinki, University of Helsinki, Department of Teacher Education

Community content sharing: Towards telecentre's Lab to Land approach

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ABSTRACT

Capturing and sharing of local content and keeping within the need of the community is an essential step towards people's participation in the developmental process. Information Communication Technologies have tremendous potential to preserve and share indigenous knowledge, which can enhance people's opportunities and be a major source of empowerment – especially for the socially and economically backward. This is an approach paper focussed on the process of socio-economic empowerment of rural communities by integrating responsive and localised Information Communication Technologies in their lives. The methodology of "lab to land" adopted by the ICT R&T Centre is well accepted by the farmers and women who are using ECKO successfully, has been explained elaborately and can be replicated elsewhere by the proponents of the telecentre's approach. Issues of learning, challenges faced and the edge that technology has over other community based management systems have also been highlighted as key learning's for initiatives that propose to take technology to the people.

Keywords: *Information Communication and Technology (ICT); ICT4D; Content Management System (CMS); Content Sharing; Community Development; ECKO; AFARM; Telecentre*

INTRODUCTION

Information sharing and exchange as an ongoing process is the key to sustainable development at the grassroot level. This is largely achieved by encouraging a participatory approach among people and raising their awareness of the different activities within the community. The emergence of Information Communication Technology and access to electronic media has led to new possibilities in development and dissemination of information. Technology plays a vital role in development. But unfortunately, it is the rich that enjoy the benefits of technology. Some societies and some sections of society, advance faster than others and are categorized as the 'haves' and 'have-nots' depending upon their access to resources and their standard of living. This inequity is commonly known as the digital divide. Digital divide is not only limited to the availability and access to technology, but also concerns the issue of adaptability of technology to respond to the needs of diverse societies and people across the world. The digital divide brings problems for developing countries and cultural factors, local needs and language barriers compound these.

ICTs for Development have emerged as ray of hope for those who were until now devoid of all the benefits of computer technology. It can have a dramatic impact on achieving specific social and economic development goals as well as play a key role in the broader national development. The real benefits lie not in the provision of technology per se, but rather in its application to create powerful social and economic networks by dramatically improving communication and the exchange of information. ICTs are already being used effectively to directly address development goals. ICTs promise a society where there is free and faster exchange of information. They allow information to be transferred across distance without face-to-face contact. ICT innovations in one sector will lead to development in other sectors too as the process of development is interlinked and interconnected. The power of ICTs has reached the villages signaling a new dawn of an easier and faster communication access for the rural people (1). Rural Knowledge Connectivity is

a new participatory interactive communication process fostered by putting rural communities themselves "in the driving seat" with facilitators taking the passenger seats.

TAKING TECHNOLOGY TO PEOPLE – EXTENSION STRATEGY

ICT Research and Training Centre (2) of Development Gateway Foundation (3) at CDAC Bangalore adopts a holistic and seamless approach in translating enabled technologies into usable products. It identifies needs and requirements, carries out applied research and development, adapts, customizes and /or localizes suitable existing ICT solutions, pilots developed solutions, establishes support mechanisms for information dissemination and designs and delivers specialized training programs to enable use of solutions.

Recognizing the role of civil society and public sector institutions in providing health, education, agriculture and livelihood services to the rural poor, a multi-stakeholder strategy has been adopted. We have reached out to over 100 organisations across the country through our presentations and demonstrations at individual institutions locations and at national and international conferences. Most organizations evinced interest in deploying one or the other applications.

The Centre, though, was of the opinion that it was necessary for the interested organizations get hands on exposure to the applications of their interest so that they could assess the usability of the applications, be gain confidence about the potential of the ICTs in catalyzing rural development and make a judicious decision about deployment of applications at their project locations. The opportunity to interact with the activists would also provide the technology development team at the Centre with an opportunity to understand grassroots issues. This learning is critical for developing responsive and usable applications for a developing country like India.

It was decided, therefore, to organize a series of workshops focusing on the theme of "Responding to the Needs of Rural India". 80 representatives from 36 organizations (government and non government) from 10 different states participated in four workshops conducted in the early 2005. Each workshop was customized in keeping with the interest of the participating organizations and the computer proficiency of the participants. Although sessions in most of the workshops were conducted in English but local languages were used extensively to ensure that each participant could participate effectively. Some workshops were also conducted exclusively in the local language at the request of the participants.

The workshops were an overwhelming success and based on the demand, software applications were deployed at eight locations in seven states in the country. These places are Pune and Latur in Maharashtra, Madurai in Tamilnadu, Pondichery, Eluru in Andhra Pradesh, Kutch in Gujarat, Alwar in Rajasthan and Bhubaneswar in Orissa. Although the lack of basic infrastructure such as electricity and telecommunications limit the widespread usage of ICT applications in the rural areas but the feedback so far we got from end users were very enthusiastic.

ECKO (4) (Empowering Community Through Knowledge) the content management system, developed by the Centre has been deployed at all these project sites. It is a framework for building and nurturing E-communities. It provides a platform for creating, using, and sharing information among the members of e-communities. ECKO captures information from various sources and provides it to the users in an easy-to-use and understandable format. This information is then used to build knowledge repositories across various domains and would help in making useful inferences (5).

ECKO has been deployed at AFARM (6), an association of Voluntary Organizations in Marathwada region of Maharasthra on pilot basis. Action for Agricultural Renewal in Maharashtra (AFARM) is an association of voluntary organisations working in the field of Rural Development. AFARM was born out of an acute need for an apex institution to co-ordinate efforts of voluntary organizations, in their tasks of providing drinking water and agricultural extension services to villages in drought affected Maharasthra. The main focus of AFARM's work is to assist and strengthen the capacity of voluntary organisations and their workers and through them enhance the effectiveness of the voluntary sector. AFARM today provides a forum for interaction amongst its members, and for interaction between its members and other funding and developmental organisations including the Government, for all round development of society.

SOFTWARE APPLICATION - FROM LAB TO LAND

We follow a multi-pronged strategy to realize its goal of bridging the digital divide. We actively promote the ICT solutions, deliver specialized training programs to build capacity of users to use the solutions, pilot test the solutions developed at the Centre in selected areas and critically study the usability, effectiveness and impact of these solutions.

The steps we go through while taking technology to the people are outlined below and illustrated with a schematic diagram:

- *Need assessment*: Identify the need of the community in order to develop a framework, which can be fulfilled by using ICT applications.
- *Organization selection:* Selecting Organisations having interest in ICT sector.
- *Visiting organization/agencies for holding discussion and presentation*: Extensive outreach to reach out to interested development organizations (Gov., NGOs, etc.) who are eager to use ICTs as a tool for development. Showcasing our products at these one to one forums to understand their interest before bringing them to a common platform.
- *Conducting Workshops at the Lab*: Interested organizations participate for knowledge sharing and partnership building.
- *Deploy the suitable product:* The application is deployed at the project location based on the requirement of the organisation, and hands on training of trainers (TOT) program is provided, conducted for organizational team.
- *Feedback, Monitoring and Evaluation:* To study the effectiveness, usability of the applications and ensure that this learning feds into development of technologies and programming for deployment.

The approach is being explained in detail in Figure 1:
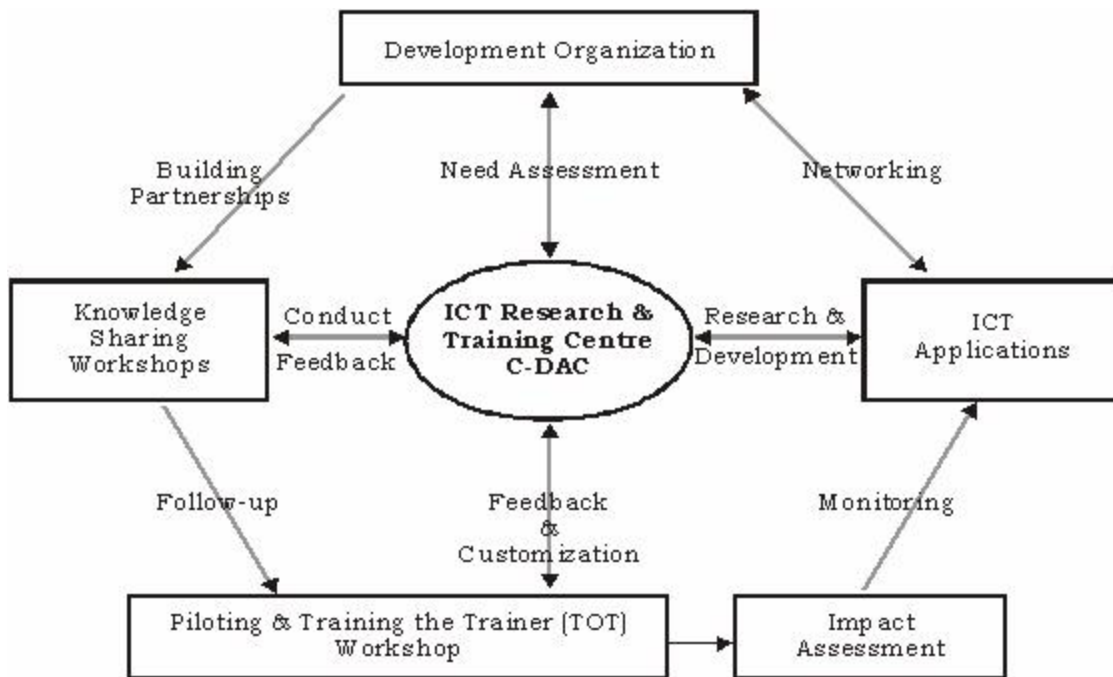
Figure 1: *The multi-pronged strategy of C-DAC*

AN EXPERIMENT WITH AFARM: CONTENT SHARING WITH COMMUNITY BASED CMS

The ECKO application was deployed in the AFARM at their head office in Pune where participants were given training on:

- Installation of the ECKO;
- Exposure as well as hands on training on ECKO and preparing them for trainer of trainers (TOT);
- Planning strategy for effective usage of application by the rural people.

Apart from AFARM functionaries associated with ICT activity, participants from different networking organizations participated in the workshop. Some participants from AFARM's Marathwada Regional Training Centre at Latur also attended this workshop and subsequently took the initiative to make use of this application for their farmers. At the Latur office, they see unique avenues in using ECKO to empower rural communities through knowledge sharing. Additionally, the AFARM head office at Pune recognizes the wide scope of this application in communicating and disseminating information among the partner organizations.

Figure 2: Model showing usages of ECKO in AFARM

1.   Involvement of AFARM at Organizational Level

Coordination and networking is an essential ingredient to achieve the common objective and achieve unity of action. One of the major objectives of AFARM is to effect and promote co-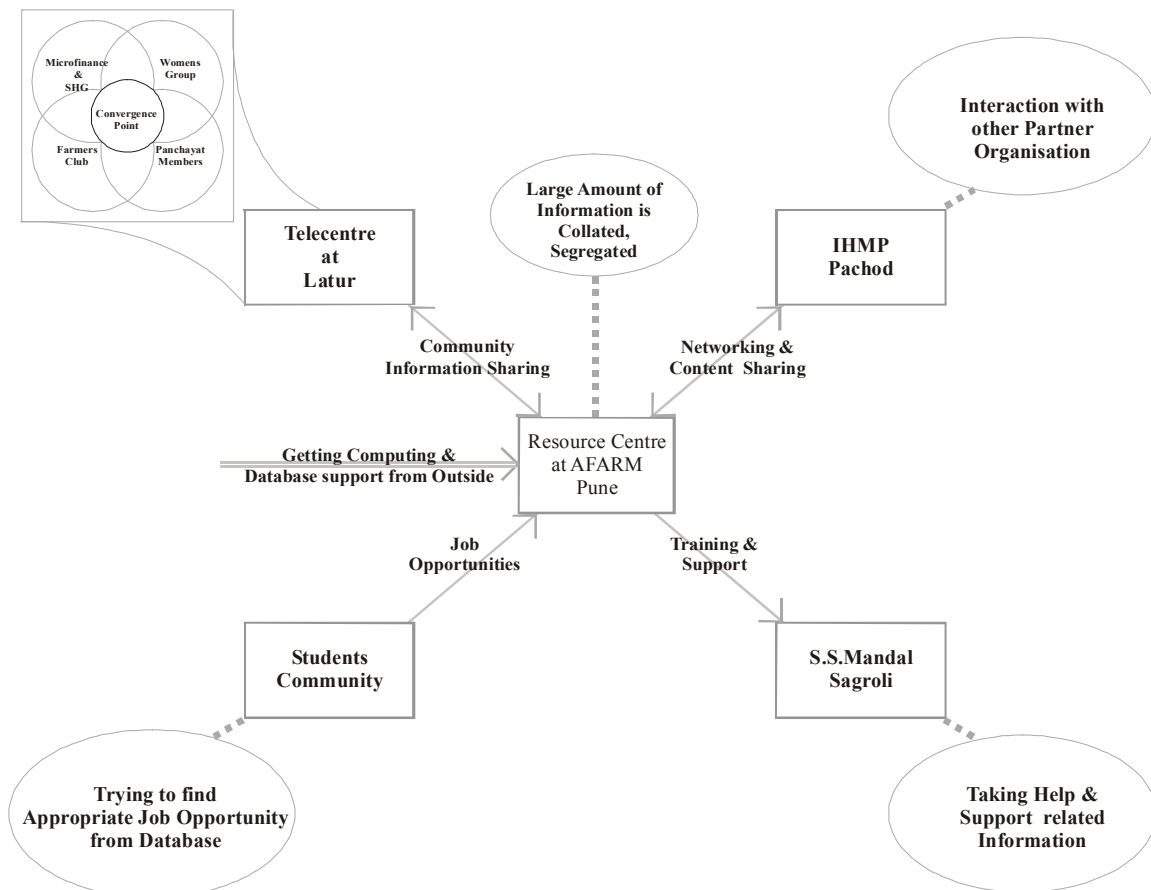ordination of the programs of voluntary agencies with the plans of the Government. To fulfill this, initially AFARM used conventional media for communication such as letter, phone etc., which was time consuming as well as costly. Now after the deployment of ECKO they are using its different services for their networking purposes (transfer of information and knowledge through ECKO). Initially they started the communication with few organizations using ECKO services on a pilot basis to see its impact. They put some statistical data and research reports related to agriculture, which were useful to all the organizations. In order to add viewers, they circulated information regarding the ECKO website (7) to their associate organizations in the state through letters and their newsletter. Almost 800 Voluntary Organizations were informed regarding this site and invited to post content on ECKO. But the response was not satisfactory. This was primarily because of non-availability of ICT tools, fear of ICTs, lack of infrastructure, lack of access to ICT and lack of financial resources.   AFARM now also hosts its regular newsletter on ECKO. This has reduces the postal, and courier charge. Presently they are trying to incorporate the services through ECKO to provide:

- A forum for consultation amongst Government departments, agricultural and development institutions, voluntary agencies, farmers and other sections of the community.

- A forum for necessary research support, to obtain information for sound planning of projects of voluntary agencies and to collect and disseminate the information to all interested parties.
- A forum for promoting, maintaining and improving voluntary agencies; to provide financial or any other assistance to individuals, groups, societies, associations, institutions or voluntary agencies having similar objective as those of AFARM.
- Information to provide technical support to voluntary agencies for soil survey, civil work and other areas of specialist inputs.
- A training manual on technical aspects of Natural Resources, Management of voluntary agencies, Development of women, tribals and nomads, etc. with a thrust on education, economic and social development through their participation.

2. Involvement of AFARM at the Community Level

Involvement of the community at the planning, execution and management stage of the network creates faith among the diverse sections of the community The Marathwada Regional Training Centre, Latur team of AFARM is working with the groups of farmers who have adopted Organic Farming and are practicing all its techniques. The program focuses on propagating the concept of low input agriculture practices. The program was initiated by AFARM three years ago. The farmers from the adjoining 43 villages to the AFARM Latur Center, started participating in the said program. During the same time AFARM was also recognized as Sendriya Shethi Mitra Va Margadarshak Sanstha by the Government of Maharasthra. The acknowledgment gained from the Government resulted in planned efforts in bringing the farmers in to the organic farming practices.

Some of the farmers in this region were well versed with Organic Farming and were practicing it successfully through their well established traditional and indigenous knowledge. The output of these practices were positive and can be replicated in other places also. But the lack of medium for information dissemination was the main hindrance, so that other farmers who were geographically separated were not aware at all to use these good practices. ECKO provide a platform for information dissemination, where these established practices were collated and put for other's to take benefit out of it.

In the beginning, the farmers who were trained in the workshop, started with uploading information in ECKO collected through the daily newspapers, periodicals & books regarding organic farming, agriculture related policies, programme implemented, exhibitions etc. After some time when they gained confidence in operating ECKO's, they shifted to uploading of the photographs related to agriculture. In the mean time, the partner organizations, who were previously only visiting ECKO for information began to upload information on ECKO to be used more effectively. AFARM's major concern was that a larger number on individuals and organisations should visit and take benefit of this site.

AFARM began discussions on strategies to enhance use of ECKO. At the end of year 2005, they zeroed in on their first group of community users- the farmers participating in the organic farming program. Farmers associated with the organic farming program were coming regularly to the Regional Center to attend meetings, training programs and other activities. On an average 5000 farmers are associated with the Organic Farming Program, and 100 farmers visit the center regularly on a monthly basis for different kinds of assistance, guidance & services etc. These farmers involved in organic farming for the last three years, are now exploring markets for their products locally and globally.

The farmers were introduced to the program of ECKO. In the initial stage the farmers were reluctant to use the tool, as they had no knowledge about it and also had fear in their minds.

Shortly they started collecting information from ECKO on a regular basis. They also shared their experiences and requested the AFARM team to upload this information. Presently the viewers of the said site are around 5000 farmers. Their limitation is they lack access to ICT in their local areas. There are also women farmers who view this site whenever they come to the training center for trainings and workshops. In order to make the farmers familiar with the ICT tools, AFARM is planning to conduct some short trainings for them, which will raise their confidence and build their skills. The challenge before them is to increase their faith in ICT and make maximum usage of prospects prevailing in the sector for harvesting excellent profits and most updated knowledge aspiring at empowering the rural communities.

The Marathwada Regional Training Centre, AFARM is also conducting a training program with Marathmoli, Maharashtra women's action net to harnessing ICTs to develop the capacity of the Mahila Vyaspeeth- Women's Forum of women led community based organizations (CBOs). This six program series has been conceptualized as a Foundational Training of Trainers program. 15 women grassroot leaders from 3 districts of Marathwada are participating in the program, which is now in its final leg. The women have built skills not only in using programs like word processing and paint but have also become proficient in sending and receiving mail. AFARM utilised BharateeyaOO, the local language open source based office suite in Marathi developed at ICT R &T, CDAC to train the women in the basic computing skills. AFARM has also used the closed group communication program of ECKO in opening email accounts for the participants. The Centre has also developed a customized version of ECKO responding to the specific concerns of women's organizations. Participants will be trained to use this customized version of to upload data in the final session in November 2006. It is proposed that the in the second phase staring 2007, this training program will be conducted at the village level with the current participants leading as trainers. The success of the program can be measured from this indicator of confidence that the participants have gained in assuming leadership to upscale the program at the grassroots level. AFARM is now looking for financial, technical and capital support to take this program to the villages.

3. Involvement of AFARM to provide Job Opportunity to Unemployed Youth

Voluntary Organisations associated with the AFARM were in need of committed, well-educated and experienced candidates for their organisations. Students looking for job opportunities in the developmental sector were also approaching AFARM for it. Being the interface for both the requirements, AFARM decided to take one step further in using ICT applications towards building the careers of the unemployed youth. They have begun uploading resumes of candidates interested in working with the voluntary organizations while using one of the services of ECKO. The associated members (Voluntary Organisations) of the AFARM, after viewing the resume of the applicants from ECKO call suitable candidates for the interviews and finally make their selection.

CONCLUSION

We have been conducting experiments at few locations with actual users and with different software tools. It has been largely a good experience and yielding results. Even though the stage is not yet set for expansion. Here we would like to share some of the learning and challenges we faced and edge of technology over other models from this experiments:

1. Learning

- It is very important to draw specific requirements at the community level and not from individuals or individual cases.

- The usability study should be taken up right from the requirement gathering stage and it should be prepared for design changes for necessary adaptation at any stage in the operations.
- Keep the system quite open and make sure the systems helps flow more money into the process than flowing out of it. This is very essential to ensure accelerated sustainability of the systems.
- It is very essential to draw experts (skilled resources) from the local community so that the problems and issues are well understood during the usage of the system and execution of the project. It may be a very good idea to build such team in the locality during the initial stages of the project so that the team could be a part of the over all project.
- We should empower the local community with all the tools and skills at the user level so that they themselves will be able to find solutions to the problems encountered during the operation and usage of the system. This is extremely important for the ownership of the system by the community. This makes the system more and more user friendly.

2. Challenges

- **Handholding:** One of the challenges with adoption of ICT application by rural people is the lack of effective training, which hampers the handholding. We are committed to the goal of empowering poor, illiterate and rural communities through usage of the ICT solutions developed. Through our programs like workshops and trainings, we ensure local capacity building such that the community can realize the potential of technology.

- **Localization:** The access to information must be available in the language, which is comfortable to the public user, generally the local language. The failure of most ICT's applications is due to the lack of support in local languages. To address this problem the applications we have developed, facilitate local initiatives for local content in local language with local language interface. The accessibility of the ECKO application in local language provides the poor rural populations to access regional and global markets and thus provides an opportunity to advance their lives. It also enables them to generate information that respects their cultural idiom and responds to their practical needs. The availability of the content management system ECKO in their regional language, Marathi, has played a major role in adoption of ICTs by AFARM users.

- **Multi-stakeholder Partnership:** To meet the development challenges, we need a partnership of government agencies, donor agencies, international organisations, private sector, research organisations and NGOs for sharing knowledge for mutual learning and joint action. The Centre emphasizes multi-stakeholder partnerships to ensure effective and optimum availability and sharing of skills, capability, managerial and organizational resources to fulfill the objective of bridging the digital divide, poverty alleviation and sustainable development. ECKO is being used by the end user with the help of Government and Non-Government Organisations who provide the vital link to the local community and play a key role in community participation for the project.

- **Sustainability:** Envisaging the sustainable model, a cost pattern is also designed so that the kiosk operators/knowledge centre volunteers can sustain their livelihood by providing different services to the end user. They can earn money by providing user management services featured in the ECKO application. They can also add to their income by selling space to various agencies for hosting their advertisements on the Portal. They can also provide necessary priced products like agriculture products and bullion prices. Along with it they can also charge money for providing job opportunities either from the candidate or from the Organizations.

3. Edge

Localized, community driven content and management of application by community are the key social features of ECKO. Event driven chat system, searchable profile, message board, forum, day-to-day local, national and international news, weather forecast, market prices and well versed shopping facilities are the other features which make ECKO as a social community software. Support of localised text-to-speech, providing interface and tool for physically challenged, robust architecture to supports other already existing systems like e-governance, e-learning applications etc distinguish it from others. Its hierarchical structured for content management, regulation of content across different community and provision of easy way to customize the application according to need of the community makes it technophile.

REFERENCES

R, Balaji, et. al (2005), "Establishment of Community Information Network in Developing Nation" *IEEE – TENCON 2005 conference*, Melbourne

ICTRT: http://www.ictrt.org.in

DGF: http://home.developmentgateway.org/

ECKO: http://www.cdacbangalore.in/ecko/

Ganga Prasad, GL (June, 2004), *Information Systems for rural communities Content Management System for Communities* http://www.i4donline.net/june04/informationsystem.asp

AFARM website: www.afram.org

ECKO - AFARM website: http://202.141.136.153/ecko-afarm/

Interactive Child Learning Aid Project (i-CLAP): Design and development of an indigenous instructional multimedia model for Nigeria

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ABSTRACT

This project is concerned with the design and development of an indigenous Instructional Multimedia prototype for enhancing early child-education in Nigeria, tagged: Interactive Child Learning Aid Project (i-CLAP). It is structured based on a combination of African art, Computer Graphics and Animation, contextualized to accommodate the needs, preferences and styles of the local learner. This paper introduces a new vision that is motivated by the rapid advancements in digital technology and the urge for cultural expressionism, as catalysts for reinforcing early cognitive development and school-readiness among Pre-primary school children in Nigeria.

Keywords: ICT, Instructional Design, Cultural Sensitivity, Early Child Development (ECD), Computer-Assisted Instruction.

INTRODUCTION

The African continent is faced with multifaceted predicaments ranging from wars, diseases, starvation, political instability, crime and corruption hence the African child has come to view the world, through these tragic experiences, negatively. Conversely, there are objects that make Africa a unique pearl of beauty like its folklores, architecture, games, storytelling (Ayo, 1995), a heritage reflecting its needs, feelings and style which act as soothing to the child's gory experience. The challenge is to harmonize this heritage with formal learning practices, which may provide greater potency to inculcate the urge for enquiry and creativity in the child, through the exploration of nature and manmade environment, toy playing, artistic and musical activities. Unfortunately, Iromantu (2004) asserts that the average African literacy rate is 58% as against developed countries that have achieved 98.6%. An ADEA's Executive Summary affirms that in the modern sub-Saharan African societies, for instance, the major agent implementing the process of education has been the traditional system featuring: face-to-face interactivity between teachers and learners, structured courses, fixed location, fixed period etc. The need therefore to improve upon these practices so as to boost educational development efforts within the sub-region cannot be overemphasized. The goal is towards nurturing a child better prepared to take up his or her own role as a useful member of the society.

The "Education for All" Agenda

Nigeria presents a complex political, economic and social environment due to its political history, demography, size, inequality levels and socio-cultural diversity. The strategic importance of the country, at the sub-region and the wider African region, places huge expectations in terms of its development performance, viewed from a political and economic perspective (Abani, 2004). According to Nicholas Negroponte, every single problem you can think of: poverty, peace, the

environment, is solved with education or including education. Hence, the Interactive Child Learning Aid Project (i-CLAP) was initiated in 2002 in search for a "techno-cultural approach" to consolidating the "Education for All" agenda, which has the onerous challenge of catering for 13 million Pre-school children in Nigeria. Key issues of concern to this research include an appraisal of the following questions:

(i)   Does adapting culturally sensitive instructional components enhance assimilation, retention and recall in Pre-primary school learning delivery?

(ii)   Does the use of Computer-Assisted Instruction reinforce flexibility, motivation and engagement in learning 'ABC' among Pre-primary school children in Nigeria?

(iii)   Is the "i-CLAP" model capable of enhancing cognitive maturation towards supporting school-readiness among Pre-primary school children in Nigeria?

McArdle (1991) defines Instructional Design simply as a systematic process of taking a human performance problem, figuring out what to do about it and then doing something about it. Therefore, the "i-CLAP" research is carried out on the assumption that integrating Artistic, Cultural and Technological metaphors in education have the potency of stimulating greater cognitive maturation (i.e. emotional, physical and intellectual) among local audiences.

Cultural Sensitivity and Instructional Design

In his book "*Learning in Infants and Young Children*" Michael Howe states that the term "experience" is synonymous with exposure to the environment, it is usually inferred that learning has taken place when changes in behavior occur as a result of experience, practical and training (Azi, 2006). This is referred to as socialization, which is the means of nurturing a child to consciousness of the way his/her society functions and his/her rights and responsibilities as he/she aspires to become a full citizen. As potential members of the society therefore, it is one of the tasks of education to prepare its children for that full membership. According to Marito (2000) it has been established that early child development (ECD) program possess positive long-time benefits on future learning potentials, educational attainment and productivity. Dickinson (2002) postulates that through Artistic experience, perception of the environment is required in clarifying, intensifying and enlarging knowledge. Also, that practicing the creation of visual images develops mental and physical skills, throughout the organization of thoughts and manipulation of materials and tools. McLoughlin and Oliver (1999) affirm that recent theories argue for the need to provide a culturally sensitive learning environment. The "Vygotsky and Social Cognition" and "Communities of Practice" models postulate that culture is a prime determinant of individual's development. In addition to culture however, McLoughlin (1999) declares, designers should know that 90% of communication is non-verbal, conveyed through visual means such as gestures and images especially in the early stage of mental growth. The British Film Institute (1999) adds that critical and creative moving image skills will be a key element of literacy development in the 21st century. Today's advances in technology avails digital applications for designing, producing and delivering visual images through interactivity allowing for the selection, controlling and self-pacing of learning. For instance, "Rightside Response", operators of an "Indigenous Multimedia and Web Projects" in Australia, is working with a number of leading Indigenous organizations to design and develop products that apply IT solutions to the business of maintaining traditional protocols. They proclaim their commitment to designing and developing multimedia products that affirm the importance of sharing and managing information in culturally-appropriate ways.

Therefore, harmonizing Africa's heritage to formal learning practices towards nurturing a child better prepared to take up his or her own role as a useful member of the society should be the major goal of an African renaissance. The "Learning Style Theory" emphasizes the introduction of a wide variety of experiential elements to the educational process such as plays, rhymes, arts/crafts, games and storytelling activities, interestingly such elements have been a heritage of the Africa society. The "i-CLAP" proposes an all-inclusive educational resource that harmonizes

these artistic and cultural experiences to contemporary multimedia technology devices. That is aimed at appealing to all the intelligences towards enriching learning, as stipulated by Gardner's "Multiple Intelligences Theory" (Chapman 2005). The "i-CLAP" initiative postulates that learning should not only be a means to a vocation, but a medium for the articulation of socio-cultural values.

Revolutionizing AV to CAI

According to Anglin (1991) Thomas Edison proclaimed in 1913 that books will soon be obsolete in schools, that it was possible to teach every branch of human knowledge with the motion picture. The Bureau of Audio-Visual Aids at the Indiana University (IU) America (established in 1940) introduced the concept of Instructional Technology into Nigeria. Under the leadership of Ole Larson, visual films were produced for training troops at the World War II, wherefrom, they became classroom educational resources (Campbell, 2003). Interestingly, IU in 1956 was awarded a $1.5 million grant to set up AV programs in Nigeria, the project spanned a period of seven years and ran out of funding, hence was phased out. Local efforts to consolidate the IU initiatives by establishing Instructional Technology development centers could not be sustained, making the use of teaching equipment in Nigeria to remain to date at the Audio-Visual stage. Even at that level, C. A. Ogunmilade the author of *"Media in Education"* affirms, Nigeria has not been making effective and efficient use of the opportunities provided by the introduction of the technology into the teaching and learning processes (Azi, 2006). Alternatively, however, in the U.S. and elsewhere today, early child education has been accorded great priority with the development of thousands of Computer-Assisted Instructional software packages. Examples of which include educational productions by: Disney World, Sesame Street Workshop, Kidspiration & Inspiration, ABC Kid's Workshop, Scholastic, Mixy's Toybox (in Australia) etc. They offer instructional enrichments in Mathematics, English, Science, Arts, Music, Religion and lots of special interest areas across the curriculum.

Structuring the "i-CLAP" Model

Many models for the improvement of instructional goals have been proposed; Adapted for this design is the ADDIE model whose five (5) phases constitute: analyses, design, development, implementation and evaluation. Guided by this model, relevant learning theories and locally set goals, the "i-CLAP" model is structured as a resource aimed at addressing the problem of educational in Nigeria. Significantly, the research is geared towards alleviating the escalating rate of failure, drop-out and to also accommodate the explosion in school age population. Hence, in advancing an indigenous model that integrates African artistic and cultural experiences to instructional multimedia design, "i-CLAP" proposes a module whose objectives include teaching basic skills in:

(i)   Alphabets and
(ii)   Object/Color Recognition

The design is targeted at enhancing early cognitive development among children within the age range of 0-6. They are meant to engage in 'ABC' learning tasks: the English language alphabets, word pronunciation and picture recognition activities using colorfully rendered digital objects, realistic speech, self-testing and dynamic feedback devices. To complement these activities, the "i-CLAP" modules also enable artistic activities in "object coloring" tasks using the "creative tools" with range of colored brushes to pick from and paint with. Amory (2001) ascertain that play associated with games, especially during early childhood, performs important roles in psychological, social and intellectual development. He claims further that it could be defined as a voluntary activity that is intrinsically motivating and involving some level of activity. Skills required for playing the computer-generated games includes logic, memory, visualization and problem

solving and it promotes goal formation and competition. The major desire is to bring the application of information technology (IT) closer to the grassroots, an essential resource for mass-literacy development in the 21st century, especially as Nigeria unfolds its new educational agenda in accordance with the Millennium Development Goals.

It is against this backdrop that the "i-CLAP" is designed composing of:

(i)   Linear Animation (Non-Interactive)
   • Wazobia
(ii)   Non-linear Animation (Interactive)
   • Match Pictures to Alphabets
   • Find the Alphabets
   • Fun With Colors

Thus, in developing the model the researcher has adapted a new art technique called "Afrimation" (African animation), composing of African art and design, child-art and caricature, Computer Graphics and Animation, to make for easy recognition, assimilation and recall among children. The linear animation clip called "The Yellow Butterfly" features "Wazobia" (a unity word among the 'Yoruba', 'Hausa' and 'Ibo' tribes of Nigeria) as the main character and other supporting actors include a boy and two girls. In opening, "Wazobia" is seen going to school as he walks through an African village scene and then into a class filled with other children where they would learn the ABC. This is to serve as a stimulant onto the interactive aspects which involves games designed with African textures and sounds. "Adobe Illustrator" is used for the vector-based drawings while the animation is made using "Macromedia Flash". The rationale is to develop a local resource that is capable of expanding "word vocabulary" and "visual literacy" skills among Pre-primary school children, as a springboard for early cognitive development. The world Education Ministers declared that "Quality Education" should embrace certain basic knowledge, values, competence and behavior specifically attuned to globalization but reflect the beauty and riches of our diversity expressed in different forms of belief, culture and language (UNESCO, 2003).

METHODOLOGY

It is maintained that a multimedia-based program must be instructionally sound and primarily used to introduce and reinforce concepts; however, to be effective it must employ appropriate testing techniques (Vidler, 1995). As a research instrument for data collection at the implementation stage of "i-CLAP", "Classroom Observation" is to be the primary source, this would emanate from students' on-task and off-task behaviors and performances. Also, to be relevant for use are online/offline secondary source data and specialized technical facilities. The latter which has been availed through grant to the researcher - the Fulbright Visiting Fellowship - to use state-of-the-art Computer Graphics and Animation facilities at the College of Imaging Arts and Sciences, Rochester Institute of Technology (RIT) Rochester, New York. Consequently, the primary and secondary resources are immensely supporting the design and development process of the "i-CLAP" model. The implementation (being the 4th phase of the ADDIE model) would mainly involve a "Comparison of Teaching Methods", wherefrom one class is to be taught by one method (i.e. the "i-CLAP" Computer-Assisted Instructional resource) and a parallel class by the other (i.e. traditional) and the differences in the amount they have learnt considered. The selection of participating schools and children would be based on "Random Sampling Techniques" in order to give equal chances and unbiased representation. However, the schools would be stratified, according to Afonja (2001) the stratified technique is one in which the population is first divided into two or more groups called strata and then random selection is

made within each stratum. The rationale is to group the schools into "rural" and "urban" settings for fair representation. It is hoped that the Iya Abubakar Computer Centre (IACC), a well equipped computer facility at Ahmadu Bello University, Zaria, would be used for the implementation. Possibly, also eighty (80) children would be selected from 4 Pre-primary schools would be participating and sixteen (16) teachers and independent volunteers would serve as Research Assistants.

Systematic "classroom observations" would be used for both 'treatment' and 'control' groups. By observing participants over a period of time the goal would be to ascertain whether the "i-CLAP" modules would improve cognitive behavior as a result. An assessment would be made of the "Students' Proficiency Portfolio" which would contain scores of all the learning activities carried out during the implementation period, including samples of works such as: written tests, drawing assignments, video or audio recordings of their behavior during class sessions. Relevant behavioral observation coding system [like the Abikoff/Gittleman (Myers, 2006)], appropriate for observing Pre-school and Reception class children in the classroom would be used. Kaduna State in Nigeria has been identified as the research centre, wherefrom an evaluation of respondents' attitudes and perceptions on early learning using computer-mediated resources would be conducted as against the traditional blackboard methods. Consequently, some valid general conclusions from the facts discovered would be drawn.

The challenge, opined Kinelev et al (2004), is addressing the question of how learners can prepare themselves for the 21st Century; we need additional didactics in order to motivate the new generation to participate. That is through creating instructional resources that are simple, flexible and sensitive to local styles, needs and preferences, capable of reinforcing school readiness among school age children in Nigeria. Moreover, this need has become a global concern not only to teachers but also administrator, psychologists, sociologists, computer programmers, software developers, web vendors etc.

SUMMARY AND CONCLUSION

In addressing a crucial issue like the need to adapt culturally sensitive Computer-Assisted Instructional components towards enhancing motivation, engagement, assimilation and recall in learning among Pre-primary school children in Nigeria, the "i-CLAP" model is proposed. The goal is to support school-readiness and life-long learning achievements among the target group. It has been established that early child development (ECD) program possess positive long-time benefits on future learning potentials, educational attainment and productivity. The "i-CLAP" is taking advantage of advances in technology which avails digital applications for designing, producing and delivering visual images through interactivity allowing the selection, controlling and self-pacing of learning. This is an attempt to develop an all-inclusive educational model that harmonizes African artistic and cultural experiences to contemporary multimedia technology devices.

Acknowledgements

REFERENCES

Abani, C. (2004). Progress Towards Achieving EFA In Nigeria. Contribution to the 2003/4 EFA Monitoring Report.
<http://portal.unesco.org/education/en/file_download.php/375e2930f509140be
2a36502c4baa576Progress+towards+achieving+EFA+in+Nigeria.doc>

ADEA's Executive Summary on DEOL in Sub-Saharan Africa (2004).

Afonja, B. (2001). Introductory Statistics: A Learner's Motivation Approach. Evans Brothers Ltd, Ibadan-Nigeria.

Amory, A. (2001). Building and Educational Adventure Game: Theory, Design and Lessons. Centre for Information Technology in Higher Education, University of Natal, South Africa.

Ayo, V. (1995). Africa. Stoddart Publishing Co. Ltd. Canada

Azi, J. I. (2006). Interactive Child Learning Aids Project (i-CLAP): Towards Developing An Indigenous Computer-Assisted Instructional Model. An Unpublished Doctoral Seminar Paper, Presented at the College of Imaging Arts and Sciences, Rochester Institute of Technology (RIT), Rochester, New York-USA. Quotes: Howe, M. (1975). Learning in Infants and Young Children. The Macmillan Press LTD, London.

Azi, J. I. (2006). "i-CLAP": Design and Development of An Indigenous Instructional Model for Nigeria. An Unpublished Doctoral Seminar Paper, Presented During the "Training the Trainer's" Workshop for "i-CLAP" Fieldwork "Research Assistants" at the Department of Fine Art / Iya Abubakar Computer Centre, Ahmadu Bello University, Zaria. Quotes: Ogunmilade, C. A. (1984). Media in Education. University of Ife Press, Ile-Ife, Nigeria.

British Film Institute, Department of Culture, Media and Sport (1999).

Caltrox Educational Software (2003). ABC 4 Kids Workshop. Developers of Computer Aided Learning and Educational Software for Children.

Campbell, G (Ed.) (2003). The Bournemouth University Postgraduate and Research Prospectus. Bournemouth University's Department of Marketing and Communication, London.

Dickinson, D. (2002). Learning Through the Arts. New Horizons for Learning. Accessed on March 26, 2006 at: <http://www.newhorizons.org/strategies/arts/dickinson_lrnarts.htm>.

<http://abc.net.au/children/mixy/toybox/mellie.htm>
<http://ddp-ext.worldbank.org/ext/GMIS/gdmis.do?siteId=2&goalId=6&menuId= LNAV 01GOAL2>
<http://nm.onlinenigeria.com>

Indigenous Multimedia and Web Projects (2006). Rightside Response: Sharing and Managing Sensitive information. Rightside Response Pty Ltd Adelaide.htm

Kenelev, V., Kommers, P. and Kotsik, B. (2004). Information and Communication Technologies in Secondary Education. UNESCO Institute for Information Technology in Education, Moscow.

Louisiana Art Education Association (LAEA) Position Statement: The Role of Art in Education.
<http://www.laea.net/mission.htm>

McArdle, G. E. H. (1991). Developing Instructional Design: A Step By Step Guide to Successful. Crisp Publications Inc. Menlo Park, California.

McLoughlin, C. and Oliver, R. (1999). "Instructional Design for Cultural Difference: A Case of the Indigenous Online Learning in A Tertiary Context". ASCILITE.

Myers, W. (2006). Visual Awareness Strategy. National Teacher Research Panel for the Teacher Research Conference 2006. <www.standards.dfes.gov.uk/ntrp>

UNESCO (2003). "Communiqué of the Ministerial Round-Table On Quality Education". UNESCO's General Conference 32nd Session. Accessed on March 26, 2006 at: < http://portal.unesco.org>

Vidler, R. (1995). Multimedia Production Process Model. AITD Newsletter.

The role of ICT in the economic development of Africa:
The case of South Africa

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ABSTRACT

Africa has been hard hit with poverty and disease and this has had an immense effect on the quality of social, cultural and political lives of the people. This has made development to move at a very slow pace in the last decades. But the presence of information and communication technologies (ICT) has somewhat carved out an alternative path to development. Not withstanding the urgency and enthusiasm with using this new medium for social and economic change, the Internet has brought about negative as well as positive contributions to development in Africa. The contributions of scholars in the field of technology in bringing about change in the lives of people in Africa in general and South Africa in particular will be discussed and analyzed. The reviews and analysis of the contributions of the scholars in the field of development will be critical in judging the overall significance of the role of the Internet in promoting social change.

INTRODUCTION

This article examines how information and communication technology (ICT) has contributed in promoting economic development initiatives in South Africa. This is an initial exploratory study that will be accomplished through a critical literature review.

In this day and age, the role of technology in improving the lives of the people cannot be underestimated. Most people, including minorities, more than ever before are now buying goods and services online, sending messages across the globe to loved ones, sending emails to donor agencies for support and receiving instant replies (Ebeling, 2003). The issue of network technology has been one of the fundamental problems affecting development in Africa since 1960. These issues of connectivity and networking are some of the fundamental setbacks that the grassroot developing companies in South Africa are facing since the Internet boom of the early 1990s (Moodley, 2002 & 2005).

With this boom, communication for developmental issues has been strengthened. However, there have been some setbacks in terms of Internet literacy and accessibility (Lister, 2002). Not everyone in the third world has the knowledge and ability to use the computer, let alone owning one. This entire notion of the digital divide has affected development adversely (Wilkins, 2000).

Brief history of the Internet

The Internet has become an invaluable bridge for Africans to regroup and discuss social, political, cultural, and economic issues facing them at home and abroad. The Internet started in America with an initiative from President Dwight D. Eisenhower who saw the need for an Advanced Research Projects Agency (ARPA) that would cater for America's computer networking and communication in 1957 (Gromov, 1995; McCormick, 2002). This computer networking and communication was used mainly by giant organizations like the military and the government. It was not until the early 1990s that the Internet actually became commercialized. It then became a communication medium between persons. Computers all over the world could then be able to

receive data and sounds from other computers stationed in other countries. Computer Mediated Communication (CMC) became very popular for interpersonal communication. It was now very possible for people to use the Internet to send and receive email messages. Thus, the Internet helped tremendously in reducing mobility and making the world a global village.

Africans, living at home and abroad found out that the Internet had greatly contributed in bringing them together as well as contributed in economic development of their countries. For instance, Ayisi Makatiani's *Africa online* [1] (Economist, 2006) has helped tremendously to expand business initiatives in the continent. As a graduate from the Massachusetts's Institute of Technology, he used his acquired technological skills to help the African continent.

GETTING RID OF POVERTY

South Africa, like most other African countries has had her share of economic and political depression due mainly in part on the imposition of the foreign model (Rodney, 1981). Rodney discusses how the slow pace of development in Africa was blamed on the western imposed modes of development. For example, "means of communication were not constructed in the colonial period so that Africans could visit their friends. More important still, they were not laid down to facilitate internal trade in African commodities" (Rodney, 1981, p.209). Unlike most African countries that suffered the negative effects of colonization and were able to partially recover from it in 1960s with self-rule, South Africa was still rocked by apartheid [2]. This had an immense effect on the economic and political lives of the people. South Africans were more concerned about street demonstrations than with development. Things took a dramatic turn when Nelson Mandela was elected in February 1990 to become the first black president of the country. The economic and political development of the country became his top priority.

The increasing rate of poverty in mostly the rural areas of the country brought about violence, rape, banditry, death and diseases like HIV/AIDS. The only way that the government of South Africa had to deal with these issues was to embrace the challenges of globalization. Technology became the answer to solve the acute economic problems of the people. Snyman et al., (2003) in their article "Getting information to disadvantaged rural communities: the center approach", made this observation:

> *Faced with problems such as poverty, poor infrastructure with regards to electricity and telephone lines as well as low education levels and computer skills, the South African government decided on the center approach as a viable option to place ICTs and other information services within reach of disadvantaged rural South African communities. (p. 96)*

The government took this option under the leadership of president Mbeki because they foresaw a lot of changes and improvement in the lives of the people if technology became an option for the people. The issue of involving South Africa in the digital age was primarily due to the fact that globalization was forcing the entire continent of Africa to keep pace with the rest of the world. For instance, Limb (2005) stated that "New strategies for digital publishing, preservation, and access are evolving among Africans and Africanists, but face daunting problems, most notably in Africa" (p. 4). And since "…electronic publishing and learning developments are increasingly dominating global educational and scientific trends" (p. 2) there was no way that South Africa had to lack behind. South Africa saw global technology as the route to achieving greater capital and investment for the people.

Media Communication, especially broadcasting was the medium to be used as a tool to educate, and at the same time inform the people on another important area of development like AIDS. The

dangers of AIDS/HIV disease was one of the primary causes of death in the country. Mjwacu (2002) posits that:

> *One of the examples for this role is the South Africa's Broadcasting Corporation (SABC) Soul City, which is entertaining at the same time educating people about health issues (for example HIV/AIDS awareness and education). The technology and signal distribution therefore, determines the right to communication and information. "development is a bridge that connects the individual to society, and the local to the Global" (Tomaselli & Aldridge 1996: 54)… This can be regarded as part of development. (Mjwacu, 2002, p. 410).*

This showed that technological innovations had to be used not only for information dissemination, but more importantly, to create educational and health awareness for the people of South Africa. This, therefore, called for the transformation of the analog systems that the South African Broadcasting Company (SABC) was using instead of digital. Digitalizing the telecommunication and the broadcasting industries in South Africa was the only way for the country to go "global." This happened because the major roadblock that the country faced during the apartheid era was now something of the past. Thus, economic and technological development became a possibility.

According to Melkote and Steeves, (2001), if development has to take place in a country, the people have to be liberated first. Their opinions are equally shared by Paolo Friere (1970) who admits that conscientization of the masses- in this case through information dissemination- is the key to achieving success with development. But government leaders must be willing to embrace development and be prepared to withstand the challenges.

Genuine development cannot take place in a continent that is full of leaders who are indifferent to the plight of its citizens (M'bayo et al., 1995). These leaders are lured by the profit business motives of multinational companies that come to invest in their countries at the expense of local industries struggling to stay afloat. These outside companies that are coming to 'invest' in Africa in general are all driven by greed. This is corroborated by Mitiku and Dirk (2006): "Third world countries are currently dominated under neocolonialism. In their view, local leaders are political elites who are advocating capitalist conservative values and are driven by **mutual self interest with the western capitalist"** (p. 127 emphasis added). The article goes on to emphasize the point that African politicians are lured by self-centered motives when endorsing foreign investments in the continent. This, therefore, makes one to ask the question whether there is genuine urge for meaningful and long-lasting developmental initiatives by neo-colonialists. Former oppressors can hardly nurture a genuine development programs to get South Africa in particular out of poverty. Instead, it is for their survival and prosperity that Africa is left in the mire of poverty and dearth (Wa Thiong'o, 1978). This is the reason for social discontent among the people and this has given rise to what Paolo Friere calls critical consciousness among the people. For development to take place the minds of the people must be decolonized, according to Ngugi Wa Thiongo.

ROAD TO DEVELOPMENT

Development of basic infrastructures in Africa has been a slogan for most countries in the continent after they gained independence in 1960. Prior to improving the lives of the people, the colonizers used assimilationist and acculturationist tactics to get the people to imitate western ways of life. The British were prone to maintaining existing cultures provided the inhabitants of Nigeria, Cameroon, Ghana, Sierra Leone and the other colonies abided by Western standards (Melkote et al, 2001). Africans in these various countries were subservient to Western civilization. The administrative and educational systems of those countries were fashioned in the manner of

colonialist's ways of life. Modernization theory made it possible for western ideals and modes of life to replace Africa's pre-existing socio-cultural modes as evidenced in this fact from Ake, (1996). "The modernization theorists talked simply of making the structure of the backward country identical to Western ones. (p. 10). This is what made the people to be subservient to the imperialists. The imperialists, according to them, had pulled them out from the jungle to the bright light of civilization. The western method of education was the way to bring literacy and resolve the problems of ignorance and the so called 'primitive' behaviors of the native African.

The French took a different approach. Their own approach was that of assimilation. This was the tendency to rid the Africans off from abiding by their social, economic and political systems. In the case of South Africa they witnessed multiple colonizations (Dutch and British). They were faced with the dilemma of choosing one development partner from the other. And now with the rise of the United States of America as the super power especially in information technology, it made South Africa to embrace most technological companies from there. The experience of Cape Town with Bill Gates technology was to positively change the lives of the people. His vision is cited in Williams, (1999): "New technologies enable a country to build a digital nervous system…it helps to improve the way people live learn and work." (p. 346). By 2010, as contained in the speech of Bill Gates during the Microsoft Government Leaders Forum Africa, 2006, attended too by Bill Clinton, he promised that the program will benefit 45 million Africans by 2010 (PR Newswire Europe, 2006). This is a very significant step in the right direction. This is now a signal to donor agencies to invest not only in South Africa but Africa as a whole. According to Williams (1999), the internet revolution and the software and hardware technology made it possible for South Africa to establish the "Cape information technology initiative" (CITI). The IT business, according to this writer was to make Cape Town the gate way to Africa's technology.

In order to show how South Africa has become the leading voice for Africa's technology, Mjwacu (2002) outlines some of the technologies that have helped to create jobs and improve the lives of the people. These technologies have been introduced only in SABC alone: "KU band satellite with "Orbicom" and "Sentech" as two signal distributor and DsTV. AstraSat and Deukom have been major tramsmission receivers. Introduced in 1995, KU-band satellite aimed at providing limitless spectrum availability.

SOUTH AFRICA AND THE INTERNET TECHNOLOGY

South Africa, like many other countries has joined other countries in sub-Saharan Africa to bring the Internet to its citizens. Computer literacy and other aspect of computer technology are prerequisites for using internet technology. Before 1997, school teachers in South Africa were not trained in technology. Consequently, it was difficult to train South African children on technology use (Potgieter, 2004). Technology training workshops for teachers of public schools in South Africa were undertaken in "three provinces between 1999 and 2002" (Potgieter, 2004, p. 208). As a result of this training, it became imperative for the National curriculum of the country to include technology as a requirement. In 2002, the following recommendation from the National Curriculum summed up the future of technology acquisition for South African children:

> *A complete new learning area (public schools in South Africa), namely technology was introduced as compulsory school subject to be taught in the foundation (grades 1-3), intermediate (grades 4-6) and senior phases (grades 7-9) of the general education and training band (first nine years of schooling) in South African Schools…the new technology learning areas does in fact have the potential to make education more relevant to the South African society. (Potgieter, 2004, pp.208-209)*

This is indicative of the fact that South African technology has made a giant leap in the future as it seeks to inculcate technological discipline and awareness to its citizen. In spite of this effort by the government of South Africa, challenges still abound especially in the area of telephone lines. Most northern African countries have had more Internet subscription lines than most other countries in the sub-Saharan region. With the exception of South Africa, Namibia and Zimbabwe that can boast of more than 600 Internet service providers ISPs (Hall, 1998), most other sub-Saharan African countries are still suffering from the lack of telephone lines to channel dial-up Internet to its people. Moodley (2003) makes this remark about the state of the Internet technology in South Africa:

> *South Africa has experienced rapid growth in Internet use, and is placed at number 35 by the Economist Intelligence Unit's (EIU) ' E-Business readiness Rankings' of 60 countries. The number of dial-up subscribers grew by an average annual rate of 80% since 1994, and the number of Internet users had surpassed the one million mark by 1998. According to EIU's Pyramid Research, South Africa had 540.000 Internet dial-up accounts in 1999, and will reach 1.1 million by 2002. Of the estimated three million Internet users in Africa, two million are in South Africa. in addition, more than 90% of Africa's internet traffic is generated in South Africa. (Moodley, 2003, p. 29)*

If technology is an indicator for economic growth, then one can say almost with certainty that South Africa, unlike other African countries in the sub-region has advanced in economic development. Findings in 2006 show that the greatest number of Internet users in Africa resides in either South Africa and Kenya in the sub-region or in Morocco and Egypt in the northern region (www.allafrica.com). This article goes on to show how this has contributed in economic development of those countries.This economic development means primarily that capital has been generated and communication infrastructure in the country has improved tremendously. "South Africa has a well developed Internet infrastructure in business and academia, and its degree of connectivity places it in the top 25 in the world. South Africa has an advanced telecom network in the commercial centers. (Moodley, 2003, p. 29). The irony is that these advancements only affect mostly those in the urban areas. South Africa, like most other African countries are still falling short of expanding Internet connection to the rural areas because of lack of telephone lines availability. In the same article, the author states that South Africa has been able to create many effective IT companies. These IT companies bring about new jobs and consequently an improvement in the economic life style of the people. These companies are: Ariel Technologies, Dimension Data, Johnnic, Ixchange, Mc Carthy's, Nedbank and Super Group (Moodley, p. 29).

CHALLENGES IN USING THE INTERNET FOR ECONOMIC DEVELOPMENT IN SOUTH AFRICA

The challenges for using the Internet for development in South Africa are not entirely divorced from those challenges that confront sub-Saharan Africa as a whole. Conradie and Jacobs (2003) have outlined six challenges that South Africa is facing. The first of these challenges is striking a balance between technology and the need for local development. Like most African countries, South Africa faces the challenge of bringing ICT to the rural areas. The need to satisfy the exigencies of the local indigenes and at the same time develop other sectors of the economy that do not warrant technology is one of the main tasks that the country is facing. One of the major set back for technology is consulting with local chiefs and councilors and making them see the need for Internet in their area. Conradie et al (2003) argue that since technology is coming from outside, it does not address the local problems. Some of these local problems involve literacy in technology. The number of Internet illiteracy in South Africa is alarming given the fact that educational quest for most of them in the past had been sacrificed in the fight for liberation. Now that another new education (Internet communication) is coming to the fore front, there has to be

adequate infrastructure within the rural setting itself to educate the people on how to use the technology. Another problem that the country is facing is long cues to the Internet cafes that are formed in the rural areas. The number of people willing to have access outweighs the number of computers that are at their disposal. Akhtar and Laviolette (qted in Hall, 1998) makes this assertion about Africa's problems and the Internet:

> *Africa's information infrastructure is by far least developed in the world. Technical statistics consistently show that Africans have the smallest number of telephone lines per capita, the most restricted access to computer equipment, the most primitive information networks, and the most inaccessible media systems. (p.2)*

This assertion was made in a briefing before the United Nations Economic Commission for Africa in 1995. Almost ten years ago, it is quite difficult to state with certainty whether the entire continent of Africa has bridged that gap. Lovink and Riemens (1996) have outlined one of the many hurdles that Africa is facing. They emphasize that America through NAFTA is linking herself with the South American continents; Japan is integrating with the 'great-Asian commonwealth while the European Union is moving away from the Atlantics. Africa will then be left alone to face her own destiny. Since technology has to do with connectivity, it is only anybody's guess to chart the technological future of Africa.

The other challenge that South Africa is facing according to Conradie is the fact that "many rural areas in South Africa do not yet form part of the national electricity grid" (Conradie et al., 2003, p. 31). This is particularly an acute problem since technology and the Internet can only be very effective if it is generated by electricity. Africa in general and South Africa in particular must first ensure that the rural areas are electrified before investing on dial-up Internet technology. South Africa like most other sub-Saharan Africa countries equally faces another difficulty. Canessa, Postogna and Radicella (1999) have introduced another difficulty that is besetting the Internet business for development in Africa: The bandwidth for the limited telecommunication lines is causing congestion and making reception and transmission very slow. To optimize the use of the limited bandwidth seems to be the way out for such a problem. In his view about the role of Internet in facilitating development in Africa, Adam (1996) paints a very pessimistic picture of the African situation:

> *African connectivity problems are the result of peculiar socio-economic conditions in the region. Many nations continue to suffer from badly performing economies, high foreign debt, declining resources and social infrastructures, alarming population growth, increased dependency, degradation of the environment and other debilitating ailments. These have direct implication on the implementation of networking projects and the type of public policies that foster connectivity in Africa. (p. 1)*

With these kinds of ailment plaguing the continent, there is the need for Africa to tackle the fundamental problems first before bringing in technology to help development, according to Adam.

There are still other problems associated with connectivity in Africa in general and South Africa in particular. These problems range from the issue of integrating the local languages into the system, varying and updating the contents of materials that are posted on the websites and most importantly, the question of security (Kamel and Weigler, 2001). One of the ways to bring most Africans to benefit from the new technology without falling prey to the digital divide syndrome is creating telecenters that would bring people together to meet in specifically designed areas to communicate with others at home and abroad. Senegal seems to be the leading country in Africa that is exploiting this initiative (Benjamin, 2000). These telecenters are found both in the urban as

well as in the rural. Almost all the remote corners of the country have telecenters supported by private companies. This initiative by Senegal could be interpreted as a way to promote democracy in the society. However, McCormick (2002) disagrees with the whole notion of using the Internet to promote democracy. She argues that the vast majority of Internet users in Africa are male and so the question of promoting democracy through the Internet is misleading.

Though the challenges for using the Internet for development in Africa abound, other scholars have seen some burgeoning growth with respect to the use of the Internet. In spite of the rather bleak picture on the future of the Internet, De Beer (2001) has seen the positive effect of governmental input in bringing about social change through the Internet in South Africa. The government subsidized the Personal Information Terminal (PIT) introduced by the ministry of Communication and promoted the setting up of the media development and diversity agency (MDDA) charged with training expertise with new technological skills, to help educate the grassroot population. The result of that endeavor will, in the near future, yield dividend because:

> *The MDDA will support projects that enable media to promote democratic and socio-economic rights through their operations and/or content, such that the public and communities are empowered to actively participate in development. This would include, for example, promoting race and gender equality, education, health care, improved basic services, job creation and environmental awareness. (p.149)*

This is indicative of the fact that a new technological face lift for South Africa is in the offing. The key challenge is spreading this new skill to the rural masses so that in the long run the gap between the literate and the illiterate is narrowed.

In a study by Faux, (2005), he states that Africa does not need to go through the industrial stages that Europe went through in order to be economically self-sufficient. Africa, according to him can make a leap into the superhighway technology and gain fast economic growth. I disagree with this view because Africa is still experiencing economic slow growth. The slow pace of economic growth in the continent is blamed on national leaders who still carry neo-colonial mentality. Meaningful development they believe, should still be top-down. The North should still design and implement developmental programs in the continent. However, this implementation, most times, are marred by inefficiencies and corruption as profits are diverted into private banks accounts in Europe. It is fallacy of economic leap into the super highway by Africa without experiencing the slow and hard industrial hardship of Europe in the 1830s that is plaguing Africa's economic growth. William Zartman (1976) shared this view with me when he argued in his article " Europe and Africa: decolonization or dependency" that "… the metropolitan countries block African development by co-opting African leaders into an international social structure that serves the world capitalist economy" (p. 326).

ASSESSMENT OF RESEARCH TO DATE

One of the main findings for this paper has been the positive as well as the negative contributions of the Internet in bringing about developmental changes in South Africa. The study by Laviolette and Aktar (1998) that sub Saharan Africa has the most inaccessible media systems in the world has further complicated the issue of looking up to technology as the solution to Africa's economic, social and political developments. Their argument too, that telephone lines per capita in Africa is the lowest in the world has again painted a bleak picture of the role of the Internet as a force to foster development. This is because the Internet system that can be cheap for everyone to afford in Africa can only be the dial-up. Cable modem and broadband could be very expensive to manage in a system where government subsidies for improving the media systems are hard to come by.

Another significant finding for this paper has been the research work done by Lovink and Riemens (1996). Their study about the unions of the Americas under the NAFTA treaty, the Japanese and the Asian treaties and the European countries getting together to form a bloc has further aggravated the African connectivity problems. The fact that these countries are getting together to mutually link with each other is very helpful for development. They may have to share one spectrum and maybe one media policy. This could help reduce individual subscription rates thereby reducing the gap of digital divide. When Africa is compartmentalized and working in isolation there is every reason to suppose that it will be expensive for individuals to get connected to the Internet so as to communicate easily, buy and sell goods and services on-line, advertise on-line, and debate online. This finding also shows the hard and difficult road that the continent has to trudge.

Adams (1996) has pointed out another problem that Africa must wrestle with in order to smoothly use the Internet as a tool for development. She suggests that if Africa could first of all tackle the fundamental problems of debt and declining resources, then it is on the right track to using the Internet. In as much I share the view of resolving Africa's debt crisis, I hesitate to agree with Adams that Africa should wait to tackle this endless struggle with debt crisis and rescheduling with the Britton Woods before bringing technological development to children in public schools, universities and government. The issue of Africa's debt burden can be overcome by equitable distribution of scarce human resources like oil wealth. Nigeria is presently undergoing an oil crisis because the people who are the primary beneficiary of the wealth like in the people of the Niger Delta are being sidelined and the oil companies and government officials are looting the wealth. The same situation pertains in South Africa as DeBeers and Oppenheimer are still monopolizing the diamond production and " to protect their earnings from Africa, these companies branched out and "globalized" their tentacles, long before the word " globalization had even been invented" (Cameron, 2000, p. 30). But a more important finding has been that of Kamel and Wiegler (2001). They have looked at another issue concerning digital divide. To them, digital divide does not only mean the absence of access or the lack of it. Rather, digital divide has primarily to do with the lack of local languages being introduced or integrated in the Internet. This can cause a significant setback to a population like that of Africa that have numerous indigenous languages and most of these languages are not French or English. The absence of African languages in the pool of Internet integrated languages of operation has greatly affected the way the populace can use it for communicative and developmental purposes.

One major hurdle that South Africa is facing on this issue of technology and economic growth is whether the overall Growth Domestic Product (GDP) of the country would be positively or negatively affected as a result of the emergence of ICTs. One scholar who has expressed this fear about the South African situation is Benner (2003). In his article " Digital Development and the Disruption in South Africa: Balancing Growth and Equity in National ICT Policies", he outlines some of the dilemmas of ICTs in South Africa:

> *There are two issues of concern here. The first issue is the question of the relationship between information technology and job creation and job destruction. The debate often gets framed in terms of whether technology is creating jobs by improving productivity and stimulating overall demand, or whether it is eliminating jobs by replacing workers with machines and automated production process. (p. 4)*

The question that will arise given this situation is that technology has brought hope as well as despair. Hope in the sense that many foreign companies would be able to invest in South Africa. In the long run, the people would have to learn new skills and work as labor forces in the companies that need their technological know-how. However, that situation is still very fluid because as Benner's article suggests, machines are fast taking the role of humans in most

organizations. A good example is the digital boarding systems at the airports. It is becoming increasingly evident that in the long run manpower would not be needed to run the airport checking counters the world over. This is a kind of low-income job that does not warrant excessive literacy. But if the machines were going to do the job what would happen to the labor force? They would have to relocate. In a country like South Africa that just had a black president in 1990, it is going to take a long time before the majority black labor force in the country become dynamic with multiple skills. Thus, one can easily say that technology has not entirely resolved the economic problems of South Africa. There are still challenges that lie ahead.

Other significant findings of this paper are the issue of imports and exports of software and hardware that can effectively run the ICT systems. In fact, according to Benner (2003), South Africa is still a dependent nation as opposed a self-sustaining one. If South Africa has to be the shinning light to the rest of Africa especially in the field of ICT as been the case now, then something has to be done to reduce her level of dependency on the West. Globalization has come to impose certain burden on the local industries to abide by what obtains in the entire world without taking cognizance of the fact that there are uniqueness that has to be addressed with respect to individual nations and continents. Now that Africa is embracing globalization, it has to sacrifice internal growth. The growing rate of imports of western goods is damaging the rapid expansion of local produce. This is why Benner (2003) cautions that:

> *while South Africa has world-class technology development and infrastructure in certain sectors of the ICT industry, there are structural distortions that heighten technological dependency and limit growth opportunities. Within the computer hardware industry, for instance, imports are high and local production is primarily limited to final assembly.* **There is essentially no local hardware component manufacture of any signficance.** *(emphasis added) (p. 7)*

This is what creates a worrisome situation. Instead of depending on the West for the manufacture of the software and hardware, South Africa could develop her own manufacture industry with the support of the West and in that case, the rest of Africa can then import relatively cheap software and hardware from South Africa through a free market system that enable free movements of goods and services. The telecommunication regulatory policies in South Africa have been liberalized in a way that exports of communication services are encouraged. Presently, South Africa's phone company MTN has expended its services to some African countries including Cameroon. With this gesture, Hodge (2000) sees hope in the horizon. He maintains that "so far all network operators are expanding into African markets, with MTN the most significant player" (p.378). With this, African telecommunication markets would no longer be dependent on the West. Another significant factor about South Africa's telecommunication policy is that it had signed the WTO telecommunication agreement on commitment to market liberalization (Hodge, 2000). These are positive insights to job creation and efficient productivity for the South Africa and the continent of Africa.

Lastly, among all the rather negative findings about the use of the Internet in bringing about social change in Africa in general and South Africa in particular, there has been a positive finding in the work of De Beers (2001). He has found the great role the Internet plays in changing lives and moving the community forward in South Africa through the MMDA. This media agency trains grassroots personnel as experts who should go about teaching the grassroot members how to use the Internet. This is the key to introducing the Internet to the people who are still getting use to western style technology.

CONCLUSION

From the findings above, it can be seen that Africa is still lacking behind in superhighway technology. Even though there is some glimmer of hope in the horizon with the example of South Africa, Senegal in the sub-Saharan region of Africa and almost all the Northern countries like Egypt, Tunisia, Morocco and Libya, there are still inherent problems with respect to the Internet. The Internet enjoys greater utility in the western countries due in part to the increase subscription rates. Almost all households have telephone lines and many users have the wireless personal communication services like cellular phones, palm pilots, laptop computers that can easily be connected to the Internet. These gadgets are also present in most African countries, but the cost of purchasing and maintaining them is a lot more expensive for them when compared to situations in the West. This is one of the reasons why the Internet is going to take a while before becoming a vital communicative medium in Africa.

For the purpose of economic development in terms of creating telecenters for Africa's goods and services, there are advantages as well as disadvantages. The advantage of using the Internet to sell Africa's goods is that turnover rates will rapidly increase. Most buyers who love certain ethnic items in Africa but who are living in Europe can just go online and purchase them and have them delivered right home within a short period of time. The only problem lies with transportation and security. With the low accountability, breakdown in communication and poor quality or poor products that Africa is certainly being confronted with, it becomes difficult to achieve the dream of technological revolution. The same argument can be applied to the study by Faux (2005). He claims that Africa does not need to pass through the needle of industrialization like Europe but actually experience a leap to gaining developmental growth through technology. The question is how that is possible when fundamental issues of economic, social and political backwardness still haunt the continent? Bribery and corruption remain the cankerworm that impedes development in the continent. Authorities in Africa have allowed lawlessness and lack of accountability by public officials to go unchecked. The case of Mumbutu Sese Seko of former Zaire and Sani Abacha of Nigeria who siphoned their countries wealth with impunity are cases in point. Numerous cases of this nature are still abounds in the continent. Adjibolosoo (2005) corroborates my point when he states that "scholars of development theory often suggest that African countries (ACs) are unable to achieve real progress because there are too many incidents of embezzlement, bribery and corruption" (p. 91). How can technology progress be possible when the infrastructures that go along with Internet like basic telephone lines are still a distant dream to a vast majority of Africans? For technology like the Internet to gain a foothold in the African continent, Africa needs to resolve the problems of bureaucracy, dictatorship, economic stagnations, war, literacy crisis and cultural importations. The western powers need to stop manipulating Africa as an ancillary continent that must succumb to western models of modernity. Africa's cultural, economic and social worth ought to be recognized as vital for her development. This is why other scholars have proposed alternative model for Africa when foreign models fail to reconcile with existing structures. The development communication model by Melkote, (2000) could be implemented in Africa. He proposed a participatory communication development model which entails bilateral interchange of knowledge. "Participatory decision making required knowledge sharing between the "experts" and the "beneficiaries" of development projects" (p.41).

Endnotes

[1]   An internet service provider (ISP)
[2]   A system of governance that separated whites from blacks.

REFERENCES

Adam, L. (1996). African Connectivity, Problems, Solutions and Actions: Some recommendations from Intel,96. Retrieved September 10, 2004, from http://www.sas.upenn.edu/African_Studies/Global_Comm/afr_inet96.html

Adjibolosoo, S. (2005). Economic underdevelopment in Africa: the validity of the corruption argument. *Review of human factor studies, 11(1*), 90-112.

Ake, C. (1996). *Democracy and Development in Africa*. Washington, DC: The Brookings Institution.

Allafrica,Inc. (2006). PanAfrica: Internet connections growing fastest in Africa. Retrived August 31, 2006, from University of Maryland website: http://www.researchport.umd.edu.

Benjamin, P. (2000). African experience with telecenters. Retrieved November 6, 2004, from http://www.isoc.org/oti/articles/1100/benjamin.html

Benner, C. (2003). Digital development and disruption in South Africa: Balancing growth and equity in national ICT policies, *Perspective On Global Development and Technology,* 2 (4) 1- 24.

Cameroon, D. (2000). The Oppenheimer conundrum. *New African,389,* 30-31.

Canessa, E., Postogna, F., and Radicella, S. (1999). Enhancing electronic collaboration in the South. Retrieved October 11, 2004, from http://www.nature.com/wcs/c12.html

Conradie, P. & Jacobs, J. (2003). Bridging the digital divide. *Engineering Mangement*, 30-34.

De Beer, A. (2001). The Internet in Africa-a new road to development opportunities or a digital highway leading to nowhere? *Critical Arts: A South-North Journal of Cultural and Media Studies*,*15(1&2),* 135-153.

Ebeling, M. (2003). The new dawn: Black agency in cyberspace. *Radical History Review, 87*, 96-108.

Economist. (2006). *From online to helpline*. Vol. 380 (8489), 58.

Escobar, A. (1995). *Encountering development: The making and unmaking of the Third World.* Princeton: Princeton University Press.

Faux, E. (2005). Information technology (IT) and economic development: *The African context. Journal of African Social Sciences and Humanities,* 1*(*1),44-77.

Freire, P. (1983). *Pedagogy of the oppressed*. New York: The Continuum Publishing Company.

Green, W. (2000). Governing reproduction: Women's empowerment and population policy. In K. G. Wilkins (Ed.), *Redeveloping Communication for Social Change: Theory, Practice and Power* (pp.103-117). Boulder: Rowman and Little field Publisher, Inc.

Gromov, R. (1997). History of the Internet and WWW: The roads and Crossroads of Internet History. Retrieved November 19, 2004, from http://www.netvalley.com/intval.html

Hall, M. (1998). Africa connected. Peer-Reviewed Journal on the Internet. Retrieved September 10, 2004, from http://www. Firstmonday.dk/issues/issues3_11/hall/index.html

Hodge, James. (2000). Liberalising communication services in South Africa. *Development Southern Africa, 17 (3),* 373-387.

Huesca, R. (2001). Conceptual contributions of new social movements to development communication research. *Communication Theory,* 415-433.

Kamel, T. (2004). African chapters and their role in Internet development in African countries. Retrieved September 10, 2004, from http://www.isoc.org/oti/articles/0401/kamel.html

Lister, M.(ed). (2002). *New media: A critical introduction.* New York: Routledge.

Lovink, G. & Riemens, P. (1996). On the dialectics of technology and development. Retrieved September 10, 2004, from http://www.nettime.org/Lists- Archives/nettime-1-1909/msg00010.html

Melkote, S. and Steeves, H.(2001). *Communication for development in the Third World: Theory and Practice for Empowerment.* 2nd Ed. Thousand Oaks: Sage.

Mekote, S. (2000). Reinventing development support communication to account for power and control in development. In K. Wilkins (Ed.) *Redeveloping Communication For Social Change,* 39-53. Lanham, MD: Rowman & Littlefield.

M'bayo,R., Onwumechili,C., Nwosu, P.(Eds). (1995). *Communication and the transformation of society.* Lanham, University Press of America.

McCormick, P. (2002). Internet access in Africa: A critical review of public policy issues. *Comparative Studies of South Asia, Africa and the Middle East,* 22(1&2), 140-144.

Mitiku, B & Dirk, Y. (2006). Development strategies and opportunities: the case of Africa. *Review of human factor studies, 11(2),* 114-133.

Mjwacu, T. (2002). Opportunities and challenges of the new technologies in media and communication: The Windhoek Declaration, *Africa and Asian Studies*, 1(4), 407-426.

Mody, B.(1999). The Internet in the other three-quarter of the World. *In The Annual Review of the Institute for Information Studies,*69-93.

Moodley, S. (2002). Connecting to global markets in Internet age: the case of South Africa wooden furniture producers. Development Southern Africa, *19*, 641-658.

Moodley, S. (2003). Whither business-to-business electronic commerce in Developing economies? The case of the South Africa manufacturing sector. *Information Technology for Development*, 10 (1), 25-41.

Moodley, S. (2005). The promise of e-development? A critical assessment of the state ICT for poverty reduction discourses in South Africa. *Perspectives in Global Development and Technology, 4,*1-26.

Peter, L. (2005). The digitization of Africa. *Africa Today, 52(2)*, 2-19.

Potgieter, C. (2004). The Impact of the implementation of technology education on In-ServiceTeacher Education in South Africa (impact of technology education in RSA*). International Journal of Technology and Design Education, 14,* 205-218.

PR Newswire Europe Limited. (2006). Bill Gates announces microsoft partnerships and programmes to benefit more than 45 million people in Africa by 2010. Retrived August 31, 2006, from University of Maryland website: http://www.researchport.umd.edu.

Rao, M. (2004). How real is the Internet market in developing Nations. Retrieved October 11, 2004, from http://www.isoc.org/oti/articles/0401/rao.html.

Rodney, W. (1981). *How Europe underveloped Africa*. Washington, D.C: Howard University Press.

Rogers, E. (1976). Communication and development: The passing of the dominant paradigm*. Communication Research*, 3(2), 213-239.

Snyman, M. & Snyman R. (2003). Getting information to disadvantaged rural communities: the center approach, *South Africa Journal Libs & Information Science,* 69(2), 95-107.

Storey, D. (2000). A discursive perspective on development theory and practice. In K. G. Wilkins (Ed.), *Redeveloping Communication for Social Change: Theory, Practice and Power* (pp.103-117). Boulder: Rowman and Little field Publisher, Inc.

Tomlison, J. (1991*). Cultural Imperialism*. Baltimore: John Hopskin University Press.

Wa Thiongo, N. (1977). *Petals of Blood*. New York: Penguin.

Waters, J. (2000). Power and praxis in development communication discourse and method. In K. G. Wilkins (Ed.), *Redeveloping Communication for Social Change: Theory, Practice and Power* (pp.103-117). Boulder: Rowman and Littlefield Publisher, Inc.

Wilkins, K.(ed). (2000). *Redeveloping Communication for Social Change: Power, Theory, and Practice.* Boulder: Rowman and Littlefield Publishers,Inc.

Williams, J. (1999). The significance of geographical information systems for development planning. *Development Southern Africa,16(2),* 345-357.

Zartman, W. (1976). Europe and Africa: decolinization or dependency? *Foreign Affairs, 54(2),* 325-343.

Review of "*Taking ICT to every Indian village: Opportunities and challenges*"

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Review of Garai, Atanu and B. Shadrach (2006): *Taking ICT to every Indian village: Opportunities and challenges.* New Delhi. OneWorld South Asia. xix, 133 pages.
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Skewed growth seems to remain the world order among and within countries. While, on the one hand, there is astounding growth in technologies, which include information and communications technologies (ICT), biotechnology, space technology, etc., contributing to improving the quality of life, on the other, countries are getting devastated for reasons ranging from HIV/AIDS, food insecurity, malnutrition, environmental degradation to engineered political instability cankering on human value systems. And this 'divide' embarrassingly exists both among and within countries.

This malaise paradoxically throws up opportunities for multi-stakeholder partnerships for the improvement of people's livelihood and quality of life. It is in this context that *education*, or in the politically correct expression *knowledge*, plays a catalytic role. That knowledge can make a difference in the quality of life is not something novel. We are aware that knowledge holds the key for development, and countries that are now affixed with the qualifier 'developed' bear testimony to the phenomenon that knowledge has been and is contributing to national development. That is to say, if knowledge can improve the quality of life, work towards wealth creation and make the world a better place to live, what prevents us from implementing policies that guarantee education to all and a corresponding plan of action for implementation? What prevents us from creating the required human and material resources to address the issue of education for all? What prevents us from redistributing resources to take education to all? What prevents us from reforming our educational systems in order that equity and quality are assured in education, no matter who and where the learners are? If investments in education do assure rich dividends in terms of national development and social transformation, what is the stumbling block? Whose responsibility is it any way to make education available to all who aspire for it? These are not merely rhetorical questions but questions that demand convincing answers.

What this boils down to is that governments alone will not be able to effect the necessary changes, but multi-stakeholder partnerships and linkages among civil societies, local communities, government agencies, etc., will certainly help bring about the desired results. With the advance in technologies, particularly in ICT, the possibilities of creating inclusive knowledge societies appear brighter than ever before.

Recognizing the powers of ICT to achieve a knowledge revolution in rural India, a National Alliance involving the private sector, cooperatives, NGOs, R&D institutions, government agencies and the mass media was forged in 2003 and subsequently *Mission 2007* was set up to establish robust rural connectivity by the 15th of August 2007, the 60th anniversary of Indian Independence. The first two National Alliance Conventions were held in New Delhi (2004 and 2005) and the third was held in Chennai in July 2006.

It is against this backdrop that this book, published by OneWorld South Asia, one of the partners of the National Alliance, is viewed.

Consisting of four thematic chapters, this book revolves around the concept of wired or wireless infokiosks, which may be conventionally or non-conventionally powered, and seems to recommend it as a viable rural connectivity model. Building a case for infokiosks, the book reports on the various civil society and government initiatives in India over a period of three years since 2003 to extend the benefits of ICT, which have hitherto been within the urban domain, to the rural India represented by 600,000 and odd villages that house about 700 million of the more than 1 billion population. The first chapter projects knowledge as the key ingredient for sustainable human development; the second suggests an institutional framework required for effective implementation of ICT-interventions; the third reviews some field-based rural connectivity projects and the fourth makes suggestions for informed decision-making in technology management.

Chapter 1 entitled *Processes and appropriation of ICT in human development in rural India: Bridging the research and practice gaps* provides theoretical scaffoldings for the whole discussion of rural connectivity – the focal point in the book. It examines the various conventional dimensions of human development, sustainable social development, ICT, etc. By presenting the notion of social development through the intervention of ICT and suggesting that the developmental impact of ICT on society can be assessed using the human development measurement tools developed by the United Nations Development Programme (UNDP), the chapter seems to dismiss as naïve the customary criteria that are anchored in economic prosperity, which are generally considered an indicator of human development. The authors advocate a human capacity or capability approach that views "economic growth only as the means rather than the 'ends' to human well-being, while expanding people's capabilities is seen as the 'ends'" (p. 6). With this, the chapter takes us to a compendious account of the constituents of human capabilities and ICT dimensions, and a stimulating discourse on the need to blend scientific and indigenous knowledge bases for sustainable development. The authors argue that human capabilities expand in a context that guarantees the fundamentals of well-being such as high level of health care, arresting prenatal/child mortality and morbidity, among others, and contributing to longevity, easy educational access, food/nutritional security, personal liberty/freedom, etc. Knowledge is the key to build and sustain the fundamentals of well-being and "Being 'knowledgeable' by its very nature has been recognised as an end of human development; and, the state of 'being knowledgeable' has been recognised seen [sic] as the means for attaining the goals of human development" (p.14). The chapter recommends the use of various "capturing, storage, processing, communication and display" (p. xiii) forms of ICT to help in accelerating knowledge generation, which in turn helps in the expansion of human capabilities.

Illustrated by the story of Yagjung, an illiterate village elder woman, chapter 2 *Human agencies for knowledge connection: Governance of ICT in rural India* reminds us that "millions of illiterate villagers are key stakeholders of the emerging knowledge society, though their inclusiveness is seldom discussed" and suggests that understanding their problems is crucial "to designing locale-specific services through infokiosks" (p. 37). Besides public, private and civil society actors, therefore, communities and individuals must form the ICT governance structure. As regards the economic viability of infokiosks, a concept introduced abruptly, the chapter paints a promising picture with "an average population density of 324 people per km" (p. 38) and with decreasing poverty and increasing literacy.

Entitled *How the promises of ICT in development being met in India: An illustrative comparison and future directions for planning, implementation and evaluation of ICT projects* chapter 3 analyses the characteristics and relative merits of existing knowledge gateways (e.g., infokiosks) insofar as they play the avowed catalytic role in sustainable human development in rural India. In order to assure the validity and reliability of the analysis, the authors have evolved an empowerment-based evaluation methodology on the lines of the capability approach. In other

words, the analysis goes beyond the infrastructure deployment, resource commitment, etc. Table 3.4 (p. 67) contains a list of projects that were subjected to the analysis.

The final chapter (chapter 4) *ICT diffusion in rural India: Current trends and emerging options* gives statistics relating to teledensity, Internet connectivity, energy status, etc., as well as suggesting various technology and energy solutions for infokiosk operation. It also lists the myriad ways in which infokiosks could be put to effective use, including public health, education, etc. Admittedly, the statistics though dated illustrate the enormity of the task involved before Mission 2007 is accomplished and remind us that "promises of ICT in enhancing citizen's capacities remain unmet so far largely because ICT infrastructure is lacking in rural areas" (p. 33).

The area the book covers is quite topical. The introduction of the concept of 'voice' as an effective instrument for empowerment and the result-based methodology adopted in the book for project evaluation are refreshing. However, to make the book more complete than it is now, an internalization of the observation that "connectivity and content are the two pillars on which the entire structure of a nation-wide infokiosk movement rests" (p. 90) is imperative, since the current focus of the book through and through is on technology and the discussion on content issues is conspicuous by its absence.

Though having acquired the status of a cliché, the observation in the book that knowledge is the key for sustainable human development does merit repetition. The way the message has been delivered in the book, nevertheless, is tortuously circuitous. The description of 'human agencies', for example, is naïve despite the claim that "the concepts of 'human agencies' will be central to the discourse in this paper and elsewhere….The term 'human agencies' refers to the capacities of human beings to make choices and to impose such choices on the world on a collective basis, usually through democratic means" (p. 14). A more lucid presentation would have certainly made the message more powerful.

The research undertaken sounds avoidably sketchy and academic in tone though the book contains developmental aspects. As regards the suggestions made for integrated ICT for human development, they are imitative in nature and devoid of innovative concepts. The initial stimulation of the authors' invitation in the preface "to explore and learn what is the most promising, yet challenging, developmental intervention happening in India…" (p. v) could not be sustained as the book fails to give much scope for exploration. The book does "raise(s) many questions for practitioners, policy makers, planners and researchers on the emerging ICTD paradigm in India" but its attempt at answering such questions as "What can ICT bring for the inhabitants of 600,000 Indian villages? How India is empowering the poor and marginalised citizens to participate in the emerging knowledge society? How will India provide voice to her millions of citizens?" (opening page) proves abortive.

Admittedly, however, given the multi-dimensional socio-cultural and economic issues that the rural connectivity initiatives and mission in India must address, including the 34 million people who are said to be at or below the poverty line (BPL), in an environment that is largely agrarian in character, any expectation for a comprehensive report based on a project study "conducted between August 2004 and March 2006" is foolhardy. The authors' attempt, therefore, at touching upon "four key distinct aspects" (p. viii) of the initiatives, each occupying one chapter, must be considered sensible. Nonetheless, more field research with content analysis perhaps is needed before any conclusion on the merits or demerits of the various projects the authors have selected for review could be arrived at.

Sufficient time should have been given for proofing the text, which would have removed embarrassing factual, spelling and syntax errors (e.g., "6 million villages" (pp.17 & 34) in place of 600,000 villages, etc.) Certain expressions, though very insignificant in number, in the book are in

Indian languages (e.g., *Panchayati Raj*). By design or by an oversight, their English equivalent is not available. The list under Bibliography is quite impressive and the index is highly useful.

In the final analysis, considering the nature of the topic, one could not but wish that the book was more "argumentative, analytical and thoughtful" than it currently is. On hindsight, however, the list of projects the book gives is valuable in that it helps the reader get an idea of the types of projects available and also may prevent civil society, government agencies and donors from duplicating them.

Original article at: http://ijedict.dec.uwi.edu//viewarticle.php?id=250&layout=html