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ICT for capacity building and knowledge communities

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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.

Coverage

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;
ICT in local governance; E-Democracy;
ICT and social marketing;
ICT enabled healthcare for remote, rural and regional consumers;
Social epidemiology and virtual communities;
Education: distance, e-learning, flexible learning and delivery, open learning, e-literacy.

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IJEDICT comprises: a "research articles" section for academic, peer-reviewed articles; a "studies from the field" section for edited (but not peer reviewed) case studies; a "project sheets" section for brief descriptions of relevant projects; a "notes from the field" section for working papers, and other commentaries on relevant topics; and, a "book/media review" section for book, software and other media reviews.

The Editors welcome submissions at: http://ijedict.dec.uwi.edu/submissions.php

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Refereed Articles

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.

Book/Media Reviews

This section contains (but not peer reviewed) reviews of books that are relevant to the use of ICT in education and/or development.

From the Field

This section includes edited (but not peer reviewed) case studies (2000-5000 words) of the use of ICT in education and/or development.

Invited Articles

As the name suggests, "Invited Articles" are ones specially requested by the Editors. Generally, they are not peer reviewed.

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.

Editorial

This section contains the editorial written by the editors for the specific issue.

Submission of Articles

Authors can upload their papers, as well as data sets, research instruments, and source documents through the journal's Submissions section. They can submit their papers, figures, and appendices in a variety of file formats, including Microsoft Word, WordPerfect, or RTF (Rich Text Format).

Registration and login are required to submit items online and to check the status of current submissions.

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- Submissions can be in Microsoft Word, Rich Text Format (RTF), equivalent Open Source document file format, or HTML format.
- 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.
- First level headings should be in bold uppercase, and second level headings in bold "title" (upper and lower) case.
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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.

- 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 - of mastery, progress and moral superiority through the development of reason".

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).

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

  http://lisweb.curtin.edu.au/referencing/harvard.html
  http://www.library.uwa.edu.au/guides/citingsources/harvard.html

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- The submission has not been previously published nor is it before another journal for consideration; or an explanation has been provided in Comments to the Editor.
- The submission file is in Microsoft Word, Rich Text Format (RTF), equivalent Open Source document file format, or HTML format.
- All URL addresses are activated and ready to click (e.g., http://pkp.ubc.ca).
- The text is single-spaced; uses Arial 10-point font; employs italics, rather than underlining (except with URL addresses in HTML documents); with figures and tables placed within the text, rather than at the end.
- A 100 word abstract has been prepared and included in the submission file.
- A 100 word biography of the author has been prepared but NOT included in the submission file (the biography will be submitted separately with the other metadata).
- The text meets this journal's formatting requirements outlined in the Author Guidelines found in About the Journal. If the journal section is peer reviewed, author identification has been removed, and "Author" and year have been used in the bibliography and footnotes, instead of authors' names, titles, etc. The author's name has been removed from the document's Properties, which in Microsoft Word is found in the File menu.

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Stewart Marshall
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Welcome to the third issue of the International Journal of Education and Development using Information and Communication Technology (IJEDICT) - an e-journal that provides free and open access to all of its content. IJEDICT emphasises collaboration across disciplines, across professions, across institutions, across sectors, and across continents in an attempt to freely share and promote best practice and best research. The journal is itself an example of the usefulness of such an approach, being the result of collaboration between two institutions, one in the Caribbean and the other in Cape Town, South Africa. Several articles in this third issue of IJEDICT continue the strong African linkage of the journal.

In “Experimenting eLearning with a Large Class” by Oduronke Eyitayo looks at the areas of application of eLearning for large classes and how it was applied at the University of Botswana for the GEC121 course, students and tutors view of the course, as well as experiences from its use. “Capacity building using an online training course” by Magagula reports on the findings of an evaluation of an online course for policy-makers in Southern Africa. The objectives of the study were to determine: appropriateness and effectiveness of the management process leading to the development and implementation of the online course; the use of the platform and CD for online discussions; quality of the online course materials; the user-friendliness of the online system; the worthiness of the different types of support systems; the learners’ views of the online course.

In their article “ICT provision to disadvantaged urban communities: A study in South Africa and Nigeria”, Akinsola, Herselman and Jacobs describe research to develop a sustainable ICT model in a Nigerian community, by evaluating ICT provision in South Africa’s disadvantaged communities and comparing it with the Nigerian situation. Four ICT centres were involved in the case study. The authors argue that bridging the digital divide in disadvantaged communities requires adequate knowledge of the underlying causes of the divide, a favourable Government policy, a focus on the benefits of providing ICT, the provision of suitable infrastructure, and a committed management that is prepared to get round the various barriers or risks found in disadvantaged communities. In “An ICT-Hub model for rural communities”, Jacobs and Herselman discuss how the ICT-Hub model or mechanism for integrated service delivery to rural communities can enable communities to manage their own development, by providing access to appropriate information, facilities, resources, training and services.

In the article “Wiring sub-Saharan Africa for development”, Tokunbo Ojo discusses the uses of ICT, the dimensions of access and the digital divide, and the development of telecentres in the Sub-Saharan African region. The article shows how technical access to ICT is often seen as the only prerequisite to economic and social development, whereas social access to literacy, content, housing and health are not given much consideration in the development agenda. The author discusses experiences at one of the telecentres, the Nakaseke Multipurpose Telecentre in Uganda, by drawing on data from the evaluative report of the International Development Research Centre (IDRC)-sponsored telecentres in Africa.

Sander, Bell & Rice, in “MIS Sustainability in Sub-Saharan Africa: Three Case Studies from The Gambia”, discuss how failure to correctly employ ICT systems has resulted in the wastage of scarce development funds and the diverting of scarce local skilled personnel away from other, productive tasks. They propose a phased implementation project model that includes, in addition to the provision of hardware and software solutions, ICT awareness building and training of user personnel as well as ongoing monitoring of the system's impact.

Moving from Africa to Asia, “Peer assessment and Computer Literacy for Junior High School Students in Geography Lessons in Hong Kong”, by Wong and Ng, discusses an interdisciplinary approach to teaching geography to junior high school students. Computer literacy lessons were given to 166 grade eight students for a geography assignment. The students submitted their work onto a central server at school using secure file transfer software. Then the students assessed one another’s work using an online survey tool. The results revealed that in general, the students were satisfied with the use of online assignment submission and networked peer assessment.

“Development of a multi-scaled virtual field trip for the teaching and learning of geospatial science”, by Arrowsmith, Counihan and McGreevy, discusses the development of a virtual field trip to facilitate action learning and action research to enhance the field experience obtained by undergraduate geospatial science students when preparing for fieldwork. Preliminary evaluation indicates that students are able to obtain a general overview of the area into which they will be working and obtain background information in an interactive three-dimensional model that will enable them to maximise their experience when away on fieldwork.

In “Elemental analysis of the online learning experience” by Kevin Carmody and Zane Berge compare four contemporary methods of online teaching and learning: 1) student-centered, 2) subject-centered, 3) teacher-centered, and 4) teaching-centered. Their article argues that the most effective methods are those that engage six dimensions of human existence: physical, social, emotional, psychological, intellectual, and spiritual. With an understanding of the personal nature of the learning interaction, the most effective teaching methods are those that engage individuals in an intimate way.

IJEDICT seeks to support the community of researchers and practitioners involved in ICT for education and development, 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=117&layout=html

International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2005, Vol. 1, Issue 3, pp. 4-18.

Capacity building using an online training course[1]

Cisco M. Magagula
University of Swaziland

ABSTRACT

This paper reports the findings of an evaluation of an online course for policy-makers in Southern Africa. The objectives of the study were to determine (i) appropriateness and effectiveness of the management process leading to the development and implementation of the online course, (ii) the use of the platform and CD for online discussions, (iii) quality of the online course materials, (iv) the user-friendliness of the online system, (v) the worthiness of the different types of support systems, (vi) the learners' views of the online course. Furthermore, the evaluator was asked to determine for the one week face-to-face workshop, (i) the quality of the workshop structure, (ii) process and materials used, (iii) the integration of the workshop with the online course, (iv) the value of the workshop for the learners, and (v) the appropriateness of the facilitators.

The results showed that (i) the design and structure of the online course was appropriate and well managed, (ii) the course delivery modes (Internet, CD-ROM, and face-to-face learning) were efficiently and effectively utilized, (iii) the course materials were challenging, (iv) the introductory activities properly prepared the learners, (v) the support provided by facilitators was very useful, and (vi) the reading materials in the CD were of high quality. Most of the learners viewed the online course worth taking.

However, most learners were frustrated by the low bandwidth which made it difficult for them to browse and surf the Internet and download PDF files. Some learners were not necessarily literate in computer use, opening and sending emails, and surfing the Internet. It is recommended that before an online course is offered, course providers should assess the profile of the intended learners, whether or not they have access to computers, Internet, and know how to open and receive emails as well as download files.

Keywords: *Southern Africa, online learning, open and distance learning,*

INTRODUCTION

One of the key drivers of the global knowledge and sustainable development in the world is capacity building in human capital. Unfortunately, Africa is the only continent in the world that has grown poorer over the last 25 years; and that has the largest number of people living below $1 per day (Commission for Africa, 2004). Africa has also lagged behind in investing in human capital. For example, the African continent has the lowest enrolment rates in basic, secondary and tertiary education compared to the other continents (Commission for Africa, 2004). Yet education is the key to sustainable development and for competing in the global knowledge economy (World Bank, 2002). If Africa is to compete in the global knowledge economy, Africa must invest more on human capital. It was against this background that the Commonwealth of Learning (COL) supported an online training course for policy-makers working in open and distance learning (ODL) environments in Southern Africa.

The online programme was offered using the Internet and CD-ROM technology. The purpose of the online course was to provide learners with an in-depth understanding of ODL concepts as well as a range of policy issues associated with planning, developing, financing, managing and

evaluation of ODL within the context of national policy-making. Overall, the aim of the online course was to assist learners understand better the relationship between good quality ODL practices and enabling national policy frameworks and mechanisms.

WHY OPEN AND DISTANCE LEARNING?

The reasons for using ODL for human capacity building in the African continent are obvious. ODL, properly structured, is one of the many cost-efficient and effective strategies for providing human capacity building in developing countries. It has an edge over face-to-face education and learning. It is a powerful channel for reaching learners anywhere at the same time provided the necessary infrastructure, equipment, and expertise are available. ODL cuts across national and international boundaries, regions and continents of the world (World Bank, 2000). It caters for all types of people regardless of their age, gender, citizenship, social standing, commitment, social responsibilities, and geographical location (Rumble, 1992).

In addition, ODL is appropriate for (i) education of a large pool of people from different levels and types of education: basic, secondary, and tertiary; (ii) disadvantaged people who are unable to enter conventional education for a variety of reasons; and (iii) training or retraining professional, technical and vocational workers who want to upgrade and update their skills, knowledge and attitudes. ODL enables learners to study at their own time, any place convenient to them, and at their own pace (Verduin, 1992).

In fact, ODL (i) has the potential for cost efficiency and effective in terms of economies of scale (Naidoo, 2001); (ii) enables educational materials to be customized to suit local needs and priorities of learners (UNESCO, 2002); (iii) accommodates the growing demand for lifelong learning; and (iv) makes it possible for post graduate level courses in developed universities to be delivered in developing countries through the Internet (Saint, 1999). ODL minimizes the need for investment in costly physical facilities and their maintenance because, in most instances, existing institutional physical facilities are utilized. As enrolments go up in ODL, the cost per learner goes down resulting in the reduction of marginal costs.

Indeed, where ODL employs the modular approach, course materials are easily updated or modified to suit the type of learners. Where ODL courses are prepared by contracted classroom lecturers, ODL improves face-to-face instruction. As a matter of fact, by using standardized materials developed by subject experts, ODL promotes quality assurance and equitable educational provision (Verduin, 1992). Where good instructional materials for ODL exist, full-time learners and lecturers use them as study guides (Rumble, 1992; Saint, 1999). Overall, ODL "holds forth the promise of increasing access to education, improving educational quality, and more efficient use of limited resources" (Saint, 1999: 12), particularly in developing countries.

THE ONLINE TRAINING PROGRAMME

COL commissioned the South African Institute for Distance Education (SAIDE) to design, develop and launch the online course. The platform for offering the online course was the Internet and CD-ROM technology. It was designed in such a way that it allowed learners to register online; it tracked the nature of the relationships between learners and facilitators and the organizations with whom they were associated. The online course was offered to 17 learners. There were four course facilitators, and each facilitator was assigned some learners. The facilitators were expected to provide ongoing guidance and feedback to online learners. In order to access the online course, each learner and course facilitator allocated a username and password, and then assigned to online discussion groups.

Assumptions about the Learners

The course designer made several assumptions about the learners. The first assumption was that learners had a basic understanding of ODL, and thus required only a comprehensive overview of the various facets of ODL theory and practice. However, the course designer was cognizant of the fact that there could be variation in terms of the level of knowledge learners had about ODL. The second assumption was that learners had responsibility for defining national/institutional policies to govern ODL in their countries/institutions, but only needed support in understanding how these national/institutional policy processes could foster best educational practice.

The third assumption was that learners would have variances in terms of the number of years of experience in national/institutional policy-making. The fourth assumption was that learners would have access to reliable e-mail accounts, although some have insufficiently stable Internet, therefore not be able to access to materials online. The fifth assumption was that all learners would be proficient in reading and writing English. The sixth assumption was that learners had some experience in teaching and/or educational qualifications of some kind. While most of these assumptions proved correct, it was discovered that, even at this level of employment, some learners struggled to use or access the e-mail.

The online course materials provided fully searchable course environment, permitting searches based on document meta-tags and free-text searches. Learners worked on the online resources before and after the face-to-face workshop. Facilitators were charged with the responsibility of managing the online group groups. Interactive materials were posted on the online course, and facilitators were also charged with the responsibility of tracking the progress of online learners on specific learning activities against defined assessment criteria. Overall, the learners were provided with a comprehensive online support system. The online course lasted five months, including a five-day face-to-face training workshop.

Courseware Structure

Since the intention was to ensure as much flexibility as possible in the design and presentation of course materials, a CD was developed as an encyclopaedia resource for learners to navigate through in different ways. Thus, all supplementary readings and resources for the learners and facilitators were accessible in the CD separately from the course structure. On launching the CD, users were given two navigation options: (i) to navigate through the course itself, and (ii) to browse through supplementary materials which were provided as reference resources. In essence, learners accessed resources according to various subject categories without necessarily having to navigate through individual activities. In this way, it was hoped that the CD would remain useful beyond the completion of the course itself.

Resources in the CD were presented using a combination of HTML and Portable Document Format (PDF). To ensure accessibility to PDF resources, an Adobe Acrobat Reader was provided in the CD. Using this technology, it was possible to increase the volume of supplementary resource information in the CD without incurring the expense of HTML design. The CD layout is shown in Figure 1.

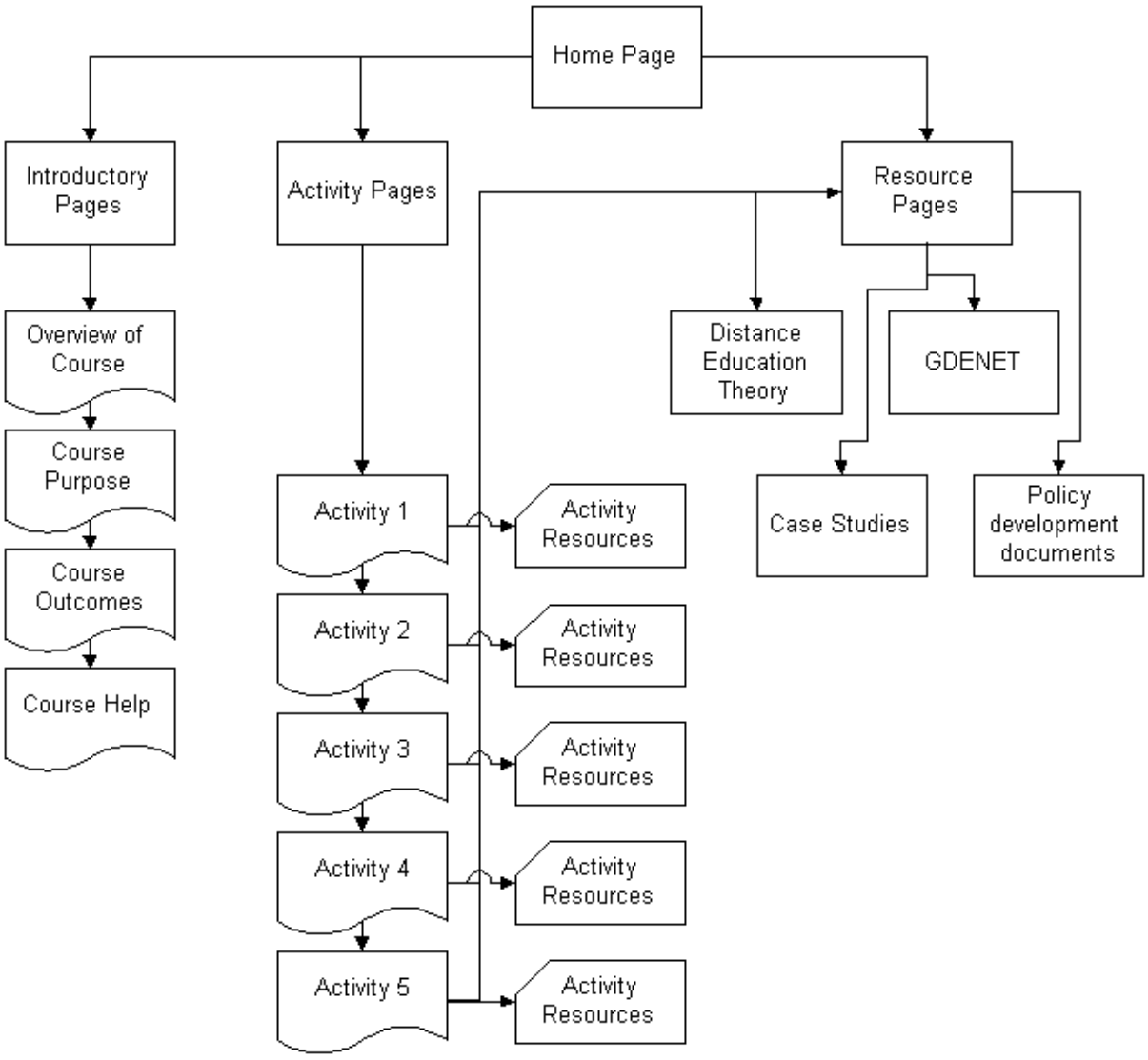

Figure 1: *The CD layout.*
Source: *Naidoo, V. Butcher, N. & Magagula, C.M. (2002*).

Course Delivery Structure

The online course was delivered in three parts. Part one took two months; and it provided learners with a conceptual platform which enabled them to understand the implications of different policy choices regarding ODL. During this phase, learners accessed a full online course environment, comprising activities, support resources, links to other useful web resources, and ongoing e-mail engagement with online facilitators and a community of their peers. Continual feedback was provided via e-mail by course facilitators, while the course environment was designed in such a way that it was possible for facilitators to monitor the progress of learners up to the run up of the five-day face-to-face workshop. Facilitators also supported learners through ad-hoc telephonic interaction. Part one accounted for roughly 40 notional hours of learning. To

ensure that access to resources was streamlined, and learners received all the required course materials course on a CD-ROM.

Part two of the online course was a five-day face-to-face intensive workshop. The five-day face-to-face intensive workshop focused on interaction among and between learners and facilitators. It provided learners with an opportunity to work through practical activities, share experiences and problems with their peers, and shape the learning environment so that it met their specific requirements. Part two comprised a further 40 notional hours of learning. Part three was similar to part one. It followed immediately after the five-day face-to-face intensive workshop. It continued for a further three months. Likewise, part three comprised of another 40 notional hours of learning. The whole online course constituted a total of 120 notional hours of learning.

COURSE EVALUATION

COL commissioned the author to evaluate the online course during and after the course offering. It was expected that by the end of the online course, learners would have understood the processes of articulating, implementing, and evaluating policies for supporting ODL practices. This was to be reflected by the learners' ability to (i) analyze a given educational context; (ii) develop a vision for opening and distance learning in a given educational context; (iii) construct practical, realistic educational opportunities that met the requirements/needs of a given educational context; (iv) define management of, and resource-needs for, implementing such educational opportunities; (v) develop a policy that would articulate realistic achievements of a policy vision within an analysed context; and (vi) analyze changing roles of policy implementers and evaluators.

Subsequently, the author was contracted to determine whether the online course increased learners' understanding and knowledge of policy development processes and whether the delivery strategies were efficient and effective. The author was requested to focus on the worthiness of the three aspects of the course delivery: (i) online delivery using internet (email facility and the CD), (ii) the one week face-to-face workshop, and the two weeks post workshop period. Also, the author (course evaluator) was expected to evaluate (i) the management process leading to the development of the course, (ii) the use of the SAIDE website and online discussions, (ii) the online course materials, (iv) the user-friendliness of the online system, (v) the worthiness of the different types of support systems, and (vi) the learners' views of the online course. The face-to-face evaluation was expected to cover (i) the quality of the workshop structure, (ii) process and materials used, (iii) the integration of the workshop with the online course, (iv) the value of the workshop for the learners, and (v) the appropriateness of the facilitators.

METHOD OF EVALUATING THE ONLINE COURSE

A soon as the online course was launched on the SAIDE website, the course designer and developer the evaluator (the author) with the list of learners, their email addresses, and the group email address, the SAIDE website, and the CD. The evaluation focused on the three phases of the online course: (i) the pre-workshop period, (ii) the one-week face-to-face workshop, and the post workshop period. The methods for evaluating the online course included questionnaires, interviews, and analysis of documents, email messages, and learning activities covering the aspects of the terms of reference. The author received all the emails exchanged between and among the learners and course facilitators. Thus, he was able to monitor the contributions of the learners and course facilitators. Also, the course evaluator was able to assess the quality of the

discussions, assignments completed by learners, and the pace at which learners were progressing on the online course.

The questionnaire was administered by the author to the eighteen (18) learners who attended the one-week face-to-face workshop and four course facilitators. Also, the author conducted formal and informal interviews covering the period prior to the one-week face-to-face workshop. Only 17 course learners and one course facilitator successfully completed the questionnaire. One learner was unable to complete the questionnaire because he was in and out of the workshop.

The questionnaire and the interviews covered learners' level of anxiety and excitement about the online course, level of preparedness for the online course, degree of computer literacy, knowledge and skills of using a computer, surfacing the Internet, and opening and sending emails, access to computing facilities and Internet, and the quality of computer facilities. In addition, the questionnaire sought to determine the usefulness of instructions and advice in the CD: instructions and advice associated with course delivery, sending emails, making use of the help files on CD, and participating in the group discussions. The questionnaire and interviews also asked learners to indicate the problems encountered whilst undertaking the learning activities, and how such problems could be resolved in future

Questionnaires were administered online through emails and at the one-week face-to-face workshop. Both the formal and informal interviews were conducted at the one-week face-to-face workshop as well as telephonically. The questionnaires contained both structured and open-ended items. Data was analyzed using both quantitative and qualitative methods.

FINDINGS OF THE EVALUATION

The general impression of the author was that the online course was well conceived and managed. The layout was simple and easy to follow. The hyperlinks were clear, directive, simplified and easy for learners to navigate. The learning activities were challenging, stimulating, and relevant to the social context and work environment of learners in the SADC region. The task activities learners had to complete attempted to tap, enhance and build on learners' work experience as they depicted life situations.

Level of Anxiety

When individuals are exposed to a new task, usually their level of anxiety rises up because of the unknown future about whether or not the tasks will be successfully handled. Naturally, it was anticipated that since the mode of delivery of the online course was new to most of learners, most of them would be anxious at the beginning of the course and then later in the course, their level of anxiety would dropped. Therefore, one of question that learners were asked was their level of anxiety before and after the three weeks of taking the online course.

Analysis of the data showed that at first most learners were anxious about the online course prior to its commencement. Figure 2, for example, shows that before commencing the online course, the number of learners who were *very anxious* about the online was 12 compared to only 1 who was *least anxious*. The rest of 4 learners were somewhat anxious. In short, out of the 17 online learners, 16 (94%) were *anxious* about the online course and 1 (6%) was least anxious about the online course.

However, after three weeks of participation in the online course, the level of anxiety of most learners dropped. As reflected in figure 2, for example, the number of learners who were still

anxious about the online course dropped to one quarter (i.e. 4 learners), presumably because they had gained confidence in using the CD and computers.

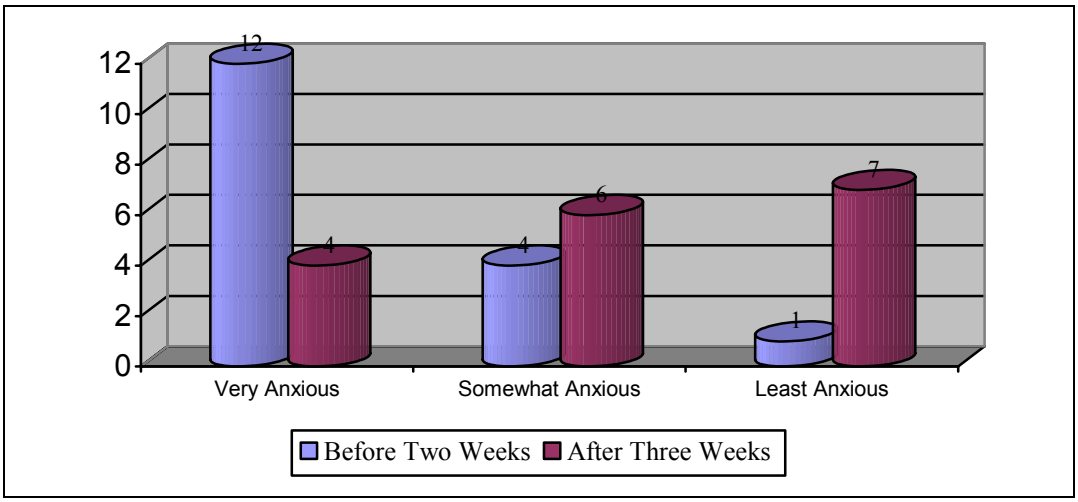

Figure 2: *Level of Anxiety of the Learners before and after Three Weeks in the Online Course (N = 17)*

Learners were asked to explain why they were *anxious* about the online courses before it started. The reasons put forward by the learners why they were anxious about the online course at the beginning of course included, among others, the realization of the high volume of work to be done, the large quantity of recommended reference materials to be read, the tight schedule for completing the assigned activities in the CD-ROM, being behind the course schedule, failing to keep pace with the demands of the course, inability to complete the assigned learning activities on time, and not having started working on the assigned learning activities. Below are samples of learners' remarks.

> *I am still very anxious because I have a lot of things to read and to do in the CD-ROM (learner 1).*
>
> *I still feel very anxious because I need to learn more and understand policy development processes (Learner 2).*
>
> *I am very anxious because I have not had time to make my input, but I have benefited and enjoyed the first email responses from other learners (Learner 3).*
>
> *I am somewhat anxious because the time available makes it difficult for me to keep pace (Learner 4).*
>
> *I am still somewhat anxious because before coming to the face- to-face session I had hardly started the course. Although I don't feel I am far behind, I still feel I am disadvantaged and want to do the earlier exercises (Learner 5).*

The reasons put forward by the learners why they were *not anxious* about the online course at the end of three weeks ranged from finding the course user-friendly, interesting and enjoyable to clarity of instructions for the activities, the course meeting learners' expectations, communication with other learners through emails, and completion of learning activities. Below are few examples of the learners' remarks.

I am not anxious now because the course is interesting and I am convinced that my expectations are being met; hence I am enjoying it (Learner 1).

I am not anxious at all now because I enjoy the course and it is an eye-opener (Learner 2).

I am not anxious now because of the relaxed approach and the user-friendly process of learning through online (Learner 3).

I am not anxious because the approach is good and I can communicate easily with other learners and get feedback from the tutors (Learner 3).

I am not anxious now because I am familiar with the course objectives, and the challenges built into the course are motivating and exciting (Learner 4).

Computer literacy

One of the key aspects of an online course is the level of computer literacy of the learners. For this online course, it was imperative that learners did have basic knowledge and skills to successfully undertake the online course. The course designer and developer had assumed that learners were computer-literate and had basic computer knowledge and skills to manipulate a computer, write emails and surf the Internet.

Against this backdrop, one of the questions of this study asked learners to rate their level of computer literacy on a scale of *above average*, *average*, and *below average*. This study operationally defined computer literacy as learners' level of knowledge of, and ability to, use a word processing package, compose and send an email, browse the Internet, and view and browse the CD. Figure 3 indicates the level of computer literacy of the learners as rated by them.

Figure 3 indicates that of the 17 learners, the level of computer literacy of the majority of learners regarding word processing and viewing/browsing the CD respectively, was *above* average. On the other hand, the level of computer literacy of the majority of the learners regarding composing/sending email messages and browsing for information in the Internet respectively was *below* average.

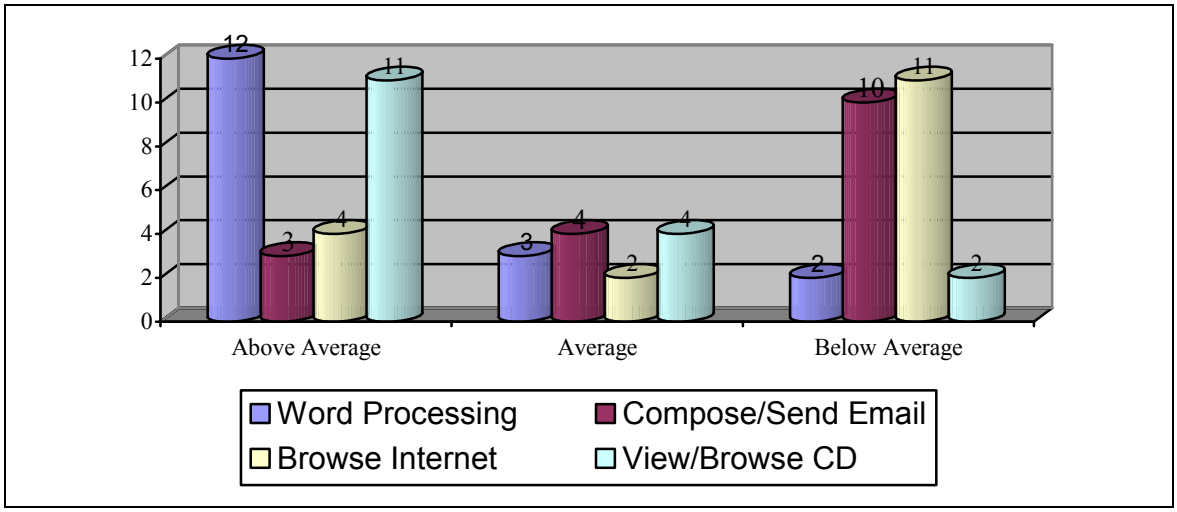

Figure 3: *The Level of Computer Literacy of the Learners Enrolled in the Online Course (N = 17)*

Of the 17 learners, for example, 12 (71%) and 11 (65%) indicated that their level of wording processing and viewing/browsing the CD respectively was *above average*. Similarly, of the 17 learners, 10 (59%) and 11 (65%) indicated that their level of literacy regarding composing/sending email messages and browsing for information in the Internet respectively was *below* average. In a nutshell, the level of literacy of most learners regarding word processing and browsing the CD was relatively high. However, their level of literacy regarding composing/sending of email messages and browsing the Internet appeared to be relatively low.

Access to a Computer

Access to a computer and the necessary browsers is a also critical component of providing an online course. Indeed, another assumption of the course designer and developer was that learners would have adequate time to access computers that had the necessary capacity and software for the course. One of the research questions was to ask learners the extent to which learner had access to a computer with the necessary capacity and software to undertake the online course, the owner of the computer, the period at which they accessed the computer, and the model of the computer. Analysis of data from this question is summarized in Table 1.

First, Table 1 indicates that of the 17 learners, 16 (94%) had access to computers for the online course. Only one (6%) learner had no access to a computer at all. Second, of the 16 learners who had access to computers, 13 (81%) used institutional computers to access the online course, whilst 3 (19%) used both institutional and their personal computers to access the online course. In other words, only 3 learners had personal computers.

Third, of the 16 learners who had accessed to computers, 5 (31%) learners shared them with other people, whilst 11 (69%) learners did not share them with anyone. Fourth, of the 16 learners who had access to computers, 9 (56%) learners could access the computers for the online course at anytime, whilst 7 (44%) could only access them during working hours. In summary, the majority of the learners did not have personal computers, but did have access to institutional computers which they did not share with anyone, but used them for the online course at anytime convenient to them.

Table 1: *Access, Ownership, and Sharing of Computer for the Online Course (N =17)*

Variable	**Learners (%)**
Access to a computer	
Yes	16 (94%)
No	1 (6%)
Owner of a Computer	
No computer	1 (6%)
Personal computer	0 (0%)
Institutional computer	13 (77%)
Both personal and institutional computer	3 (18%)
Computer shared	
Yes	5 (31%)
No	11 (69%)
Time computer accessed	
During working hours only	7 (44%)
After working hours only	0 (0%)
Anytime	9 (56%)

Computer Models

Apart from having access to a computer or owned one, it was important that learners had the appropriate model of a computer that would have the capacity (memory and bandwidth) and software to access the online course. In lieu of this fact, learners were asked to indicate the model and features of the computers they used to access the online course. Specifically, learners were asked to indicate the computer brand: that is, whether or not it was a 486, a Pentium, Pentium 2, Pentium 3, or Pentium 4, MacIntosh. In addition, learners were asked to indicate whether the computers had a CD-ROM drive, an Internet connectivity, and email facilities. Figure 3 shows their responses to these questions.

A closer examination of figure 4 shows that of the 17 learners, 8 (47%) learners had no idea at all about the model of the computer they were using to access the online course. One learner had a 486 computer, two learners had Pentium 1 computers, two learners had Pentium 2 computers, two learners had Pentium 3 computers, one learner had a Pentium 4, and one learner had a Macintosh. In fact, given this data it was not easy to conclude whether or not the 8 learners who had no idea of the model of the computers they were using were: either the 486 computers or Pentiums I, II, III, IV. Similarly, it was not possible to conclude whether or not the computers they used to access the online course were relatively "new" or "old".

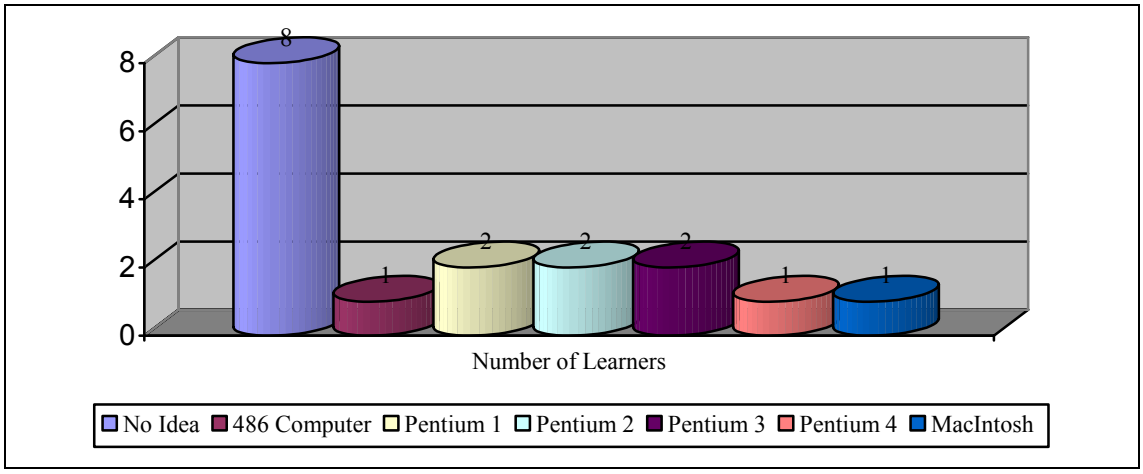

Figure 4: *Model and Features of the Computer Used for the Online Course (N = 17)*

Notwithstanding this observation, learners were asked if the computers they used had a CD-ROM Drives, were connected to the Internet, and had an email facility. Figure 5 shows that of all 16 learners who had provided data for this question had computers that had CD ROM drives that could read the CD the resource materials. Similarly, out of the 16 learners who provided data for this section, 14 learners (88%) had computers that had Internet connectivity and email facility. In addition, the 14 learners knew how to use the email facility.

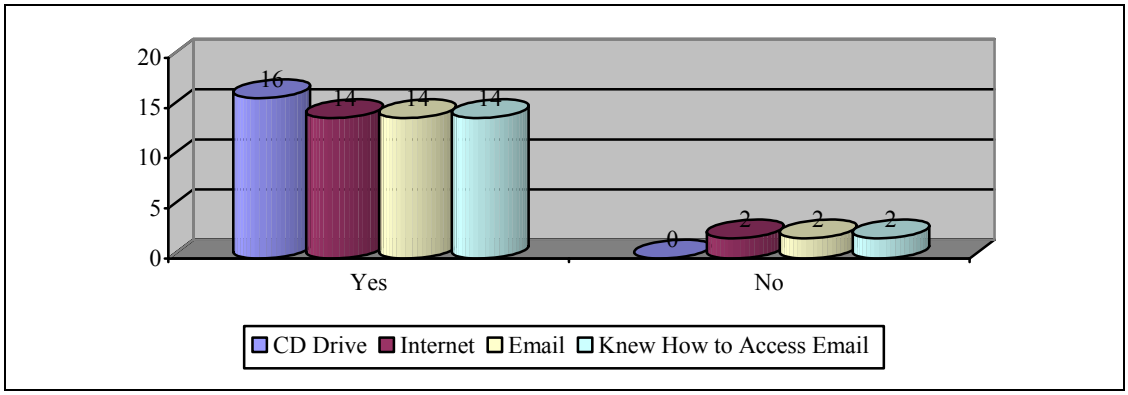

Figure 5: *Computers with CD-ROM Drives, Internet Connectivity, and Email Facility*

Learners, however, expressed frustration at the slowness of their computers in accessing the online course at the SAIDE website. The explanation could be that the bandwidth of the learners' computers was low and could not accommodate PDF files. In fact, most learners complained that they had difficulty in down-loading and opening PDF files and/or sending file attachments through emails.

On the other hand, most learners found the instructions in the CD related to the purpose, content, structure, expected outcomes, and mode of delivery of the online course very helpful. They had no difficult following them. The comments and feedback they received from colleagues and/or course facilitators were also very helpful, encouraging, supportive, constructive, and confidence-building.

Online discussions, however, were not fully utilized as expected despite facilitators' efforts and encouragements. Pertinent issues raised through discussions were often not followed through to their logical conclusion. It was not clear why it was so. It could be that learners were not used to such discussions and/or did not invest much time on this activity since they were all working and therefore very busy people. The online system, in the opinion of the author, was very user-friendly.

Workshop

Concerning the face-to-face workshop, most learners felt that facilitators clearly stated the workshop objectives. In the learners' opinion, the quality of the content and the way facilitators presented it at the one week face-to-face workshop was quite good. They felt that the physical conditions of the one week face-to-face workshop and logistical arrangements were also good.

The author was also of the opinion that the workshop activities met learners' expectations in terms of the time allocated to the various workshop activities, the quality of the handouts, audio-visual equipment, and the pace of facilitators' presentation. The workshop activities were neither very demanding, nor very light. However, most learners felt that the workshop session on budgeting for an ODL programme was inadequately covered, and recommended that more time should have been spent on it. The time provided by facilitators for active participation, practical activities, and group discussions were sufficient.

The aspects of the workshop perceived by learners to be *most valuable* included the process of developing a vision and policy framework, characteristics of a good vision, guidelines for

formulating a good policy on ODL, the session on financial planning, group activities, critical reflections, the inputs of resource persons, the activity on policy formulation and development, the video on vision, linking vision to policy development, and designing and evaluating a policy framework for ODL programme. Indeed, the views of the learners were that the course content, handouts, supplementary readings, assigned activities, and course delivery format (i.e. online and face-to-face workshop) were *critical* features for the success of the online course. Furthermore, most learners expressed satisfaction with the online course and that it met their expectations.

Efficiency and Effectiveness of the Online Course

The concept *efficiency* means being able to work well and without wasting time or resources. In the context of the online course, cost efficiency would therefore imply the extent to which time and money budgeted for this course was used for the purpose of which it was budgeted for. The concept *effectiveness* implies the desired impact or expected outcome of an event. Again, in the context of the online course, cost effectiveness would imply the extent to which the money used to fund this course had the desired impact or expected outcomes.

Although these concepts imply different things, they are not mutually exclusive. In the context of the online course, two questions were asked. The first question was: To what extent was the money budgeted for the online course used efficiently? The second question was: To what extent was the money budgeted for the online course produced the desired impact or expected outcomes? In other words, was the online course successful in meeting the intended objectives?

Regarding the question of efficiency, the course evaluator, unfortunately, was unable to look at the financial records of the managers of the online course due to time constraints. Therefore, it was difficult to judge whether or not the budget allocated for the online course was efficiently used. With respect to the second question of effectiveness, and judging by the completion rate, the quality of the online discussions, and the amount of knowledge and skills learners learned as reflected in their email exchanges, online assignments, and participation in the one week one-day workshop, one concluded that the online course was a success and met its intended outcomes.

At the time of compiling this report, for example, out of the 17 learners who registered for the online course, 9 (53%) had completed the course. Also, of the 17 learners 4 (24%) had no access to computers and 2 (12%) were computer illiterate. In essence, the completion rate for this course was approximately two-thirds (64%). However, it is likely that the completion rate increased in view of the fact that at the time of compiling this report, few learners were still expected to submit their last learning activity. In fact, the completion rate may have been higher than this had the nomination and selection criteria only allowed learners that were computer literate and had access to computers with high bandwidth internet connectivity and CD-ROM drives. The comments of one of the facilitators perhaps support this view:

> *Participation rates and the quality of input including the feedback already received on the first round of online engagement plus the workshop, suggest that people have found it useful and it has helped them to engage in key problems. Also, it is important to remember that this is a pilot, so we have succeeded in testing the viability of this mode of delivery. Here, we have learned that the key to success is that people should have functional email* (Facilitator 2).

SUMMARY

In summary, the view of the author is that the various aspects of the online course which contributed *most* to the learners' learning included (i) the design and structured of the course, (ii) the challenging nature of the course materials, (iii) the introductory activities which prepared the learners, (iv) the one week face-to-face workshop, (v) the support provided by facilitators, and (v) the quality of reading materials in the CD. Indeed, most of the learners were of the viewed that the online course was worth it because it enabled them to acquired knowledge and skills on policy articulation, financial management and general administration of ODL.

That learners did acquire knowledge and skills on online learning and the dimensions of policy development process was evident in the quality of the learning activities shared through the emails. An analysis of the submitted learning activities and reflective comments showed learners' high level of understanding and articulation of the key dimensions of policy development processes. This came clearly in the learners' submissions of their countries' policy framework for ODL. The submissions demonstrated that learners had clear understanding and articulation of the stages of policy development processes (vision, mission statement, strategic objectives, and strategic outcomes) and the strategic processes (advocacy) to achieve the intended outcomes.

On the other hand, the aspect of the online course which few learners felt contributed *least* to their learning was failure, on their part, to send emails which kept on bouncing back. This in turn led to their inability to participate fully on online interactions with other learners. They attributed this failure on their inability to use the email technology. In light of this finding, it would perhaps be useful for course designers and developers of the online course to include, in the orientation or introductory section, a unit on how to use an email (open, read, compose, and send emails). Indeed, one possible practical work for learners may be completing an assignment which will indicate their level of literacy in using the email facility.

RECOMMENDATIONS

Based on learners' and course facilitators' views and feelings as well as the author's observations, the following recommendation were made: (i) that the two modes of course delivery (online and face-to-face) be retained, (ii) that the topic on financial management be given more time and attention in future in light of the fact that it did not receive adequate time and attention at the one week face-to-face workshop, and (iii) that in future people enrolling in this course should be computer literate, and have access to computers and the Internet facilities with at least a moderate bandwidth capacity. However, learners that have no access to Internet connectivity and computer facilities at all should be provided with printed materials. Learners who fail to complete pre-face-to-face activities should not be allowed to attend the face-to-face workshop. In short, they should be discontinued from the course.

The author recommended that course facilitators should regularly check if the learners' progress online was in accordance with the intended objectives of the online course. Most of the learners were of the view that the time for offering the online course was inappropriate as it was close to the festive season (November, December and January). In view of this observation, the author recommended that in future the online course should be offered between June and August, not towards the end of the year because everyone seemed to be very busy trying to meet deadlines at the workplace and also looking forward to the festive season.

The use of assigned learning activities and templates for writing responses should be retained since most learners found them to be very helpful to complete the tasks. Course facilitators tended to ignore the issues raised by peers in emails group discussions. It was not clear why this

was so. The author recommended that course facilitators should monitor and indeed respond to issues raised by learners in email discussion groups as well as guide the discussions so that the intended course objectives are achieved.

Finally, the author noted that there was less vigour from course designers and developers in assessing the level of computer literacy of prospective learner, particularly when it came to the use of the email facility. In light of this, the author recommended that in future course designers and facilitators should assess the level of computer literacy of prospective learners, the quality of Internet connectivity including the bandwidth capacity, and availability of CD-ROM drives in the computers. This assessment will assist course designers and developers of online course adjust the delivery methods according to the learners' level of computer literacy and ability of the computer facilities to efficiently use the courseware.

CONCLUSION

The online course had enabled policy makers in Southern Africa acquire knowledge and skills on ODL. Generally, the use of ICT to deliver the course was a success and worth the investment. This method of course delivery can open new modes of educational course delivery elsewhere in developing countries with appropriate infrastructure and technology. This mode of course deliver, in the opinion of the author, is likely to increase human capacity building throughout the developing world. However, there is need for proper planning and assessment of learners' level of computer literacy, the extent to which they would access computers, and the capacity of the computers to handle the course delivery courseware. There is also a need to check out the Internet accessibility as well as the broad band Internet before the online course is launched so that learners are not frustrated. Properly planned, this model of course delivery could be used to provide similar online course in other regions of developing countries, thereby increase capacity building.

The major challenge facing most developing countries in benefiting from online courses of this nature is access to broad bandwidth connectivity (Naidoo, 2001). This challenge hinders not only offering online courses for capacity building in developing countries but also researchers and librarians from accessing up-to-date databases for teaching and research purposes. The fact of the matter is bandwidth in developing countries is expensive to the extent that African universities, outside of South Africa, are paying over $55,000 per months for 4mbps inbound and 2mbps outbound, which is 100 times more expensive than equivalent prices in North America or Europe (INASP, 2003).

This challenge is definitely disadvantaging developing countries from participating in the global knowledge economy and human capital production. African scientists and researchers are finding is extremely difficult to keep abreast with developments in their areas of specialization simple because they cannot link up, collaborate, and dialogue with their counterpart scientists in developed countries (INASP, 2003). There is an urgent need to explore strategies that could be used to address this challenge.

Endnotes:

[1] The Commonwealth of Learning (COL) supported the funding of this program. The first version of this paper was presented by Vis Naidoo, Cisco Magagula, and Neil Butcher at the Second Pan-Commonwealth Forum on Open learning in Durban, 29 July – 2 August 2002.

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ICT provision to disadvantaged urban communities: A study in South Africa and Nigeria

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ABSTRACT

The focus of this research was to develop a sustainable Information and Communication Technology (ICT) model in a Nigerian community, by evaluating ICT provision in South Africa's disadvantaged communities and comparing it with the Nigerian situation; to identify applicable models and service mechanisms; and, to identify pitfalls and risks. This research was conducted by analyzing the problem from four points of view: ICT infrastructure, management, influencing factors and the risks of ICT provision in disadvantaged communities. A literature review was undertaken to discuss those issues. Four ICT centres were involved in the case study. This study aims to evolve a commercially sustainable provision of ICT in the rural communities of Nigeria.

The authors argue that bridging the digital divide in disadvantaged communities requires adequate knowledge of the underlying causes of the divide, a favourable Government policy, a focus on the benefits of providing ICT, the provision of suitable infrastructure, and a committed management that is prepared to get round the various barriers or risks found in disadvantaged communities.

Keywords: *Nigeria, South Africa, Rural communities, ICT provision, ICT infrastructure, ICT management.*

INTRODUCTION

Nigeria, a country on the West Coast of Africa, with an estimated population of 120 million (Common Country Assessment, 2001), is the most populous nation in sub-Saharan Africa. It occupies a landmass of about 923 768 square kilometers, and is generally known to have over 274 ethnic groups in the Federation. The Government's desire to move closer to the people has progressively led to the division of the three major regions into 36 states grouped under sixgeopolitical zones with a total of 774 local government areas (LGAs). A breakdown of the statistics available on Nigeria shows the following: More than 55% of the people are female; the poverty rate is about 67,8%, the majority of the people (70%) lives in the rural areas, and over sixty per cent of the young (0-15) are under the age of 15. These statistics indicate that the majority of Nigerians fits the main focus of the Global Forum, which is to reach those who are yet to be reached (the class of the poor, the illiterate, women, the marginalized, and those living in remote areas) through one form of education or the other (whether formal or informal education). In particular, women and minority communities, such as nomads, fishermen, and unemployed youths are examples of these hitherto neglected communities in Nigeria (Jegede, 2002:1).

In terms of its economy, Jegede (2002:1) points out that about 90 per cent of Nigeria's annual revenue comes from petroleum – it exports two million barrels of oil a day – and that it ranks as the country with the seventh largest oil reserves in the world. The country's less-than-desirable economic growth makes it almost impossible to cope with the resources needed by the huge and fast-growing population to develop the country and upgrade the welfare of ordinary persons, especially in the rural areas. Jegede (2002:1) mentions that only five per cent of the Nigerian

population can access online Internet-based material. This group lives in the urban areas and are the people described by Herselman (2002:270) as the "Resource Advantageous (RA)". The majority of the population – about 70 per cent – live in the rural areas, and this group, according to Jegede (2002:1), has no access to telephone, facsimile, computer or Internet-based services.

Herselman (2002: 271) points out that this group of people has fewer opportunities to take part in our new information-based economy, in which more and more jobs and services are related to computers.

The Federal Government of Nigeria realized that the country was lagging behind in the race to become a digital society, and saw the potential of information and communication technology (ICT) to empower people – particularly, people with disabilities, women, youth and rural communities. Therefore, it declared Information and Communication Technologies (ICTs) a national priority, in the year 2001 (Bello, 2003:1).

The success of ICT projects in rural communities, according to Disraeli (2001:4), depends on sustainability and the deployment of suitable infrastructure. In other words, an ICT-related project should consider local needs and local skilled staff, or the adequate training and development of the local people. If such projects still depend on foreign staff and skills, then it is not a case of the transfer of technology but of the "dumping" of technology that is often outdated. This results in a casual relationship between technology “dumping” and technology transfer. One finds that the “dumped” technology that is outdated is often provided to rural communities without the ability for community to use it. People in the community are not trained to use the technology or the hardware and software are so outdated that it cannot be applied to the benefit of the community (schools or businesses). One the other hand communities are then forced to use the outdated technology without any success. Conradie and Jacobs mentioned one of the six serious challenges in ICT development are reconciling the tension between technology push and local development needs (2003:30).

The main focus of this research is to develop a sustainable ICT model in a Nigerian community to bridge the digital divide, by evaluating ICT provision in South Africa, and to compare it with the situation in Nigeria.

PROBLEM STATEMENT

Rural communities in Nigeria are marginalized in this era of global integration by being denied access to ICTs, which, according to Bello (2003:1) have the potential to empower. The direct effects of such marginalization are:

- The lack of information in disadvantaged communities – information that would enable them to make informed decisions about their own development;
- The problem of the location of appropriate information, its delivery to the target user, and the coordination of its use by disadvantaged communities;
- The lack of mechanisms that would enable disadvantaged communities to generate and share information with other communities for national and international development;
- Disadvantaged-community decision-making, conflict resolution and self-governance constraints on account of incomplete, often unreliable, information;
- The need for capturing information from communities for effective development planning, governance and accountability.

The task of providing ICT access is subject to particular challenges common to the rural areas of developing countries. According to Caspary and O'Connor (2003:6), those challenges include the following:

- Remoteness, leading to high start-up and maintenance costs, as well as a lack of electricity, so that computers in rural areas often require generators and voltage stabilizers;
- A low population density, which again negatively impacts upon costs;
- The lack of relevant human capital (in particular, technicians for maintenance and repair). Consequently, costs are raised, since the equipment used must be extremely robust;
- The low-earning capacity of the rural population, so much so that considerations of commercial viability could lead to firms having to charge prices that, at best, only a tiny minority could afford.

Main research question: To what extent can ICT be deployed to bridge the digital divide in Nigeria?

METHODOLOGY

A case study method was chosen as the preferred research method for this study, as it allows specific contexts to be studied in greater detail to obtain knowledge that is "useful" and not merely interesting (Olivier, 1999:121).

Denscombe (2001:30) argues that a case study approach has certain features associated with it and when brought together they form a broad approach with an underlying rationale for the direction and planning of the investigation that separates it from the other research methods. Particularly, for this project, it will enable the researcher to benefit from the past experience of the community ICT centres currently operating in South Africa and abroad.

Participant selection

As part of the case study, the following data collection techniques were used:

- Semi-structured interview
- Non-participant observation
- Internet, Government publications, literature review and any other documents from these centres.

Table 1 shows details of the participants.

Table 1: *Participant Selection*

Centres	Location	Community Population	Services	Type of Ownership
Enifade Cyber Café	Akinyele Bus/Stop, Abesan Housing Estate, Ipaja, Lagos, Nigeria	105 000 (estimate)	Internet call (VoIP), Local telephone call, Internet browsing, E-mail, Faxes, Photocopying, Desktop publishing, Binding and lamination, Basic computer training	Small business entrepreneur
Globe Net Cyber Café	Keda Bus/Stop, Abesan Housing Estate, Ipaja Lagos, Nigeria	105 000 (estimate)	Internet call (VoIP),Local telephone call, Internet browsing, E-mail, Faxes, Photocopying, Desktop publishing, Binding and lamination, Basic computer training, Access to Government services, Political information and awareness, Information on foreign and local institutions, bursaries, admission, Examination results	Small business entrepreneur
Mamelodi Community Information Services	Mini-Munitoria municipal offices near Denne-boom (Ko Renteng) near Pretoria, South Africa	The official government statistics indicate that the population was 154 466 during 1991 national survey. Independent consultants however, estimated the population to be approximately 750 000 during 1996.	Directory of services in and around Mamelodi Internet and e-mail training Internet and e-mail usage Public access touch screen information kiosk Information awareness provision, counseling and referrals Database of questions asked Need analysis survey Desktop publishing Computer and information literacy training Workshops	MACIS is registered under section 21 Company Act (Act No. 61 of 1973), as a non-governmental organisation with a not for profit making motive.
Bokgoni Technology Centre	Bokgoni Technical High School, Atteridge-ville, Gauteng, South Africa		OBE training Faxes Computer literacy training Lamination Scanning Word processing Internet and e-mail usage	Community-based ICT centre managed by Bokgoni Technical High School Management.

CHALLENGES FACED BY THE DIGITAL DIVIDE IN RURAL AREAS

According to the free encyclopedia, Wikipedia (2005), the term ‘digital divide’ refers to gaps that exist between groups regarding their ability to use ICTs effectively, due to differing levels of literacy and technical skills, as well as the gap between those groups that have access to quality, useful digital content and those that do not. Doczi (2000:4, 5) points out that the definition for the term ‘digital divide’ can be explained as follows:

> *The term digital divide was coined to define the gap between those who have adequate access to Information and Communication Technologies (ICTs), such as computers and the Internet (information haves) and those who have limited or no access, for either socio-economic or geographical reasons, or both (information have-nots).*

Wijewardena(2002:4) points out that, in order to bridge the digital divide, a clear understanding of the underlying causes of the digital divide is necessary for the development of policy prescriptions. That is, the success of any policy prescription to narrow the digital divide will largely depend on the extent to which that policy prescription will deal effectively with the underlying causes of the digital divide. Caspary and O'Connor (2003:5) mention that reaping the potential benefits of the Internet presupposes that the problem of affordable and low-cost access in rural areas and other low-income communities has been resolved. In addition to the question of cost, the problem of quality of access should not be underestimated, especially in the remote areas of developing countries. Cables tend to be in poor repair, and international access to Internet is often very limited. The nearest server may well be farther than a local phone call away. A combination of such factors tends to make Internet access very slow and costly in those areas.

On the surface, the problem of bridging the rural-urban digital divide does not appear to be too difficult. It seems as if all that would be required is to go to a number of such underdeveloped rural areas and to provide and install the necessary information technology infrastructure and equipment that has been lacking there up to now. However, Conradie and Jacobs (2003:30-33) stated that unfortunately, there are many examples of well-funded rural development initiatives in Africa that have proceeded from this premise, but that have failed to provide any meaningful benefits to the local communities involved. Conradie and Jacobs (2003:33) conclude their findings by highlighting the importance to realise that ICT usage cannot be seen as a stand-alone sustainable activity in the rural environment, but rather as an activity in support of something else (for example promoting education, health, or government information actions). They particularly pointed out the importance to consult with the community to determine what local activities need be supported by ICTs, and to get support from the community leadership for any training or other actions involved in the initiative. Conradie and Jacobs (2003:33) further states that an ongoing monitoring and evaluation action that gives feedback from the community to the developing agents is needed. As stated by Conradie and Jacobs (2003:33), the prerequisite for success is therefore finding a formula that addresses and solves both the technical and social challenges involved in such development actions.

According to Conradie and Jacobs (2003:30-33), the Final Report of the ITU-D Focus Group 7 of the International Telecommunication Union (ITU) (2001:5-6) and Mwanjok (2002:12) the matter is clearly more complex and there are many technical and social challenges, which need to be considered. The following typical challenges exist:

- Reconciling the tension between technology push and local development needs
- The lack of electric power in some rural areas
- The lack of supporting communication infrastructure ain the rural area where an intervention takes place
- The lack of Personal Computer (PC)-related skills in the local rural community
- The lack of PC-related applications and sustainable career path opportunities in the rural area involved
- Other social challenges specific to the rural area involved (e.g. local power relationships, political divisions)
- The scarcity of technical staff.
- Difficult topographical conditions, e.g. lakes, rivers, hills, mountains or deserts, which makes the construction of wire telecommunication networks very costly.
- Severe climatic conditions that make critical demands on the equipment.

- Low level of economic activity mainly based on agriculture, fishing, handicrafts, etc.
- Low per capita income.
- Underdeveloped social infrastructures (health, education, etc.).
- Low population density.
- Lack of ICT policy
- Bureaucracy in dealing with ICT maters
- Lack of donor coordination
- Implementation delay resulting into a loss of interest
- Lack of awareness/understanding of ICTs
- Technology adaptation
- Lack of local manufacturing capacity
- Lack of spare parts
- Rapid technological changes
- High cost of hardware/software

In support of the above, Erwin and Taylor (2004: 24) state that certain social key elements in ICT adoption that also need attention and commitment are:

> *ICT competency as an essential skill, trust, collaboration with civil society, government and business sectors, perceived relevance, information granularity, spatial dimension and assessment, policy and research.*

Given the above problems, the probability of rural communities being provided with ICT appears to be remote. Nonetheless, this study aims to evolve a commercially sustainable provision of ICT in the rural communities of Nigeria.

BENEFITS OF ICT DEVELOPMENT

Cecchini (sa:1-3) identifies three priority areas in which ICT potential could be harnessed for the reduction of poverty: Opportunity, empowerment, and security. Opportunity makes markets work better for the poor and expands poor people's assets. Empowerment makes Government institutions work better for poor people and removes social barriers. Security helps poor people manage risk. The relatively low cost and wide reach of ICT infrastructures, such as the Internet, radio and television enable the delivery of education to isolated rural areas, and information technology training is beginning to be offered at rural schools and private institutes. ICT can also improve health-care delivery to the poor. Telemedicine can diminish the cost and hardships of long-distance travel for medical attention and diagnosis. E-mail and medical list servers can deliver recent medical findings to health workers lacking research and technological facilities, at a minimal cost. Furthermore, ICT can simplify medical data collection, record management and paper filing. With ICT, it is possible to locate service centres that provide documents, land records and other public services closer to citizens. Such centres may consist of an unattended kiosk in a Government agency, or a service kiosk located near the client. The potential benefits include increased transparency, less corruption, better delivery of Government services and greater Government responsiveness. Information disclosure and the possibility of interacting with officials also build pressure for Government accountability. The poor become empowered because they

feel they are getting a service, rather than a favour. This view is further supported by Menou, Poepsel and Stoll (2004:49) when they state that even in a Latin American study on ICT provision to community telecentres the challenge of service provision, finances, diversity, connectivity and human resources are the same as those for the two African countries.

BRIDGING THE DIGITAL DIVIDE IN SOUTH AFRICA

South Africa is the fourth largest country in the Commonwealth and has the sixth largest population. With fifty per cent of its population living in urban areas, South Africa has a higher rate of urbanization than most sub-Saharan countries. However, some of the huge disadvantaged townships are included in that urbanization figure.

South Africa, with its history of apartheid, has an outstanding commitment for changing its legacy of inequalities in freedom, access to information, wealth and opportunity based on race. The country is strongly devoted to overcome and mitigate the disadvantages in large parts of society that had resulted from past policies: Access to information and telecommunications, as well as education, freed from the crippling and discriminating concept of Bantu education, are crucial elements and form the building blocks of the concept of "empowerment.' (Intelecon Research 2000:38).

In South Africa, according to Mogale (sa:1), ICT centres were established in some part of the country as a way of addressing the digital divide problem. According to Benjamin(2002:11-12) the main thinking surrounding ICT centres in South Africa came from the ANC-aligned structures in the early 1990s, especially the NGO, Centre for Developing and Information and Telecommunication Policy (CDITP). This thinking led to the process of drawing up the Green and White Papers on telecommunications that led to the Telecommunication Act, 1996. In that process, an agency was proposed that could facilitate access to telecommunications for all South Africans. This was set up in early 1997 as the Universal Service Agency, at the same time the South African Telecommunications Regulatory Authority (SATRA) was established.

According to Intelecon Research (2000:39-46), the Universal Service Agency (USA) is a unique statutory body established by the South African Telecommunications Act, 1996. It is meant to promote affordable universal access and universal services in ICTs for disadvantaged communities in South Africa in order to facilitate development, empowerment and economic growth. Its short- to medium-term objective is to facilitate the provision of telecommunication services where everyone can access them, that is., within a reasonable distance, which means thirty minutes of traveling. The USA manages the Universal Service Fund (USF) which was established to finance needy telecommunication users in terms of the Telecommunications Act, 1996. A portion of it will be used to subsidize the initial funding of ICT centres. The USF is built up by contributions from telecommunication service providers and donor organizations.

The Universal Service Agency launched an ICT centre pilot project with the objective of providing universal access to telecommunications in South Africa. Those ICT centres are managed and operated by approved franchisees and are located in disadvantaged communities, particularly rural areas. The objective of the ICT centre project is to provide universal access through public facilities: telecommunications, facsimile, e-mail and telephone. Some will provide access to the Internet. The aim of the Agency is to develop a model for the effective running of ICT centres in disadvantaged areas, which could then be reproduced in such a manner that they would not need any more funding from the Agency. This would also promote community ownership and control.

In South Africa, the following important projects were identified and used to gain an appreciation of the use of ICT:

- SchoolNet;
- Mamelodi Community Information Services (MACIS);
- Technology-Enhanced Learning Initiative of Southern Africa (TELISA);
- Distance Education Digital Learning System (DEDLS) – in the planning stage;
- The African Virtual University (AVU) – pilot stage completed;
- The Universal Service Agencies' ICT centres.

With regard to the focus of those projects, there are two clear focus points: tertiary education and community projects.
ICT centres are situated at various locations within the community, each providing a different range of services. Other initiatives to bridge the digital divide in South Africa, according to Wright (2003:27), are the following:

- Projects spearheaded by the Department of Communication. The project has seen the outfitting of buses with computers and satellite dishes in an effort to take the Internet to communities that has never had access to it. The buses are parked at schools and community centres, and users are assisted to do everything – from typing up their CVs to setting up e-mail accounts and accessing Government information and educational material online.
- Professor Peter Wentworth of Rhodes University has developed a project tagged “Hole in the Wall”: Computers are literally installed into a hole in a wall near a derelict playground where street kids used to play. The idea is to develop a computer that can be controlled by the user running a finger over a pane of glass. The idea is to install computers in secure locations in townships, such as at shops, post offices and community centres, where passers-by access them through the buildings’ windows.
- Companies in the IT industry, such as Microsoft South Africa, has a number of projects aimed at providing previously disadvantaged and rural communities with real access and training. The digital village project comprises the creation of computer resource centres equipped with, among other things, computers with Internet access, and the latest Microsoft software and books. Each centre is managed by a community member who have been trained in the necessary IT and management skills.
- The “Citi-Bridge” project is a technological outreach and resource centre jointly developed by Bridges.org with CITI (the Cape IT initiatives). The centre will be housed within the Bandwidth Barn, a CITI-sponsored high-tech business incubator, and will be a public space with a variety of resources, where people can learn about using technology and understanding the implications of technology to become better informed Internet citizens. A training section will allow hands-on instruction with a range of educational programs, beginning with very basic lessons for new users. A library with information materials will be available for public use. The online component of the project will feature a “community directory” of organizations and initiatives helping spread information technology, a “volunteer directory” of individuals looking to help bridge the digital divide, and a schedule of regional events in IT-related policy and development.
- Community Informatics research network of Cape Peninsula University of Technology (Erwin and Taylor, 2004:21).

In the table below, a summary is given of Community Universal Access ICT projects in South Africa.

Table 2: *South African ICT Provision Project*
(Source: Adapted from Community Universal Access ICT Project in South Africa)

ICT provision	Its main focus
Universal Service Agency ICT centres	Provision of universal ICT access centres to disadvantaged areas (such as Mamelodi Community Information Services)
Vodacom Phone shops	To fulfil the universal service obligation to disadvantaged communities
GCIS Multi-Purpose Community Centres	Provision of Government services and information to disadvantaged communities
Department of Communication projects	ICT services through the post offices, establishment of research laboratory in traditionally disadvantaged institutions
Community computing/MPCCs	ICT literacy course, training, community- based information service (CBIS) centres

CURRENT STATUS OF THE TELECOMMUNICATION INDUSTRY IN NIGERIA

A look at the comparable system in Nigeria reveals that there has been a modest development in the telecommunication industry since the inception of NITEL, in 1985 (Arzika (2000:3-8). Today, Nigeria has a public network capacity of about 700 000 lines, 400 000 of which are connected. Nigeria, therefore, not only lags behind advanced countries, but also lags behind comparable African countries and even countries supposedly worse off. The process of deregulating the industry was initiated to tackle these observed shortcomings. This began with the establishment of the Nigerian Communications Commission (NCC) by Decree 75 of 1992, whose main objectives include the following:

- Creating a regulatory environment to facilitate the supply of telecommunication services and facilities;
- Facilitating the entry of private entrepreneurs into the telecommunication market;
- Promoting fair competition and an efficient market conduct among all players in the industry.

According to the African Internet Status Report (2002:2) the extremely sparse and unreliable fixed-line network in Nigeria, which also suffers from severe inter-exchange congestion, is still a major impediment to widespread Internet uptake. Some of the wireless local loop operators, which have been licensed in the urban areas, have promised to provide data services over their subscriber links, but have yet to launch them.
The privatization of the public telecommunication operator, NITEL, and the introduction of a second network operator are expected to accelerate Internet use (African Internet Status, 2002:2).

The need to bridge the digital divide in Nigeria

According to Arzika (2000:2-4), telecommunication facilities in Nigeria were first established in 1886 by the Colonial administration. They were meant to discharge an administrative rather than a socio-economic function in the development of the country. Accordingly, the introduction of public telegraph services linking Lagos by submarine cable along the west coast of Africa to Ghana, Sierra Leone, Gambia and on to England was a greater priority than a robust telecommunication network.

The total number of telephone lines by the time of independence, in 1960, was only 18 724 for a population estimated at about 40 million people. This translated to a teledensity of about 0.5 telephone lines per 1 000 people. The telephone network consisted of 121 exchanges, 116 of which were of the manual (magneto) type with only five being automatic. Since independence, a number of development plans have been devised for the expansion and modernization of the telecommunication network and services. Most of them have never been fully implemented.
Nigeria, with a population of about 120 million people, is the largest black nation in Africa. The wealth of nations is no longer equated on the scale of the quantity of the inherent natural resources but on the quality and strength of the knowledge-based workforce. For decades, the nation's development has depended solely on its rich natural heritage of crude oil and other associated resources (Iriajen, 2000:1).

Arzika (2000:3) points out that, between 1960 and 1985, the telecommunication sector consisted of the Department of Posts and Telecommunications (P&T) in charge of the internal network and a limited liability company, the Nigerian External Telecommunications (NET) Limited, responsible for the external telecommunication services. NET provided the gateway to the outside world. Telecommunication development during that period was characterized by serious short-falls between planned targets and their realization, principally because of poor management, lack of accountability and transparency and a low level of executive capacity.

Iriajen (2001:1) acknowledges that Nigeria is still under the scourge of poverty and religious and ethnic unrest. Until recently, ICT development in Nigeria was among the slowest on the continent, with only 450 000 functional fixed telephone lines for a population of 120 million and a low Internet penetration due to a poor telecommunication infrastructure and little expertise.

By the end of 1985, the installed switching capacity was about 200 000 lines, as against the planned target of about 460 000. All the exchanges were analogue. Telephone penetration remained poor, equal to one telephone line per 440 inhabitants, well below the target of one telephone line to 100 inhabitants recommended by ITU for developing countries. The quality of service was largely unsatisfactory. The telephone was unreliable, congested, expensive and customer-unfriendly.

On account of this, the Posts and Telecommunications Department was split in two the Postal Division and the Telecommunication Division, in January 1985. The latter merged with NET to form Nigerian Telecommunications Limited (NITEL), a limited liability company, while the Postal Division was reconstituted into another organization called the Nigerian Postal Service (NIPOST). The main objective of establishing NITEL was to harmonize the planning and co-ordination of the internal and external telecommunication services, to rationalize investments in telecommunication development and to provide accessible, efficient and affordable services (Arzika, 2000:5).

Nigeriabusinessinfo.com (2001:1) points out that the Nigerian Government has also made efforts to provide Internet services, with an initial capacity of 5 500 points, starting with Lagos as the main point of presence (POP) with 3 000 ports. However, this can only be interpreted to show that less than five per cent of all Nigerians have access to the Internet. According to a report of

the United Nations, the total Internet connectivity in Africa is about 50 000 people, and more than 80 per cent of that number is in South Africa. Of that figure, only 9 000 are Nigerians. However, with the deregulation of the telecommunication industry, 108 licences have thus far been approved, 48 of which have been issued on payment of the fee. It is hoped that with democracy and the window of opportunity now being open to investors in the Nigerian economy, more and more companies will invest in the Nigerian telecommunication industry.

Bello (2002:2) points out that the Federal Government is aware that the country is lagging behind in the race to establish a digital society and has taken a number steps to bridge the digital divide in Nigeria. According to Iriajen (2000:3), recent moves by the Government include the following:

- The implementing of the New National Telecommunication Policy, in September 2000, to liberalize the sector;
- The declaration of ICT as a national priority project;
- The approval of the National Policy on Information Technology and the establishment of the National Information Technology Development Agency (NITDA) in March/April 2001;
- The implementing of the National Space Research and Development Agency (NARSRDA) for the Nigerian satellite system.

Benjamin (2000:12) mentions that privately owned cyber cafés have been established by businessmen in an effort to bridge the digital divide. They often provide as many services as other types of ICT centres, and are sustainable. In order to further justify the need to bridge the digital divide in Nigeria, the next section discusses the community information needs in Nigeria.

According to the Economic Commission for Africa (ECA) (2003:1), Nigeria has been less active in embracing ICT for social and economic development, even though it is dubbed by many as the potential powerhouse of the information society and of Internet growth in Africa. A National Information and Communication Infrastructure (NICI) workshop supported by various international development partners, including ECA, brought together various stakeholders in Abuja, in March 2000. The main recommendations of the workshop were to set up an ICT coordination mechanism and to develop a NICI policy and plan. Consequently, the Nigerian Information and Communication Technology Agency (NICTA) were created under the umbrella of the Ministry of Science and Technology. NICTA has produced a document, entitled “Nigerian National Policy for Information Technology (IT)”, which was issued under the auspices of the Ministry of Science and Technology. The policy document that has 31 objectives, emphasizes, amongst others, the need for harnessing ICT for education, wealth creation, poverty eradication, job creation and global competitiveness.

The key strategies outlined in the policy document are the following: Establishing a national fund for ICT, setting up an ICT development agency, harnessing ICT to improve Government operations, empowering the public and private sectors and small and medium enterprises by creating an enabling environment, harnessing ICT in the education and health sectors and setting up information technology parks. The document is believed to stir public debate on the key areas identified by the policy drafting committee. ECA and UNDP are expected to spearhead this process in order to assist Nigeria to put in place a comprehensive ICT policy and NICI Plan for implementation, at both the federal and Government levels. A Development Agency for ICT has been put in place to coordinate the elaboration of a national strategy.

MODELS OF ICT PROVISION TO RURAL COMMUNITIES

Two clearly distinct ICT models are proposed for providing access to ICT services in disadvantaged areas of developing countries – multipurpose community centres (MPCCs) established by public institutions and cyber cafés established by private individuals. The major difference between the two types of centres, according to Proenza (2001:4), are ownership and operational purpose. Internet cafés are privately owned businesses which do not focus on development, but MPCCs are operated by institutions using perhaps the second most commonly used governance structure, that is, the non-profit non-governmental organization (NGO), traditionally relying on donor funding – at least to cover investment costs. Proenza (2001:5) argues that cyber cafés often provide as many services as other types of MPCC. They train their clients, for example, in basic computer skills and office applications, either in response to local demand or to stimulate a demand for their services. On the other hand, many NGO-run MPCCs are practically cyber cafés in disguise.

Wellenius (2003:4) argues that, when one relies solely on the profit drive of private sector entrepreneurship and investment in the provision of ICT services one is unlikely to achieve the desired development outcome in full. Extending access to people living in the developing world's rural areas requires some initiative and help from the Government. ICT centres may not be able to achieve commercial sustainability beyond initial public support in localities with very low incomes, with low population densities, or without access to good-quality, competitively priced telecommunication infrastructures. Minimum education levels, social and economic links, other infrastructure, and familiarity with modern technology, all probably correlated with income, are needed for a demand to build up and for ICT centres to contribute to development. As is also indicated by Erwin and Taylor (2004:22) many governments have recognised the growing issues associated with inequitable ICT access but the problem of effective use of the access whether it is based around physical, attitudinal, educational, disability, cultural or integration concepts as well as civil society and a new contract that binds civil society, public and private sectors into a value matrix are the challenging issues which face familiar forms of governance and business education.

Table 3 presents the ICT centre services under different categories (Jensen and Esterhuysen, 2001:46-48; Microsoft, 2000:24-30). Apart from the services, these centres also need content to support their services and products offered.

Table 3: *ICT services categorization*

Communication	Information	Business	Training
Telephone call	Employment agency	Transport bookings (air, sea, land)	Distance education
Internet (e-mail, Chart, Newsgroups, browsing)	Government information	E-commerce (exchange of goods and services)	E-learning
Facsimile	Local and international news	Secretarial services	Basic education for adults
Teleconferencing	Weather information	Desktop publishing	Basic computer literacy
File transfers (text, pictures, sound, video)	Stock quotes	Graphics design (business cards, logos, etc	
Document download	Market prices	Photocopying, printing	
	Web site directories	laminating, binding	
	Trade opportunities	video-, digital, still camera hire/Renter services	
	Product/service Information	Stationery sales	

FINDINGS

The findings in this research can be divided into different sections:

ICT centre infrastructure

Suitable ICT infrastructures for bridging the digital divide in respect of disadvantaged communities, as indicated in participants' responses, include:

- Power supply;
- Lifeline infrastructure, such as water, roads, transport, energy and security;
- Building;
- Hardware: telephones, computers, LAN network hub, printer, scanner, television set, fax laminating machine, codec camera, projector, radio, video, CD and audiotape players, microphone;
- Software: Windows 2000 server, XP, 98, MS Office, PageMaker and CorelDraw. Others tools are training CDs or audiotapes (for mathematics, chemistry, entertainment, etc.);
- Telecommunication: Narrowband packet radio, GSM 400, combined point-to-multipoint/wireless local loop systems, CDMA450, very small aperture terminals (VSATs), satellite-based Internet access, digital satellite radio, meteor burst communication, IMT-2000, wireless routers and Voice-over IP (VoIP).

  Although the telephone line connection costs less and it is better safeguarded against computer hackers; it is regarded to be very slow in terms of access and can be deployed only when there is fixed-wire communication infrastructure. Fixed wireless tends to be suitable for some disadvantaged areas that are close to urban cities, but satellite connections are most suitable for Internet connection in the rural areas where other telecommunication infrastructures are not available, irrespective of the current disadvantages of satellite connections.

ICT centre management

ICT centre management should include members of the community, so that they can plan, organize, lead and control the efforts of organizational members and the use of organizational resources in order to achieve stated organizational goals. This is characterized by a cycle of "direct, measure, and control". It is equally important to involve the service of a full-time paid manager, who should be able to direct and control the resources of the centre, effectively, including other staff and the day-to-day administration of the centre. An adequate plan should be made for maintenance and repairs, support in the event of equipment breakdown, accountability measures and security.

The people manning ICT centres should be user-orientated rather than technical specialists. Evidence suggests that computer users are more likely to seek assistance from support staff who are friendly and who can build empathy with their clients than from people who are less able to do so, but who possess greater technical knowledge. The approach of ICT centres should be problem-orientated, not technology-orientated. They should respond to client encounters in a way that recognizes their primary and secondary effects. The primary effect is to solve a problem for which the client seeks the services of the centre. The secondary effect relates to the extent to which the client increases his/her understanding of the technology being used and the likelihood

of him or her using that knowledge to approach the centre for help in solving additional problems that may occur later on.

Influencing factors

The main influencing factor for ICT provision in disadvantaged communities is the need to provide less expensive access to reliable information and communication, which are currently inadequate. It is evident from the participants' responses that ICT possesses enormous potential to bring less expensive access to information and knowledge to every member of the disadvantaged community. Other factors include the need for community development, for employment provision, for the generation of income; for providing access to Government information and for fostering cooperation between the various community organizations.

Policies should be formulated that encourage ICT inflow into the country or disadvantaged communities by reducing taxes or allocating a subsidy for ICT infrastructure targeted for disadvantaged community deployment, by making social amenities available and by enabling legal support.

There is clear evidence that knowledge should no longer be the domain of the few. Success in promoting democracy, human resource development, socio-economic development, international cooperation, trade and commerce, requires access to information and an ability to use it effectively. The ongoing information and communication revolution is leading to accelerated globalization in economic and social activities. This presents tremendous challenges and opportunities for both industrialized and developing countries alike. Unless the benefits of ICT are successfully harnessed in the disadvantaged community, it will lead to greater disadvantages. The intensive use of ICTs could, according to NEPAD (New Partnership for Africa Development) (2002:119), be of unprecedented comparative advantage to the continent. ICT can –

- provide an impetus for the democratisation process and good governance;
- facilitate the integration of Africa into the new information society, using its cultural diversity as a leverage;
- be helpful tools in a wide range of applications, such as remote sensing and environmental, agricultural and infrastructure planning;
- utilize existing related tools better to provide training that would allow for the production of a critical mass of professionals using ICT;
- be used to establish, in the research sector, African programmes and technological exchange programmes that are capable of meeting the continent's specific needs, especially the need to combat illiteracy;
- be used to identify and exploit opportunities for trade, investment and finance;
- be used to establish regional distance learning and health education programmes to improve the situation in the health and education sectors; and
- be used in conflict management and in the control of pandemic diseases, to help organize an efficient early warning mechanism by providing the tools for the constant monitoring of tension spots.

Risks of ICT provision in disadvantaged communities

There is a clear indication that to reap the benefits of ICT provision in disadvantaged communities, other social development resources, such as a stable electricity supply, telecommunication infrastructures, roads, transport, etc are equally important. Deployment of ICT in disadvantaged communities require more than ICT equipment donations or the funding of specialized programmes of the centre; there is a need to pay more attention to the centre's sustainability.

Other factors that could be considered as risks to ICT provision in disadvantaged or rural communities are the following:

- Political challenges at national and international levels;
- Bureaucracy in dealing with ICT matters;
- Lack of ICT policy;
- Low literacy rates;
- Lack of donor coordination;
- Implementation delay resulting in a loss of interest;
- Lack of awareness/understanding of ICT;
- Scattered population in rural areas;
- The cost of financing and the availability of funds;
- Technology adaptation;
- Lack of technical capacity/maintenance;
- Lack of infrastructure and social amenities (roads, water, energy, health, etc.);
- Lack of local manufacturing capacity;
- Lack of spare parts;
- Rapid technological changes;
- High cost of equipment/software.

ICT provision in Nigerian disadvantaged communities

ICT deployment in a Nigerian community to bridge the digital divide will require that all stakeholders properly address the following.

- Harnessing the benefit of ICT in disadvantaged communities depends on the availability of a suitable telecommunication infrastructure.
- Government policy should encourage ICT resource inflow by creating an enabling environment, and provide for specialized subsidies to rural ICT centre operators, education reform and the redistribution of socio-economic development that will enhance the income of all citizens.
- Management structure should be committed to maintenance, the support of donated ICT infrastructure and the provision of funds to cater for improvements and its sustenance.

- Other social infrastructures should be developed; for example, electricity, transportation, roads, water, etc.

RECOMMENDATIONS

The following recommendations can be made to private ICT centre operators, community ICT centre operators and Nigerian ICT provision policy makers.

Private ICT centre operators

Services commonly provided by privately owned ICT centres include e-mail, Internet browsing, facsimiles, computer literacy training, and desktop publishing. Fewer services are provided in the area of community development; while most of the contents that are browsed are developed outside the community or country. There is a need to include services and contents that will encourage community development, empowerment, and economic growth.

Privately owned ICT centres should work out modalities to network in a form of association, in order to enhance Government participation. This will improve the contribution of the centre to the development of its immediate locality, and will enhance patronage by creating awareness of local goods and services. Government involvement will be encouraged, while ICT centre associations could facilitate the implementation of Government policy on ICT provision in disadvantaged communities and thus benefit, either through reduced taxes or Government subsidies and legal support.

Community ICT centre operators

Most community ICT centres are established, either through donation of equipment or funds, for specific programmes or volunteer services. Their sustainability depends on the generation of funds for maintenance and support. Such a donation may be handled over to an established institution within the community, such as a school, library, hospital, etc., for better management. Otherwise, the management of such a centre should be prepared to assume responsibility for the maintenance and support of donated equipment, in order for it to be sustainable. Adequate plans should be made for paid staff, and the centre should not rely on volunteers who come and go, as they will.

I also wish to recommend that all equipment should bear the centre's name, to discourage buyers of stolen goods. Equipment furniture should be constructed with burglar-proof and padlocks installed to keep them in a fixed position with all doors provided with strong locks. It is important to note that all community ICT centres require proper assets management systems.
Finally, the centre and its full content should be insured against theft and fire.

Nigerian ICT policy makers

The recommendation to Nigerian ICT policy makers for harnessing the opportunities provided by ICT and reach the objective of bridging the digital divide in disadvantaged communities; it is essential to note the following measures:

- Provide an enabling environment and improve social amenities, such as stable electricity, telecommunication infrastructure, etc.
- Encourage ICT inflow, reduced taxes, or subsidies on ICT infrastructures (hardware/software), legal support to disadvantaged community ICT centre operators, etc.

- Encourage the use of public institutions (schools, libraries, hospital,s research centres, etc.) in introducing ICT, while private entrepreneurs are encouraged to set up public access in the form of cyber cafés.
- Reform national educational systems to embrace the use of ICT by learners and teachers alike. Create ICT research centres and training institutions.
- Encourage the implementation of e-government, e-education, e-health, e-commerce, etc, which will enhance the use of ICT for information access.
- Create public awareness and training to enable the public to make use of the services offered by ICT centres.

It is important and a matter of emphasis to understand that social amenities, such as a stable power supply, should have priority over all the other stated recommendations above.

Research limitations

To only focus this study only on how infrastructure, management, Government policy and risks are involved in ICT provision in Nigerian disadvantaged communities to bridge the digital divide, will limit its scope. It is also important to include ICT centres in Nigeria and South Africa (4 in total) and to compare the usage of ICT in these. Therefore two privately owned ICT centres in urban areas as case studies in Nigeria as well as two community-owned ICT centres as case studies in South Africa in urban disadvantaged areas were involved. The ICT centre managers were interviewed and the main focus was on restricting the study to disadvantaged communities. Greater attention was placed on Internet provision and access.

FINDING GENERALIZATION AND FURTHER RESEARCH

Although the findings of this investigation were limited to ICT provision in Nigeria to bridge the digital divide in disadvantaged communities, useful information was obtained on ICT provision to bridge the digital divide of a disadvantaged community. This is expected to provide scope for further discussion and research on how to deploy ICT effectively in disadvantaged communities.

Community ICT provision in South Africa compared to that in Nigeria.

The table below state the summary of ICT provision in South Africa compared to that in Nigeria, as it is revealed in the case of this study.

Table 4: *Summary of ICT provision in South Africa compared to Nigerian situation*

FACTORS OF COMPARISON	SOUTH AFRICA	NIGERIA
Model of provision	Educational/Community project.	Private entrepreneur, community cyber cafés
Aim of provision	Facilitate development, empowerment and economic growth	Business purposes (to generate profit)
Government policy	Adequate support, funding, coordination through Universal Service Agency (USA).	Deregulation of telecommunication industry, Yet to implement community project programme.
Infrastructure/ technology	Wireless, telephone, satellite	Satellite, telephone
Risks of provision	Security, funding, skills	Social infrastructures (electricity, roads, etc), Funding.
Management	Community-based	Private ownership
Contents/Services	Information, communication, Government services provision, job creation, community development, general awareness	Information, communication, employment opportunities.
Funding	Government, telecommunication operators, NGO's, international organization, ICT industries.	Personal savings, bank loan
Sustainability	Difficult to sustain	Sustainable

CONCLUSION

The aim of the research has been to contribute towards understanding the extent to which ICT could be deployed in Nigerian disadvantaged communities to bridge the digital divide, focusing on factors such as:

- ICT infrastructure;
- ICT centre management;
- influencing factors in ICT provision in disadvantaged communities;
- risks involving ICT provision in disadvantaged communities; and
- Current Government policies and civil society.

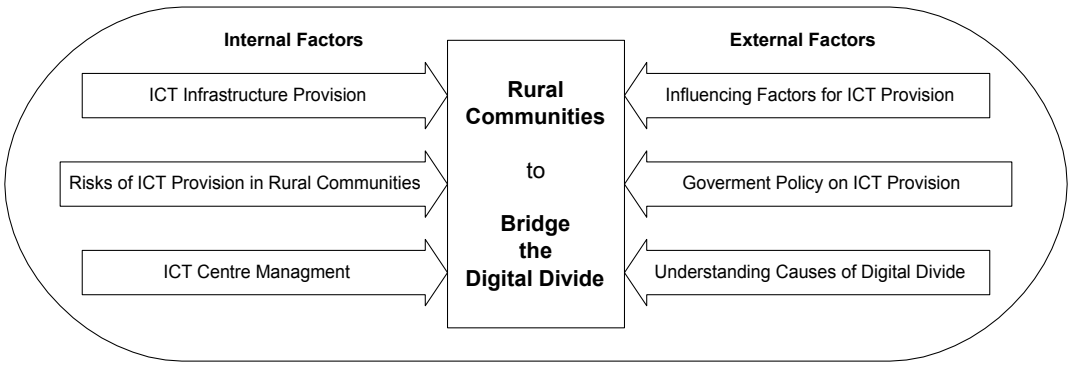

Figure1: *Influencing Factors towards a Sustainable ICT Model*

The investigation revealed that different types of ICT infrastructures exist by means of which disadvantaged communities can be empowered to access and share information relevant to their need. Some such types of connection being wired, fixed wireless, satellite, etc. The management structure and its level of involvement, in addition to Government policy on ICT adoption, as well as factors influencing ICT provision, are contributing factors to determine whether a centre would be sustainable or not, while most ICT centres managed by private entrepreneurs or public institutions, such as schools, seem to be sustainable. ICT centres that are managed by community organizations are difficult to be sustained due to inadequate funding and the level of commitment of the management.

The study also revealed that various risks or barriers exist that could hinder the provision of ICT in disadvantaged communities. The need to improve and empower all citizens should be a large enough influencing factor for overcoming such barriers.

In the final analysis, ICT provision in Nigerian disadvantaged communities to bridge the digital divide should be implemented with the aim of providing a sustainable structure. According to Figure 1 above, causes of the digital divide in disadvantaged communities may be coupled to the risks involved in providing ICT in the area. There is a clear indication that a committed management structure and appropriate ICT Government policies with suitable infrastructure would produce the desired benefits that would make ICT centres in disadvantaged communities sustainable. Fundamental to this is the recognition of the concept of civil society alongside business and government as a triumvirate to deal with the huge problems of inequity that ICTs are delivering across the world. As Erwin and Taylor (2004:22) suggest a new social contract is required that binds and partners civil, private and public sectors in delivering social inclusion and social cohesion in ways that strengthen economic, social and cultural benefit in the information society. This divide is one of the many facets of the basic social divide, which is growing in all countries. A comprehensive approach is required that would leverage all strengths and assets at community centres and which involves individuals at the centres, businesses, governments and civil society as well as action research where observation and analysis will be conducted by the actors themselves and where the results can be fed back to these centres for improvement. This will hopefully lead to a better understanding of and enhanced capabilities in harnessing ICT in the service of real human development.

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Development of a multi-scaled virtual field trip for the teaching and learning of geospatial science

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ABSTRACT

There has been considerable research and development into the use of multimedia in teaching and learning geospatial science. Geospatial science professions like cartography, geomatics and surveying are practiced-based and therefore are heavily reliant upon the application of knowledge to practical situations in the field. Action learning and action research establishes a learning environment in which students are actively engaged in building, testing and refining mental models.

This paper discusses the development of a virtual field trip to facilitate action learning and action research to enhance the field experience obtained by undergraduate geospatial science students when preparing for fieldwork. Developing the virtual field trip to encompass field observation for a number of geographic scales is discussed as part of this paper. Preliminary evaluation has been undertaken with results indicating that students are able to obtain a general overview of the area into which they will be working and obtain background information in an interactive three-dimensional model that will enable them to maximise their experience when away on fieldwork. Further work into the development of new localised sites and more tools to assist students with orientation and navigation are required.

Keywords: *Virtual Reality Modelling Language, Virtual Field Trip, Nested Models, Action Learning.*

INTRODUCTION

Action learning and action research assume that learning results from active experience (Kember, 1999). Traditionally, the delivery of information to students has been via what Michael and Modell (2003) term the “lecture hall” approach. This is achieved by an instructor (or lecturer) standing in front of an amphitheatre-style lecture hall with steeply ranked rows of seats armed with a blackboard (whiteboard) and projector screen. It is assumed that as the lecturer delivers information to students, they will “learn” that information, generally in a passive way. In contrast, action learning, which incorporates active learning, establishes a learning environment in which students are actively engaged in building, testing and refining mental models (Michael and Modell, 2003).

Practice-based geospatial science professions like surveying and cartography are reliant upon the application of knowledge in practice. It is therefore imperative that theory is integrated into practice through action learning (Chien et al., 2002). Within the School of Mathematical and Geospatial Sciences at RMIT University, we teach geospatial science undergraduate programs that incorporate aspects of geography, and in particular physical geography, where the fundamentals of geomorphology, climatology and hydrology are covered. Interactive computer-based exercises are used to teach the principles of reading topographic maps. These exercises utilise an interactive map base linked to formative questions that focus on topographic relief and scale, and were developed using Macromedia software. These are linked to RMIT’s Distributed Learning System (DLS) built around the Blackboard on-line platform. However, due to student

numbers, and financial and time constraints, fieldwork is reserved for second year. As part of the second year, students participate in a field camp of four days where they are required to undertake a series of "mapping" activities. One of the activities is for students to assess hiker impact along popular walking tracks in the Grampians National Park in western Victoria, Australia.

This paper discusses a project that was undertaken to test how effective the development and implementation of a virtual field trip (VFT) is for the preparation of second year undergraduate cartography and geomatics students for mapping fieldwork. In addition, the paper addresses how well the VFT facilitated action learning and action research through instructor directed exploration and examination of environmental biophysical factors in a real-world setting. Action learning and action research are seen as important aspects in undergraduate learning and enables students studying for practice-based professions particularly in the geospatial sciences, to be confronted with real-life applications. However many of the complexities and vagaries associated with real-world data make identification of specific yet important relationships difficult for undergraduate students. We set out with the intention of simplifying and removing some of these complexities through the adoption of a VFT. Through the VFT it was anticipated that students would be able to initially explore relationships between observed impacts and the natural variables that lead to variation in the levels of impact without the complexity of the real world. Once they have grasped these relationships it then becomes possible for them to be exposed to the complexities and vagaries of the real world and working with "real data". VFTs can simplify the complexity of reality in a readily accessible format, and enables the instructor to draw to students' attention, specific environmental relationships that may be missed on an actual site visit (Ramasundaram et al. in press).

From earlier research undertaken by Counihan (2005), evidence shows that by providing additional information prior to actual visitation to a locality enhanced knowledge of that locality and in turn leads to a greater appreciation of that locality. Given time constraints there is a need for students to maximise their learning experience whilst away. Virtual field trips (VFTs) are defined as being a collection of resources designed for the effective teaching and learning of fieldwork based on computer and web technologies. VFTs are virtual by the fact that no actual visitation to the location, takes place. However, according to Qiu and Hubble (2002), a VFT for geoscience teaching is comprised of explicit learning objectives, a related glossary, landscape images, video clips and quizzes. Students are able to learning at their own pace and are able to undertake, in a virtual sense, basic field exercises. VFTs vary in what is presented and the quality and approach of what is presented (Qiu and Hubble, 2002). These include VFTs that use a series of maps, text and photographs that read like a diary of activities on a field trip, for example the five day tour of the Grand Canyon developed by Bob Ribokas (2002), through to the Virtual Field Course hosted by the Geography Department at the University of Leicester (www.geog.le.ac.uk/vfc/index.html). The Virtual Field Course is comprised of a number of exercises, including one based on a geo-referenced database, focussing on computer-based support for fieldwork. Likewise, the Department of Spatial Sciences at Curtin University of Technology in Western Australia, has developed the "Virtual Online Learning" (www.cage.curtin.edu.au/volearning/) that can be used to facilitate geographic concept learning using a number of spatial activities ranging from survey principles to thematic classification. VFTs are not new but this project incorporates a Virtual Environment (VE) for the study area, developed using the Virtual Reality Modelling Language (VRML), as the centrepiece of the VFT. VRML provides a ubiquitous, rather than dedicated, and cheap three-dimensional simulator that can be accessed via the Internet (Brodlie and El-Khalili 2002). Klemm and Tuthill (2003) have demonstrated that VFTs can be used to augment field trips as well as provide a virtual alternative when no actual field experience is possible. In fact they go further by suggesting "VFTs can engage students in active learning and encourage them to think and solve real-life problems" (page 191). Moore and Gerrard (2002) found in their "Tour of the Tors – Virtually Interesting Project" of the Dartmoor Tors developed for university students, that given the ability to self

navigate and travel "freely" around virtual scenes provided the means to gain additional knowledge not always available from fieldwork alone. Moore and Gerrard (2002) note that the "conjunction of multiple views of the world and/or data (multiple representations) stimulates a greater understanding or insight into that data. It is this synthesis as it is expected in the Virtual Field Course (VFC, 1999) that enhances the learning environment for the student. The availability of multiple representations: media, map data and virtual reality, of the same geographical region, each of which offers a different perspective of the place, improves the scope of student learning" (page 190).

However the aim of the VFT for the Grampians was not to replace, but rather to augment actual fieldwork undertaken by second year geospatial science students. This is in line with Stainfield et al. (2000) who identified that a VFT should aim to introduce and prepare students for fieldwork and to improve efficiency of time spent in the field. Dykes (2002) notes that VFTs that rely on virtual reality are advantageous to fieldwork for three key reasons:

- They parallel the way students learn in the field through observation and analysis.
- They can fulfil a number of fieldwork learning objectives including teaching students to observe and interpret different physical environments and to make comparisons between these environments.
- They can improve any well-known deficiencies in fieldwork teaching in time effective manner, not dependent upon non-proportionate data collection efforts.

DEVELOPING A VIRTUAL FIELD TRIP FOR THE GRAMPIANS NATIONAL PARK, VICTORIA, AUSTRALIA

The Grampians National Park (GNP) in western Victoria, Australia covers approximately 167,000 hectares and with annual visits in excess of 1.5 million visits for the annual period from mid 2000 to 2001 (Parks Victoria 2005), is one of Victoria's most popular tourist destinations. The park is comprised of three sandstone upthrust ridges that run in a predominantly north to north-westerly direction for 90 kilometres. Whilst not high ranges by international standards, where the highest point is Mount William at 1168 metres, they do form a striking example of a cuesta landform standing above the surrounding peneplain.

Students are taken to the Grampians and are expected to complete a series of field exercises. One of these exercises relates to examining the characteristics of hiking impact along walking tracks in the park. A model of susceptibility in the park has been documented in Arrowsmith and Inbakaran (2002).

The first day of the field exercise, students are driven throughout the park and given an introduction into the geomorphology and derivation of these landscapes. Subsequent days are spent in the field, traversing walking tracks and taking field measurements such as slope and direction of a specific walking track, slope and aspect of the ground terrain, track surface type, depth of impact (gullying) and vegetation type. Locations are recorded using hand-held GPS receivers. Students are then asked to draw a map of the walking track showing recorded observed impacts and to investigate spatial correlations of observed measurements that lead to increased or decreased impact.

Management of scale in the VFT

What is clear is that students are exposed to work at a range of geographic scales. At an introductory level, students are required to gain an appreciation of the size and variability of the terrain contained within the park. In the past we used a series of 1:25,000 and 1:50,000 topographic maps to illustrate the complexity of the shape and topography of the park. Anecdotal

evidence from students indicated that a clear appreciation of the steepness of the escarpments of the eastern slopes were under-estimated. Also under-estimated were the magnitude of distances between locations and the levels of difficulty of hiking tracks. Additionally our field visits have encompassed interest at least two geographic scales: general overview scale of the Grampians, and a detailed knowledge of single walking tracks. It could be argued that a third scale, that of specific sites along the track at which field measurements are taken, is also required.

Scale variability was always going to present a challenge when developing the VFT. The complexity required at the site-specific level, for example a site might consist of a geographic area of radius 10 to 20 metres comprising the walking track, and adjoining rocks, trees and undergrowth, would overwhelm a park-wide model if it were to run over the Internet. In addition, for students to appreciate levels of impact and determine vegetation type, photos of real situations were necessary. Yet we also required students to be able to place walking tracks, and specific sites along them, in geographic context within the park.

Hence it was decided that the VFT would be made up of "nested" virtual environment (VE) models at three specific scales, all linked geographically to each other. The first scale where students would enter and be introduced to the VFT, would cover the entire park. The second scale would encompass the popular 'Wonderland Range' area, where students undertake most of their activities whilst in the field. The third and final scale would be site-specific and represent small study areas of specific interest. This third scale VE would incorporate many of their biophysical and human impact factors required by the students. Five sites demonstrating differences in environmental impact were identified in previous fieldwork. This would enable students to gain an appreciation for different combinations of biophysical variables and resultant levels of environmental impact from hikers along the tracks.

Development of nested VFT models

Four stages were involved in the development of the VFT. In stage 1, all necessary spatial digital data were acquired and transferred as separate themes into ArcView 3.2, a widely available desktop GIS. These data were then exported as VRML files in grid or raster format. Stage 2 consisted of generating a digital elevation model with a 600 metre cell resolution, adopting a 1.5 vertical exaggeration for the park-wide model. Models for the study area, and site-specific locations were developed as part of stages 3 and 4. Stage 4 also included the acquisition of digital landscape panoramas for use in the site-specific models. In addition, formative questions were linked to the site-specific panoramas using HTML hotlinks.

Stage 1: Compiling data and building terrain surfaces

The data used to develop the VFT consisted of topographic maps, photographs of prominent locations and study points taken during a previous field trip, a rectified Landsat Thematic Mapper satellite image of the whole GNP, and digital topographic data.

The primary data source used to develop the VFT was the State Digital Map Base (Topographic) dataset developed by the Victorian Department of Sustainability and Environment. This is a tiled vector data source containing a range of topographic themes including hydrography, vegetation, relief, transport, infrastructure, and administrative areas at a scale of 1:25,000. Using the topographic data index for this dataset, the appropriate tiles encompassing the whole GNP were selected and merged in ArcView 3.2 GIS. The most important layers in terms of developing a terrain surface were the 10-metre interval contour layers.

Clipped from this merged dataset were the necessary contour data for the whole GNP and Wonderland Range models. These data were then converted to a grid surface of the appropriate cell resolution and exported from ArcView GIS into VRML format.

Stage 2: GNP model development

A grid of 600 metre cell resolution was used to create the VRML terrain surface for the park-wide model. A range of larger and smaller cell sizes were tested but the 600 metre resolution grid provided the best mix of verisimilitude, acceptable file size, and interactivity. The vertical exaggeration of the terrain surface was set to 1.5 as it was felt that a student using the VFT would not fully comprehend the diversity of elevation throughout the park without this adjustment. Brown et al. (2002) noted that often when creating a credible representation of a virtual landscape, 'white lies' are required, specifically mentioning the use of vertical exaggeration as an example of one such 'white lie'.

The Landsat Thematic Mapper (TM) image containing additional information including land cover, was then draped over the terrain to provide a further degree of realism. The TM image had a pixel resolution of 30m and was captured in the year 2000. Flags and flag poles with floating rotating signs were then positioned at prominent locations throughout the park (for example Mt Abrupt – see figure 1).

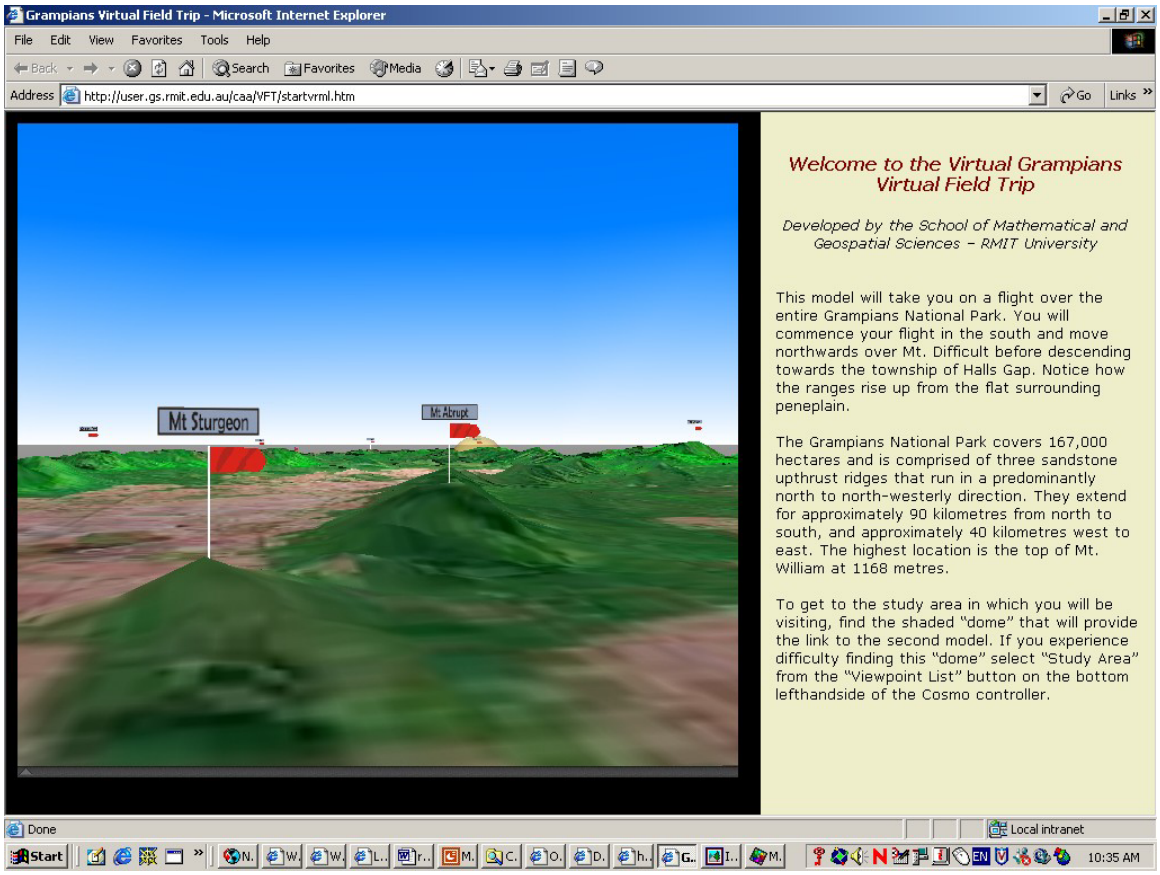

Figure 1: *Flags are positioned at prominent locations within the model.*

A partially transparent dome was placed over the Wonderland Range area, the second scale VE, to indicate its extent. A link to the nested, Wonderland Range VE model is incorporated into this dome (see figure 2).

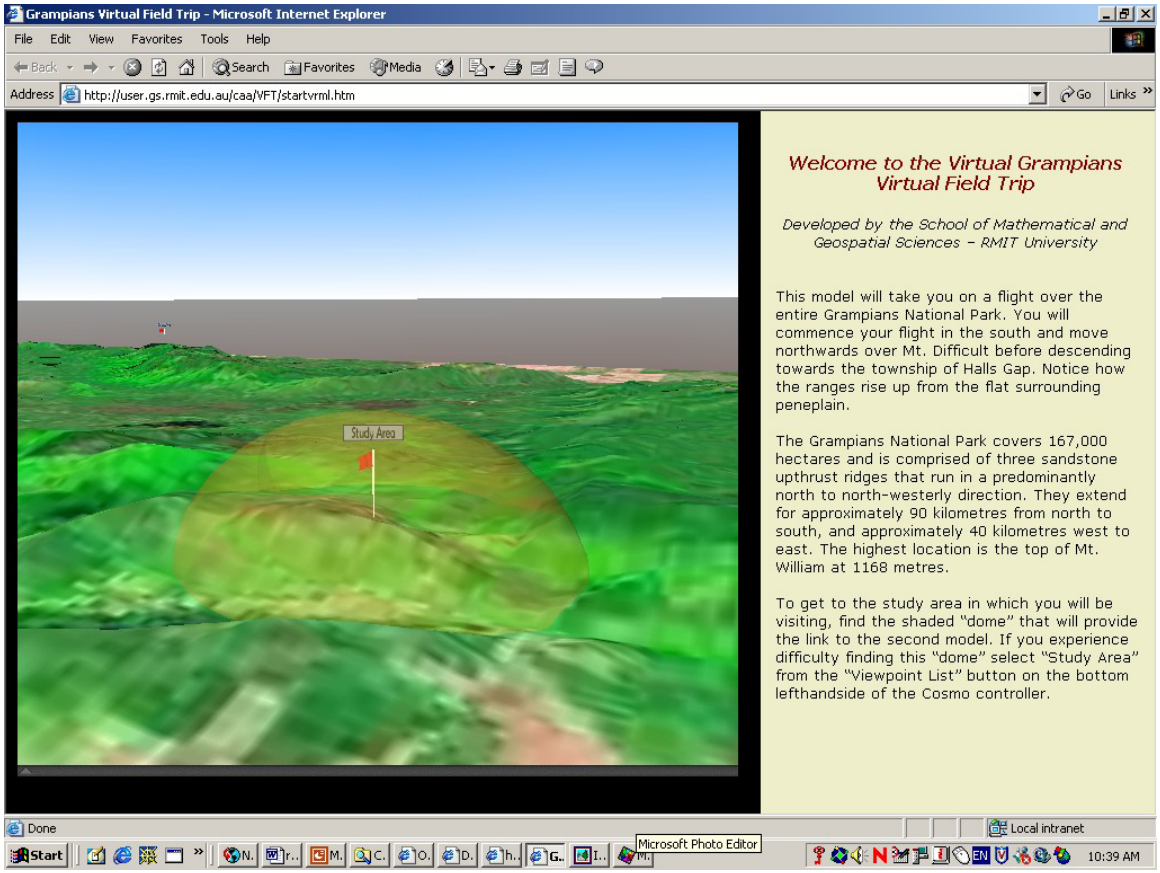

Figure 2: *A transparent dome is placed above the topography to indicate the location of the second level model.*

Finally, a fly-through, which provides a guided tour of the GNP and its prominent locations, was integrated into the model to introduce each student to the park (see figure 3). The fly-through starts automatically when the model is loaded and was seen as being important in providing spatial context within the whole park of localised sites in which the students would be working. Fly-throughs are also seen as important motivators and if done properly should invoke the user's interest and attention (Dransch, 2000).

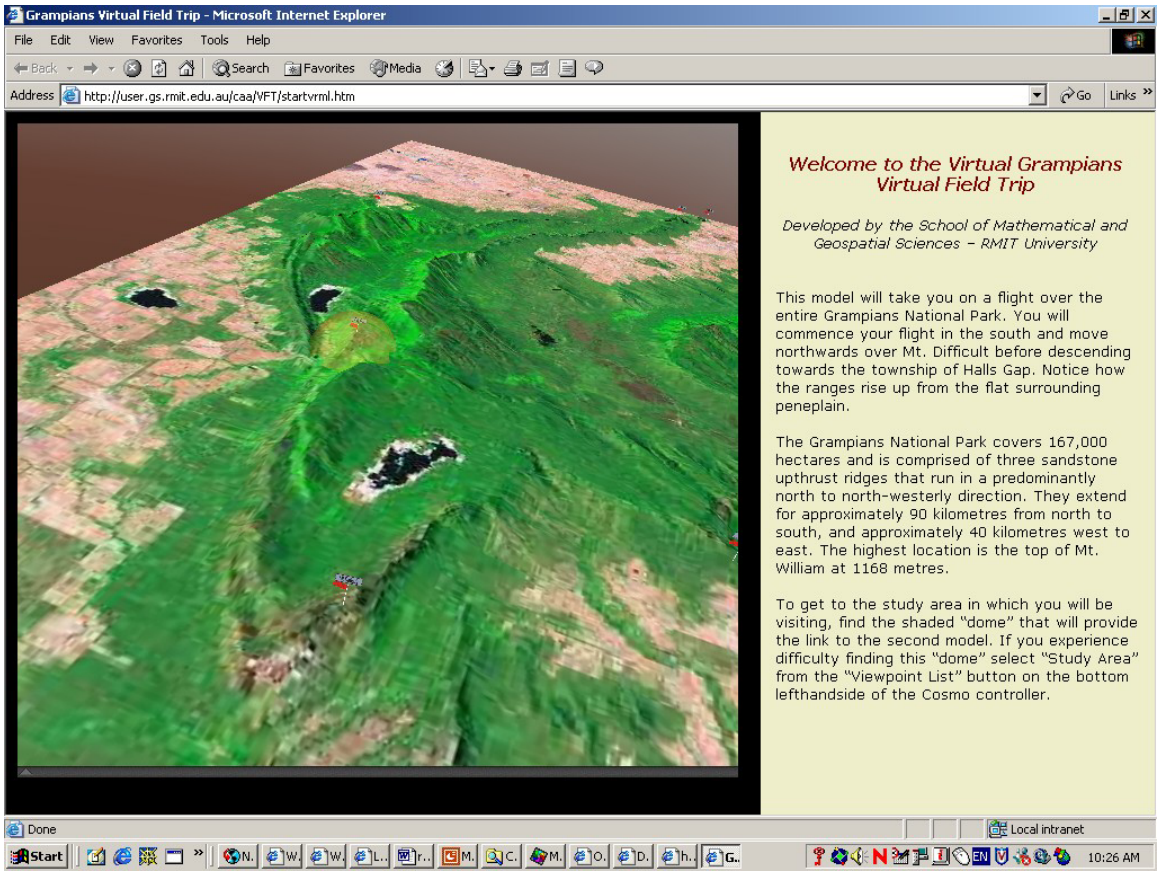

Figure 3: *A fly-through provided students the opportunity to visit the entire park area before entering the smaller study area.*

Stage 3: Wonderland Range model development

Like the GNP model, a variety of grids of varying cell resolution were tested in the development of a VRML terrain surface for the Wonderland Range VE model. It was determined that a grid of 50m cell resolution provided the best mix of verisimilitude, acceptable file size, and interactivity. Flags and flag poles with floating rotating signs were positioned at study points throughout the VE model. A partially transparent dome was used to indicate the extent of the Halls Gap township.

To provide additional functionality and flexibility, a Heads-Up-Display (HUD) menu system was incorporated into this model. Using this menu system, the student is able to access a range of options including a viewpoint list, links to the GNP model and individual site-specific study point models, and two terrain drape selection options. The viewpoint list accessed through the HUD allows the student to easily visit each study point and other significant locations, therefore assisting in the development of an understanding of the terrain and study area. Miller et al. (2002) note that viewpoints provide reference locations to which users can return following exploration into areas which are not of interest. Also through the HUD, a student is able to alter the terrain drape. Two terrain drape options are offered with this model. The first is a scanned topographic map of the Wonderland Range area while the second depicts the roads and walking tracks the students use while on their field trip (see figures 4 and 5). Finally the student's apparent

Australian Map Grid (AMG) location while traversing the terrain, within the VE model, is also provided within the HUD.

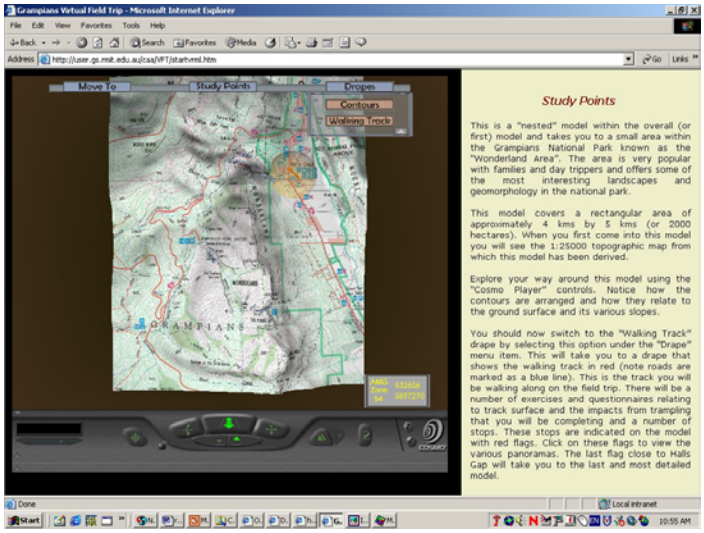

Figure 4a: *On entry to the second scale model a draped topographic map is encountered.*

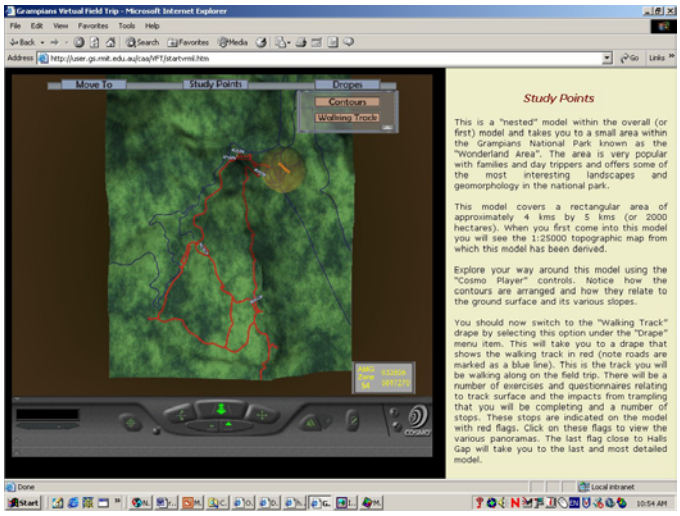

Figure 4b: *The topographic map can be interchanged with a map delineating the walking track with points of interest.*

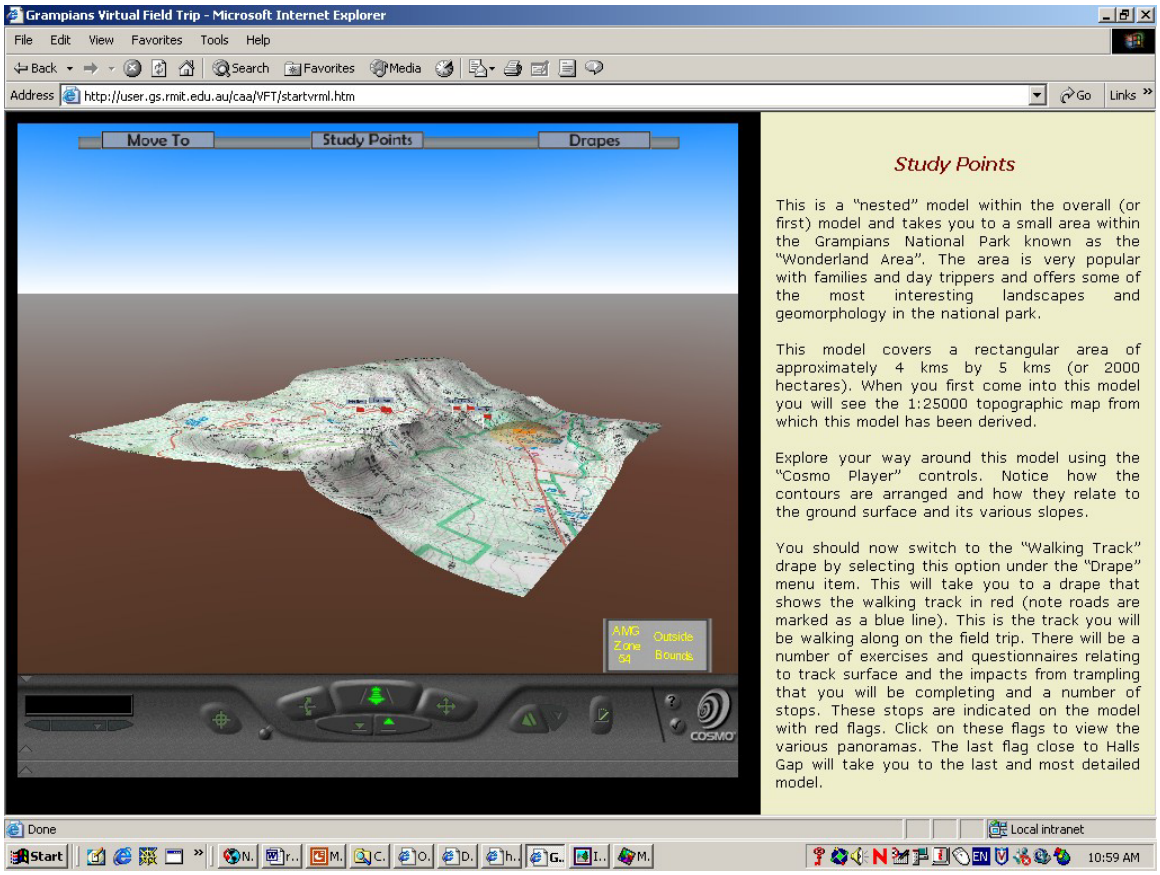

Figure 5: *The angle of view can be altered to reflect the three-dimensionality given by the second scale model.*

Stage 4: Development of the site-specific study point models

To enable students to gain some understanding of the relationships between biophysical properties along walking tracks and the impacts observed, five site-specific locations were identified from previous field visits. For each of these five site-specific locations a third level model was developed. These models are comprised of an enclosing semi-transparent hemisphere or dome that is placed over an approximation of the terrain at the location, therefore creating a completely enclosed study point characterisation. The terrain approximation was created based on measurements and photographs taken during a field visit to each location. Stitched 360° imagery taken at each location are placed on the inside of the enclosing dome, therefore providing a greater sense of enclosure and immersion. Other imagery of ground surfaces (such as rock and grass) was used to texture the terrain surface. Vegetation objects (for example trees and bushes) were incorporated using vegetation imagery collected while onsite. Using photographs enables actual vegetation, walking track surface and impacts upon it, and surrounding rock features to be observed much as they would in the field. A HUD was also incorporated into each of these study point models, enabling the student to return to the GNP, Wonderland Range or other study point models.

Placed throughout each site-specific model are a series of embedded interactive question bubbles shown in figure 6. When a student interacts with each of these bubbles, a series of formative questions relating to the observations similar to what is expected in the field are provided to the student. These questions were developed with reference to the learning objectives of the VFT and focussed on topics such as track surface type, track slope, impacts from trampling and identifying adjoining vegetation communities.

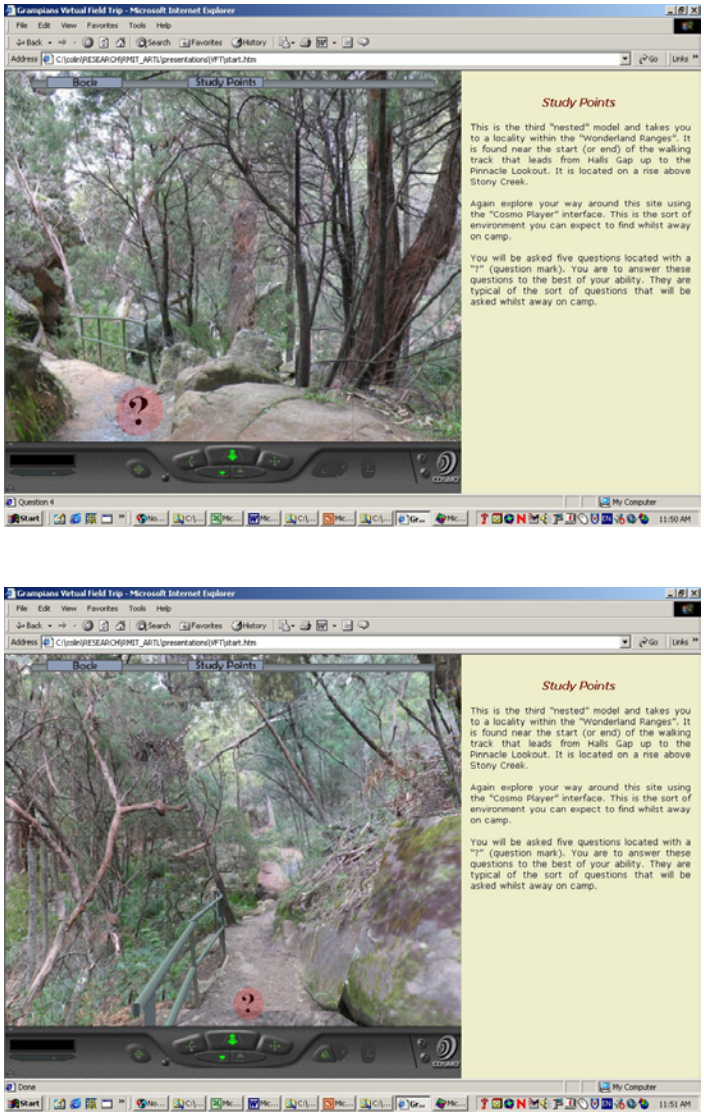

Figure 6: *Site-specific models give the students an appreciation for the type of environment through which they will be traversing. Question bubbles enable interactive feedback to students.*

EVALUATING THE VIRTUAL FIELD TRIP

The VFT was developed for second year geospatial science students who attend a mapping camp in September each year. Due to time constraints we were unable to evaluate the VFT prior to their departure. It is intended to do this prior to the 2005 camp. As a preliminary evaluation postgraduate students in the School of Mathematical and Geospatial Sciences were invited to participate in the initial evaluation towards the end of 2004.

We opted for a three-part questionnaire. The first part consisted of eight questions that sought general responses regarding whether participants had been involved with field trips at university before, and whether or not they had previously visited the study area. The purpose of these questions was to ascertain how participants felt about field trips in general, and to gain an understanding of their base knowledge of the study area. Out of the 17 participants, only two had never been on field trips, and five had never been to the study area.

The second part of the questionnaire consisted of 17 statements for which we sought agreement or disagreement of statements, on a five-point Likert Scale, relating to their experience with the VFT. Statements included preference for participating in field trips, through to feelings of replacing fieldwork with the VFT and appreciation of the VFT to facilitate student learning. These questions enabled a quantitative analysis of responses to be undertaken.

Subjective responses to three questions formed the third and last part of the questionnaire. Questions centred on what the participants found as the best and worst aspects of the VFT and how the VFT could be improved.

The following five general observations were extracted from responses:

- all students like field trips and camps;
- most students got good marks for geography related courses;
- all students are able to work well with computers;
- all students believe that field excursions are a valuable learning resource; and
- most students disagree that VFTs should replace fieldwork.

Specific observations relating to the VFT included:

- the majority of participants found it useful and would prepare them adequately for fieldwork;
- about half the participants experienced difficulty navigating their way around the VFT and became disoriented;
- most participants could anticipate that a range of biophysical factors would result in variable impacts; and
- all, with the exception of one participant, would feel more comfortable about going on a field trip to the Grampians. This participant also expressed some concern regarding gaining understanding of the variability of impact along walking tracks.

At least half of the participants commented in an open-ended question, that they found the fly-through and three-dimensional effects useful for giving a good topographic overview for the region. The biggest drawback was becoming disoriented within the model and having difficulty navigating along pathways through the model. The use of a two-dimensional index map would help alleviate disorientation, similar to the one used in a three dimensional VRML developed for tourism in natural areas (Counihan 2005). Given that one of the key objectives for the fieldwork is to ascertain how and where, given variable bio-physical variables, hikers impact upon walking tracks in mountainous terrain, it was felt that this objective was only partially met. Because of the

complexity of building intricate detailed models, only one study site could be fully developed as a test case. Therefore multiple sites with variable biophysical features could not be encountered within the VFT.

However, given the positive feedback in this initial study, it is felt that it would be worthwhile building upon the initial models and fully develop large-scale models at all five sites along the walking track. This should be completed before the 2005 field trip takes place to ensure that proper evaluation can take place prior to the fieldwork being undertaken.

Hurst (1998) notes that one of the most important advantages of the VFT is its ability to portray information at a variety of scales. Our VFT was developed using the three-scaled "nested" model discussed in section 2.2, to enable a range of fixed scale models to be encountered, each conveying different types and amounts of information. However, even within a single model, students are able to move around and within the virtual environment and are able to zoom into specific locations or zoom out to get a complete overview of the locality, something unobtainable in the real field trip. This was noted in several responses from participants in the evaluations.

Also noted by Hurst (1998), is the promotion of three-dimensional visualisation which is important for geoscience students to understand. Within a VRML model the students are able to move about a 3-D environment, rotate the environment, change viewpoints, take aerial and landscape views.

Apart from the evaluative questionnaire we observed students working at their own pace. They were able to revisit sites, review formative assessment and obtain instant feedback on their individual responses, and explore the models uninhibited by other students or staff. This is a clear advantage in student-focussed learning environments, and not all students learn in the same way or at the same rate.

Of course heading the disadvantages associated with using VFTs to replace "real" field trips are that VFTs are merely abstractions, or simplifications, of the real thing (Hurst 1998). There are many facets of a real field trip that are totally lost in a computerised VFT. Touch, smell, sound and other subtle information that collectively form a picture of the environment into which the students finds his or herself, are omitted from the VFT. However soundscapes could readily be incorporated in to each of the models.

In terms of facilitating action learning and action research, the VFT did allow students to encounter a real world setting, albeit virtually. They were able to roam the VFT at their own pace within a series of nested models, each at a different geographic scale and corresponding level of detail. Whilst fundamental correlations between biophysical variables and hiker impact could be examined, it was felt that without multiple sites, these relationships could not be verified and also made understanding the relationships more difficult. For action learning and action research to be truly effective within this VFT, these sites must be fully developed.

FURTHER DEVELOPMENTS

Despite the extensive developmental work already undertaken in this project, there is still a long way to go before full implementation is possible and therefore full advantages and learning outcomes for students can be achieved. First, and foremost, is the need to develop the remaining site-specific VE models along the designated walking track. Currently we have fully developed one of these sites, and this contains a number of linked formative questions embedded in the VE. However, given one of the underlying objectives of the field excursion, is to draw relative comparisons through observation, of impacts along walking tracks and to spatially associate

impact with vegetation, and physical parameters (including slope, aspect and track width and surface, as well as distance along walking track), a variety of specific site locations with varying biophysical factors need to be encountered by students in the VFT. We have identified four other site locations, and have taken digital panorama photographs for each of these. Nevertheless, we now have a process in place to build the VE for each of these locations with relative ease. New formative questions relating to the specific aspects for each site will need to be designed, but technologically this should present little if any difficulty. Once these site-specific VEs have been constructed it should be possible for students to clearly identify those biophysical variables that correlate with high hiker impact. They will be led into observing this through carefully constructed formative assessment, as part of the Action Research Action Learning process.

One of the project objectives was to use the VFT to teach and enhance the map reading skills of first year physical geography students. We now have in place a three-dimensional base model, the second scale VE, where we have draped the 1:25,000 digital topographic map across. Formative questions that link directly to the model regarding the shape of terrain and contour shape and separation, as well as calculation of distances using scale and simple co-ordinate calculations using grid co-ordinates supplied in the HUD in the model, need to be developed.

Given the nature of fieldwork, students work either in pairs or in small groups of three students. This is important not only for safety reasons, but it also encourages students to discuss and reflect on what they are observing in the field, and listen to peer opinion. The Centre for the Study of Higher Education at The University of Melbourne has identified a number of educational advantages that group work possess, but have highlighted

"three good reasons for group learning:

- *peer learning can improve the overall quality of student learning;*
- *group work can help develop specific generic skills sought by employers; and*
- *group work may reduce the workload involved in assessing, grading and providing feedback to students." (CSHE, 2005).*

Group fieldwork can be emulated in the VFT through the use of discussion boards including threaded discussion groups using the facilities provided within the RMIT DLS, Blackboard. Debate, peer opinion and collective report writing, with input from the fieldwork co-ordinator can all be achieved on-line.

Feedback from participants of the evaluation noted a number of small improvements including instructions for using browser controls, index maps for relative orientation, adding numbers to the questions marked on the site locations and improving image quality. These are relatively minor amendments and can be altered without too much difficulty in a future release.

Finally, whilst not essential, a desirable outcome would be to find another university either in Australia or from overseas who are developing similar VFTs so that students can experience other destinations and participate in collective discussions with students from different cultures and backgrounds to enhance their own knowledge base. We have already participated in international collaborative projects for the teaching and learning of geography via The Online Center for Global Geography Education (Solem et al., 2003) developed under the auspices of the Association of American Geographers (refer to http://www.aag.org/education/center). Our students saw this as a most advantageous exercise that enabled them to interact with students from another university in another country (in our case Utrecht University). The VFT discussed in this paper can be accessed at the following URL: http://user.gs.rmit.edu.au/caa/VFT/start.htm.

CONCLUSIONS

This paper discussed the development of a virtual field trip to the Grampians National Park in western Victoria. Part of the objectives for undertaking this work was to facilitate Action Learning and Action Research through the use of a virtual environment built using VRML, to enable students to "explore" a locality for which they were going to visit. Whilst virtual field trips are not new, this paper discussed the development of a virtual field trip that made use of a three scaled virtual environment "nested" model. Three scales enabled students to gain an overall appreciation for the study area, yet also explore some of the detail of localised sites and in particular examine the links between the biophysical variables and impacts from trampling from tourism. More work in building the virtual environment models for other localised sites should enable students to examine other localities exhibiting tourism impact.

Initial evaluation has shown that whilst the majority of participants found the virtual field trip useful in preparing them for fieldwork, they experienced some difficulty in navigating the system. All expressed concern that a virtual field trip should not replace actual fieldwork.

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An ICT-Hub model for rural communities

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ABSTRACT

Information and Communication Technologies (ICT) has the potential to change new and old forms of economic activity. This can result in e-literate groups, low skilled or low paid workers, unemployed people, sole parents, and those with disabilities that do not have access to these ICTs. However, it is likely therefore that assisting people to improve their access to and skills in ICT will be an important means for a Government to grow an inclusive, innovative economy for the benefit of a country. Therefore the ICT-Hub model or mechanism for integrated service delivery to rural communities may be applied for this purpose.

An ICT-Hub can be seen as a sustainable physical centre with the necessary infrastructure to provide generic services like tele-centres, desktop publishing, business support, application development, training and information services to the community.Communities and locations with poor Internet availability are likely to be considered less favourable places for economic investments, thereby limiting enterprise development and job creation and restricting the growth of SMEs, currently seen as a key driver of economic growth.

ICT-Hub provides a structure, which enables communities to manage their own development, by providing access to appropriate information, facilities, resources, training and services.

Keywords: *South Africa, Best Practices, Service Delivery, ICT, Multi-purpose Community Centres (MPCC) and ICT-Hub*

1 INTRODUCTION

Development of the local economy in rural South Africa, and Africa in general, is severely compromised by the lack of infrastructure, services and know-how. This is especially the case for enabling technologies in the Information and Communication arena.

We are living through this revolution, which brings together people from different environments (National Research Foundation, 2004). In these circumstances, people may learn from one another, but they also need basic access to and understanding of information and communication technology (ICT). Not only do people need to understand the rapid evolution of new ICTs, they also need to keep pace with the rapid changes imposed on the social structure at work, at home, in the classroom and in the entertainment field. It is indeed necessary to shape the South African information society by harnessing the key information and communication technologies and skills required for the socio-economic development of the country. This understanding needs to take shape within the context of the realities of the country in terms of information literacy. Interfaces between technology and society will need to be different, as levels of understanding may be very different from those that occur in other parts of the world. If South Africa does not become a major player in ICT, it can result in a scenario where the country will struggle to compete globally.

ICT can be regarded as both a driver and an enabler. In many of the other National Research Foundation (NRF) focus areas, ICT is treated as an enabler - influencing how things are done -

but this focus area considers the aspects of ICT as the driving force for current or future change (NRF, 2004).

South Africans need to be part of the information society to be globally competitive, play their rightful role in the region and benefit as individuals. Part of this initiative is access to information and awareness of the possibilities of the effective use of ICT. Broader online literacy is required, as ICT is becoming a popular service delivery channel increasingly used by the government, business and financial sectors. It is important to address the growing functional illiteracy that disempowers people from living effectively in a modern society, by taking away people's fears of ICT (National Research Foundation, 2004).

In many respects, South Africa can at best be a fast follower in this expansive world of technology. There should be a clear distinction between the need to develop ICT capacity and the need to conduct research in this area. Fostering capacity is as important as conducting research. Many of the issues listed in this focus area can only be addressed effectively through partnerships between the NRF, industry, government and social communities. The main business of the NRF, however, remains the support and promotion of research into these issues, whereas building ICT capacity may be the responsibility of the partner.

The purpose of this article is to present the development of a model for successful implementation of ICT in a rural community (Itsoseng) and to make recommendations to the community centre for better sustainability. For this purpose the concept of a community centre first has to be explained and analyzed.

2 DEFINING MULTI-PURPOSE COMMUNITY CENTRES (MPCC)

A great deal of research has already been done on evaluation of the true state of Multi-Purpose Community Centres (MPCC) in South Africa and abroad (MPCC Research Report, 1998; Gomez & Hunt, 2001; Jensen & Esterhuysen, 2001; Conradie & Jacobs, 2003). The emphasis has, it seems, always been on community needs, financial aspects, services provided, management structures and operational aspects. It is therefore important to determine exactly what will the best practice framework be for evaluating a Multi-Purpose Community Centre? (This issue will be addressed in the following section.)

In addition with the best practice framework is the importance of understanding what definitions various parties are using to describe the operations or existence of a Tele-centre or MPCC or any form of a Community Service Centre. Community Service Centres are widely seen as a key measure of offering a wide range of services needed by the communities to the communities, and empowering communities to bring about their own development (Conradie, Morris & Jacobs, 2003).

There are many kinds or types of Community Service Centres or better known as Tele-centres. Tele-centres may be independent individual agencies, or various government initiatives like Universal Service Agency – Tele-centre Programme, Government Communications and Information Services (GCIS) - Multi-purpose Community Centre (MPCC) Programme, part of a project or national agency. It is also known as Community Service Centre, Community Information Centre, Community Resource Centre or Community Computer Centre according to the *MPCC Research Report* (1998:4).

At the end of the day, Tele-centres or MPCCs aim to stimulate and respond to the demand for information and communication services needed by the community. An indicator of the success of

any Tele-centre or MPCC is the degree to which it becomes an integral part of the community it serves.

According to the South African Government Multi-purpose Community Centres programme (Government Communications and Information Services, 2001b), MPCCs have been identified as the primary vehicle for the implementation of development communications and information programmes, as these are capable of offering a wide range of services that communities can use for their own empowerment. The *MPCC Research Report* (1998:5) points out that there have been discussions around the definition of a MPCC at many conferences and meetings, but an initial definition could be:

> *"An MPCC is an organisation offering a range of developmental services (including information services) to a specific community and with a large degree of community involvement."*

According to the Tele-centres for Socio-economic and Rural Development in Latin America and the Caribbean (Proenza et al., 2001:iii), a Tele-centre may be defined as:

> *"A shared site that provides public access to information and communications technologies"*

The report from the South African Government Communications and Information Services on the Establishment of Government Multipurpose Community Centres (Government Communications and Information Services, 2001a) provided the following brief description of an MPCC;

> *"An MPCC is a place where a number of services are provided by local, provincial and national government, as well as parastatals, NGOs, CBOs and the private sector. The services offered at an MPCC are those that have been identified by communities"*

Analysing the definitions of a MPCC as explained by various parties in South Africa and abroad (indicated in examples above), it is clear that Community Service Centres are playing a major role in **integrated service delivery** to the various communities across the globe in developing countries. Apart from defining a MPCC for the purpose of this article it is also necessary to highlight, which best practices have been identified and applied in the development of the an ICT-Hub for rural communities.

3 IDENTIFY BEST PRACTICES OF MPCCS

According to the Tele-centre Research Framework for Acacia best practices (Whyte, 1998) they use a framework in terms of defining the following characteristics regarding case studies:

- Background;
- Financial Issues;
- Infrastructure;
- Service Provided;
- Management Structure;
- Operational Aspects;
- Linkages;
- Issues.

With reference to the MPCC Research Report conducted by the National Information Technology Forum (MPCC Research Report 1998:24) best practices identified for use as a framework in terms of defining the characteristics regarding case studies are discussed in the Table 1.

Table 1: *Defining the characteristics*
Source: (Adapted from the MPCC Research Report 1998:24)

Best Practice Characteristics	Description
Sustainability	One of the main characteristics of best practices is sustainability. It involves all the facets of the project from financial to political issues. Sustainability for a project or an organization means being able to maintain or prolong the services with the means available and this depends largely on the type of services provided, income generation and future plans.
Ownership	Management structure is also important in determining the success of the project. Depending on the services provided and resources available, small and efficient managerial staffs is important for a MPCC.
Linkages	Linkages in this instance mean the relationship that MPCCs have with other related and unrelated organisations. It also means that centres communicate with each other on matters of common interest, which could bring many far-reaching spin-offs. The extent of the centre's connection or link with other centres determines largely its success or failure.
Services	Services provided by the centres vary from area to area, but one of the best practices in terms of services is demand driven services i.e. that the services needed are defined by the clients which will convince them to sacrifice their resources to get them.
Finances	Financial issues are very important to the success or failure of MPCCs. It is important to have clear strategy on fundraising and raising income for centres. A clear business plan is generally accepted as a good practice for MPCCs.

Apart from best practices for a community centre one also needs to focus on key elements to address the needs in communities.

4 KEY ELEMENTS/COMPONENTS

Every MPCC is different in providing appropriate information, facilities, resources, training and services to the community. The most important key elements/components that should exist in community centres will now be provided as these should serve as mechanisms to determine the focus of service delivery in relation to the needs of a community. With reference to the Government Communications and Information Service (GCIS), some of the key elements of the MPCC programme were identified in terms of the following (Government Communications and Information Services, 2001a):

Political Neutrality: An MPCC must be a non-political community institution that brings services closer to the people.

Physical Infrastructure: The community needs to use an existing accessible infrastructure as a site for providing services. If an under-utilised existing building (where potential for growth is available), the community should look at the possibility of using it as an MPCC site. In some areas, there are no appropriate buildings to be used as MPCCs, in which case, other options of providing prefabs, containers or mobile units need to be explored.

ICT Infrastructure: In order to provide fast, efficient and effective services, there is a need to have appropriate Information and Communication Technology infrastructure at MPCCs. This will help people in rural areas to have access to technologies, thus enabling them to participate meaningfully in the global economy.

Integrated Service Delivery: An MPCC is a place where people have access to information and services from various service providers. This may include government (Labour, Home Affairs, Welfare, Education and Agriculture) parastatals (e.g. Eskom, Telkom and DBSA), NGOs, CBOs as well as business and private sector.

Information: Information from all sectors is critical in MPCCs. Government information, policies and plans should be communicated through this institution to communities.

Sustainability Issues: There are many different types of centres termed MPCC in South Africa. For the purposes of the government initiative, MPCCs are defined as those centres that have at least six government departments offering services. Government services add value to other services that are offered by the NGO and Business sectors. An MPCC should also have access to technology in the form of an Information Technology Centre (ITC) such as a Tele-centre or other forms.

Apart from these key elements as identified by Government Communications and Information Services (2001a:7), Berlyn (1997:4) determined that Multi-purpose Community Centres should be directed towards content. However, a MPCC can be made up of a mix of the list of collective contributory components that appear in the figure below. The actual mix depends on what the community wants and what it is possible and/or feasible to supply with the limited resources at hand.

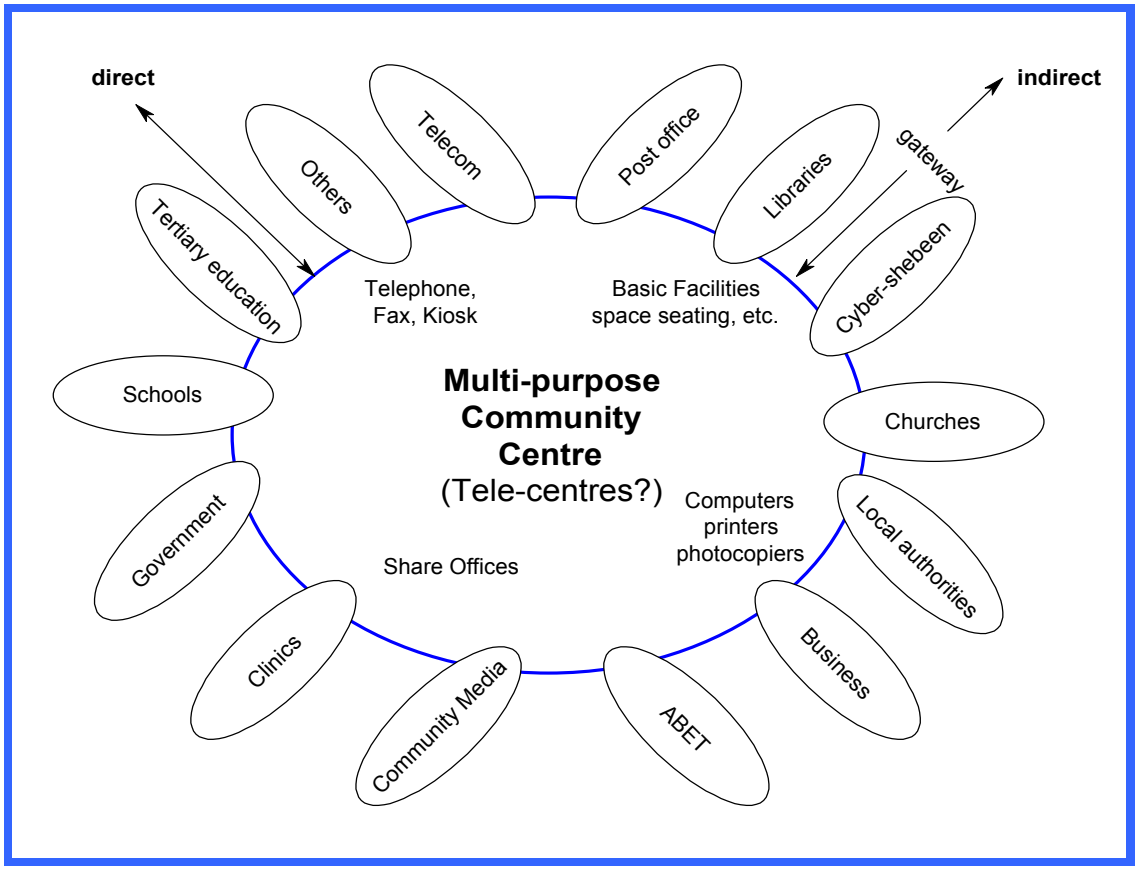

Figure 1: *MPCC Collective Contributory Components (Adapted from Berlyn, 1997:4)*

The direct contact services, which the individual community members can access in a MPCC without intervention of a third party, include telephone, fax and e-mail. The indirect contact services that might have to be rendered by or through a third party or "gateway" at an MPCC include electronic library, tele-education, tele-medicine, the Internet and Government online (Berlyn 1997:4).

A survey was conducted and information where collected and analysed at the community centre in Itsoseng with regards to service provision based on the best practices, which were identified earlier by Whyte (1998:1).

5 METHODOLOGY

The first step was to let the relevant organisations and stakeholders of the Ikageng MPCC know of this case study and even more importantly to have the buy-in of the community leadership and MPCC staff members of Itsoseng to conduct the case study. The organisations and relevant stakeholders that were contacted regarding the case study include the following list:

- Tshwane University of Technology (TUT);
- Council for Scientific and Industrial Research (CSIR);

- Ikageng MPCC Coordinator;
- Ikageng Community Management Board;
- Ikageng MPCC Staff Members.

A single case, case study was used, because like Creswell states (1998:8) the real business of case study is to take a particular case and come to know it well, not particularly as to how it is different from others, but for what it is and what it does.

> *"The case study is in a sense a kind of simulation of a real-life situation in which the experience is second-hand and probably condensed. The important merit of the case study is that it allows a problem to be studied in a complex form, including elements of real-life events, which it might be impossible to reproduce in the classroom. The main virtue of case studies is the way in which they can efficiently integrate a wide diversity of subject matter. (Jaques 1994: 94)"*

The case study researcher typically observes the characteristics of an individual unit - a child, a clique, a class, a school or a community. The purpose of such observation is to probe deeply and to analyse intensively the multifarious phenomena that constitute the life cycle of the unit with a view to establishing generalisations about the wider population to which that unit belongs (Cohen & Manion 1994:106). Whatever the problem or the approach, at the heart of every case study lays a method of observation. As a case study, it can be intrinsic because of its uniqueness or instrumental because of the stating of issues.

Creswell (1998:118) states that a purposeful selection of participants represents a key decision point in a qualitative study. This could be regarded as important because it "*permits logical generalisation and maximum application of information to other cases*" (Creswell 1998:118). The participants in the case study consisted of the centre coordinator, staff members and users of the centre. Information and viewpoints from the community leader and his management team were needed as well as the Ikageng Multi-purpose Community staff members. Their inputs were needed in order to obtain as much detail and insight as possible on the Ikageng Multi-purpose Community Centre (MPCC) and the community at large. The data in this study was collected through semi-structured interviews and questionnaires. Three different sets of questionnaires were prepared and used during the survey process for the purpose of the case study in Itsoseng:

- One set for the Ikageng MPCC Centre Coordinator and IMCOP Management;
- One set for the Ikageng MPCC Staff members;
- One set for the Ikageng MPCC users.

6 DATA COLLECTION AND ANALYSIS

Techniques employed in data collection were those typical in case studies. They included observation, semi-structured interviews, literature studies, open-ended questionnaire and personal experience. Observation is one of the earliest and most basic forms of research. Adler and Adler (1998:80) state that we make observations of the everyday world, which guide us in forging paths and interpreting actions and reactions of others. The nature of this observation is systematic and purposive.

The Ikageng MPCC (figure 2) is located close to the taxi rank in Itsoseng. It is not visible from the taxi rank, but signboards (figure 3) display the details of the MPCC and the services they offer.

The local post office is within walking distance from the centre and a retail shop is on the opposite side of the street where the MPCC is located.

Figure 2: *Ikageng MPCC*

Figure 3: *Signboard at Taxi Rank*

The MPCC is a brick building consisting of three rooms and a toilet and is hosted next to a medical doctor's practice. A reception area, office and training room exist at the centre. A computer network with network points and ducting are installed at the centre to give it a more professional look a like. The services they offer are displayed on their information board (figure 4) with some examples thereof. Furthermore the MPCC mission and vision statement are displayed on the notice board and community members used the photocopying and training facility during the visit.

Figure 4: *Ikageng MPCC Services offered Display*

The observations and interviews done at the Ikageng MPCC in Itsoseng were conducted after a number of visits over a period of two and half years. A detailed training session dates are shown in Table 2 stating the minimum training and support requirements that were applied on the participants in the case study.

Table 2: *Ikageng MPCC Staff Training Sessions*

Ikageng MPCC Staff Training Session	
Period	**Description**
02 July 2001 to 06 July 2001 (Week 1)	1) MPCC Orientation 2) Introduction to Windows 3) MS Word Tutor Training: CBT CD-ROM 4) MS Excel Tutor Training: CBT CD-ROM
30 July 2001 to 03 August 2001 (Week 2)	1) MS Word Tutor Training (continue) 2) MS Excel Tutor Training (continue) 3) MS Publisher Tutorial
25 September 2001 to 28 September 2001 (Week 3)	1) Business Skills Training: Your Approach to Business 2) Business Skills Training: Costing and Pricing 3) Business Skills Training: Your Business Plan 4) Content Creation: Front Page Tutorial 5) PC Components: Technical CBT CD-ROMs
22 October 2001 to 26 October 2001 (Week 4)	1) Business Skills Training: Costing and Pricing (continue) 2) Business Skills Training: Your Business Plan (continue) 3) Business Skills Training: Marketing 4) Content Creation: HTML Tutorial 5) PC Components: Technical CBT CD-ROMs (continue)
12 November 2001 to 16 November 2001 (Week 5)	1) Business Skills Training: Your Business Plan (continued) 2) A+ Tutorial Material and Orientation 3) Content Creation Continue
13 May 2002 to 17 May 2002 (Week 6)	1) Business Skills Training (Support) 2) N+ Tutorial Material and Orientation 3) Content Creation (Support)

Mason (1996:38) refers to semi-structured interviews as qualitative interviewing, which are characterised by the following:

- A relatively informal style, for example with the appearance of a conversation rather than a formal question and answer format;
- A thematic; topic-centred, biographical or narrative approach, which covers the issues or themes the researcher wishes to cover; and
- Assumption that data are generated via interaction.

Semi-structured interviews have the advantage that the interviewer is allowed to introduce new material into the discussion, which has not yet been thought of beforehand, but developed during the course of the interview (Hitchcock and Hughes 1989:79). The semi-structured interview approach was very beneficial as the element of flexibility allowed the interviewees to freely

express their views. The purpose was not to get simple yes or no answers but descriptions of episodes, linkages and explanations (Stake 1995:65).

Although different sets of questions were posed to the Ikageng Multi-purpose Community Centre (MPCC) management, staff members and users, the questionnaires focussed on the background, sustainability, ownership, linkages, services, finances and uses of the centre (best practices - cf 3). Questions to the Ikageng MPCC Coordinator and staff members include issues with regards to sustainability, ownership, linkages, services and finances. Questions to the Ikageng MPCC users include the opinion of the users on the centre (for example; "do you think the centre is useful to the community?") Open-ended questions were chosen as they permit free response from the subject and allow greater freedom of expression and a wider range of responses (Ary, Jacobs and Razavieh 1990:411). As the researcher was interested in whether the management and staff of the Ikageng MPCC initiative has motivation, stability and direction in terms of the operations, the open-ended questions were preferred. The open-ended questions were put to the Ikageng MPCC Management to have more information on the needs and perspectives of the leaders of the community in Itsoseng. A second set of questionnaires was given to the Ikageng MPCC management to complete as part of the case study. Important data collection instruments were personal experience with regard to ICT-equipped rural community centres (Conradie & Jacobs 2003:30-33; Conradie, Morris & Jacobs, 2003:199-217) and a literature study review.

The case study research method was complemented by qualitative analysis during this study as Babie (1992:6) defines this term as "the non-numerical examination and interpretation of observations, for the purpose of discovering underlying meanings and patterns of relationships". According to Ary, Jacobs and Razavieh (1990:449) data collection and data analysis take place simultaneously. From the outset of the first interview or observation, the qualitative researcher is reflecting on the meaning of what has been heard and seen. This process of data analysis is inductive as it proceeds from data to hypotheses to theory (Ary, Jacobs and Razavieh 1990:450). They (1990:451) further state that it involves working with data, organising it, breaking it into manageable units, synthesising it, searching for patterns, discovering what is important and what is to be learned, and deciding what to tell others.

This study has therefore involved all the above-mentioned processes in order to make a qualitative analysis of the findings. The research data obtained through the interview process, site visits and questionnaires used in conducting the survey in the Itsoseng Community, but more specifically the Ikageng Multi-Purpose Community Centre. However, it is important to be reminded of the best practices (cf 3) indicated in the previous section identify a framework that defines the characteristics regarding case studies for community centres. Therefore, the questionnaires sets used during the case study in the Itsoseng Community was researched and developed within the framework of the best practices as discussed earlier.

7 RESEARCH FINDINGS

According to the community leader, a retired human resource manager and resident in Itsoseng since 1970, the idea of establishing an Information Technology Centre in Itsoseng originated in February 1999. The idea was developed with the CSIR lead consortium and a proposal was born out of the discussions, which led to the establishment of the Ikageng Multi-Purpose Community Centre in the Itsoseng community.

The Ikageng Multi-purpose Community Centre (MPCC) initiative was started in June 2001 by a consortium of parastatals and private sector companies in conjunction with the Itsoseng Community. The consortium consisted of the Council for Scientific and Industrial Research (CSIR), Human Science Research Council (HSRC), Agricultural Research Council (ARC),

Renewable Energy Africa (REA) and later the Tshwane University of Technology (TUT) funded by the former Department Arts, Culture, Science and Technology (DACST). According to the community leader, the Ikageng Multi-purpose Community Centre (MPCC) started operating on the 1st July 2001 from Itsoseng Butchery Building in Zone 2 extension with the two managers from Itsoseng Mpepu Community Project (IMCOP), six selected youths who received prior training on Microsoft Office, Microsoft Publisher and Business skill training by the consortium. The consortium provided the Ikageng MPCC with Information and Communication Technologies, various other peripheral hardware and stationery to start the centre. Members of the Itsoseng Mpepu Community Project (IMCOP) who also raised funds to support the project organised initial office furniture. The Ikageng MPCC in support of this new initiative in the Itsoseng community received a further donation from a large cement company.

During a number of visits by the research team during 2003, the Ikageng Management were interviewed on general issues concerning the current and future existence of the Ikageng Multi-purpose Community Centre. During the discussion session the leadership pointed out a number of stumbling blocks for the successful existence of the Centre. The results obtained from these interviews, questionnaires and discussions were used as inputs to develop an ICT-Hub Model (cf 8) for rural communities.

Results obtained from the Ikageng MPCC Coordinator(s)

The first set of questionnaires, addressing the services provided, financial issues, management structures, linkages and sustainability issues of the centre were researched, developed and constructed to assist the researcher in the information gathering process with the centre coordinators or management committee. These questionnaires were constructed to comply with the research framework in terms of defining the best practice (cf 3) characteristics regarding case studies of community centres.

(a) **Services Provided:** The services provided by the Ikageng MPCC is one of the framework characteristics identified in section three (cf 3). The following section (cf 8.1) indicates the importance of the services that this centre must fulfil to satisfy the customers needs. Questions were ask to the Ikageng MPCC Coordinators regarding the services of the centre in order to establish the profile of the clients using the services and not the detail concerning specific services.

The feedback from the questionnaires indicates that the Ikageng MPCC provides affordable good quality work within the reach of the residents they serve in the Itsoseng Community. The Centre either provides in or facilitates in the needs of the local community in which they are located. The clients that use the services of the centre, have an average education level of standard six and an average income in the region of R300 per month.

(b) **Financial Issues:** The next framework characteristics identified (cf 3) includes the financial issues regarding a Community Centre and the following section (cf 8.10 and 8.12) outlines a business model which defines the income generating potential of a centre. From the questions concerning the financial issues of the Ikageng MPCC, indicated that most of the funding is generated currently from internal funds (organisations within the community of Itsoseng) and not raised from donations or other funding sources outside the community. The coordinators felt that they will continue raising funds this way for as long as the centre exists. At the time of the survey, the bank balance of the Ikageng MPCC was R1 700. The Ikageng MPCC future plans concerning the fundraising include donations and financial support of companies in the area as well Government. At the time of the survey, a business plan exists and was available. To enable the centre to improve their current income, they need to expand and grow their current services offered to the community, their customers.

(c) **Management Structure/Ownership:** The management structure and ownership plays a vital role in determining the success of a centre or initiative as highlighted by the best practice characteristics (cf 3) of a community centre. Therefore the centre coordinator (cf 8.7) plays an anchoring role for the centre with regards to the responsibility for the day-to-day management of an ICT-Hub, which applies to the Ikageng MPCC as well.
The reporting structure lies with the same two persons for management and financial decisions in the Ikageng MPCC, one person from the Ikageng MPCC staff members and one from the Ikageng management board. According to the Ikageng Centre Manager, the perception of the community of the centre is very good and supportive. The Centre gets support from various leaders and institutions in the area (e.g. Post Office, Police Station Department of Welfare, Minister of Religion, etc.). Currently the Ikageng MPCC have six staff members running the centre on a daily basis, with skills ranging from managerial to computer related, to provide in the needs of the community. Some of the skills gaps or shortages that were identified by the centre management are (1) N+, (2) Windows Network Infrastructure Administration, (3) Windows Server and (4) Windows Directory Service Administration. According to the management these areas of improvement will help the centre considerably with the expansion of the range of current services to the community and grow their revenue stream.

(d) **Linkages:** The literature study (Benjamin, 1998; Whyte, 1998; Jensen & Esterhuysen, 2001) also indicated that linkages with or from other MPCC in the area is an indication that centres communicate with each other on matters of common interest, which could bring lots of far reaching spin-offs for the participating centres. Therefore the ICT-Hub model (cf 8.3) revealed the importance of establishing the communication systems in an ICT-Hub and other community centre initiatives. At the time of the survey the Ikageng MPCC had no relationship with other MPCCs in the area, as they where the only true Multi-Purpose Community Centre in the Itsoseng area. The Centre uses mostly the media as a source of referrals according to the centre management.

(e) **Sustainability:** One of the main characteristics or most probably one of the most important best practices identified of any centre or initiative is sustainability (cf 3). Therefore the operational components and business model (cf 8.10 and 8.12) of an ICT-Hub is based on defining the income generating potential of the main operational components (cf 8.10) in order to achieve sustainability.

The estimated monthly budget of the Ikageng MPCC is R4 800. This income needs to be generated internally from their own earnings through the services the Centre provide to the community. The figures include no donor funding. The Ikageng MPCC services are used not by a specific group of people but by all age groups, sex, youth and occupation from the Itsoseng Community. The average number of people that visit the Centre per day over a period of a week is estimated at a minimum of 30 and a maximum of 50 per day.

Results obtained from the Ikageng MPCC staff

The second set of questionnaires was directed towards the Ikageng MPCC staff members to gain insight on operational issues as perceived by the centre staff. The specific operational issues included the centres uses and users, local stakeholders, organisation, facilities and equipment, languages used in the centre, location of the centre, funding of the centre, problems experienced and needs.

(a) **Centre Uses:** From the three respondents of the Ikageng MPCC staff members two have indicated that one of the main uses is as a (1) resource centre and all three have indicated

that the other main uses for the centre is (2) copying documents, (3) computer centre, (4) training and education. This information assisted in the identification of the key services that an ICT-Hub must offer to a rural community (cf 8.1).

(b) **Centre Users:** The ICT-Hub model goes further by identifying the potential target groups (cf 8.1) in the area and matching them to the services they require. The feedback from the three respondents indicated that the Ikageng MPCC is servicing four target groups in the Itsoseng Community. These target groups and the number they serve per group is captured in the following table:

Table 3: *Ikageng MPCC User Groups*

User Groups	**Number**
Individuals	800
Pupils and Students	1 500
Community Organisations and NGOs	50
Business	8

(c) **Local Stakeholders:** Of the three respondents, two indicated churches/religious bodies and educational groups as the important local stakeholders of the Ikageng MPCC. The third respondent did not indicate any stakeholders.

(d) **Organisation:** The management structure and ownership was identified as important in determining the success of a centre or initiative (cf 3). The ICT-Hub model (cf 8.7) indicated that the centre coordinator plays an anchoring role regarding responsibility for the day-to-day management of an ICT-Hub. Therefore the decision taken by the stakeholders was to establish a Close Corporation for the Ikageng MPCC. This allows the Centre to operate as a legal entity and open new business opportunities for them.

(e) **Facilities and Equipment:** The literature study revealed that appropriate information and communication technologies infrastructure at a centre, supports fast, efficient and effective services (Jensen & Esterhuysen, 2001; Conradie, Morris & Jacobs, 2003). However, study indicated that the Ikageng MPCC have access to telephone lines at the Centre to enable them to provide the Tele-centre component services such as e-mail, phoning and faxing to their clients as discussed identified by the ICT-Hub model (cf 8.2 and 8.10).

Table 4 summarises the facilities and equipment available at the Ikageng MPCC in Itsoseng. An additional Unix FreeBSD intranet server is installed on the Ikageng MPCC network providing services such as web, mail, ftp and DHCP servers. A detailed description, including serial numbers, quantity, specifications and delivery dates of the various infrastructures such as office equipment, information and communication technologies, stationery kits, application software and books and training networks were obtained during the research.

Table 4: *Ikageng MPCC Facilities and Equipment*

Number	Item	Number	Item
8	Computers	14	Chairs
1	Printer	3	Rooms
1	Photo Copier	0	Toilet
1	Fax Machine	-	Security in place
10	Desks	1	Scanner
1	Laminator	1	Digital Camera
1	Binding Machine	-	Computer Network (Windows 98)

(f) **Languages Used:** Communication is a very important ingredient in any business or operation to achieve success. Therefore it is of importance for the staff members of the Ikageng MPCC to understand the languages their customers use. The results from the survey indicated that four languages are used in the Centre, namely Sepedi, Sesotho, Setswana and English. The two most used languages in the Centre are Setswana first and English second. All the staff members' home language is Setswana, except for one staff member whose home language is English.

(g) **Location of the Centre:** The location of a community centre is another contributing component towards the success of such an initiative (Berlyn, 1997; Jensen & Esterhuysen, 2001; Conradie & Jacobs, 2003). Therefore the best location for an ICT-Hub (cf 8.11) is also highlighted as critical for success. However, passing traffic is very important for the viability of such a community centre as the Ikageng MPCC. The survey indicated through questionnaires and observations, that the Ikageng MPCC is located next to a taxi rank, 3 minutes walk from a clinic and 4 minutes walk from the nearest school. Further more the Centre is located in a large residential area with a number of working camps located within 4 minutes walk from the Centre according to the feedback received from the staff members.

(h) **Funding of the Centre:** Financial sustainability of the Ikageng MPCC is crucial for their continuous existence of the Centre and is well supported by the literature study conducted during this research project (Doczi, 2000; Proenza et al, 2001; Jensen & Esterhuysen, 2001; Conradie, Morris & Jacobs, 2003). Therefore the purpose of the ICT-Hub is to use the operational components (cf 8.2) and the business model (cf 8.10) to define the income generating potential of the services in the main components of the model.

Only two of the Ikageng MPCC staff members responded to this section of the questionnaire on the financial sustainability of the Centre. Asking the question how much money was required to setup the centre and how they raised it; both responded R10 000 of donor funds is needed to setup a centre of such nature as the Ikageng MPCC. This indicates that they rely on donor funds to equip and kick-start the centre and that they are not really familiar with the cost associated in establishing the infrastructure of this Centre.

During the interview process with the management of the Ikageng MPCC, it was indicated that they are not generating sufficient funds by themselves, and were reliant on external donors. However, the Ikageng MPCC is successful to a degree, although they have not yet found a way of guaranteeing their own financial sustainability.

(i) **Problems Experienced:** The feedback from the questionnaires indicated that the Ikageng Multi-purpose Community Centre experience two main problems, namely suitable premises

and funding. Therefore, the issue of permanent suitable premises is dealt with in terms of the requirements for the best location for an MPCC or ICT-Hub (cf 8.11) in this model.
Secondly, the centre experience problems in terms of funding capital and working capital expenses and more importantly the registration with ISETT SETA. Therefore, sustainability (cf 8.2 and cf 8.10) of the Centre will be boosted with the accreditation of the Ikageng MPCC with ISETT SETA regarding the training services they offer. The Centre will definitely boost the generation of funds as explained in terms of the income generating components (cf 8.10), more specifically the training component.

(j) **Needs:** The survey identified the current needs of the centre with regards to training and advice as continuous improvement of qualified training officers (cf 8.9) and secondly the need to start sales of stationery in the area. Last but not the least, a need was identified for equipment such as a digital duplicator, request for funds and permanent facilities for the centre.

Results obtained from the Ikageng MPCC Users questionnaires

A third source of information obtained during the survey was the users of the Ikageng MPCC that have completed the questionnaires to provide feedback on their view on the perception of the services and support that the centre itself provides to them and the community at large. The result of this questionnaire was aimed to reflect whether the users of the Ikageng MPCC could afford the services, the perception of the community regarding the Centre and the estimated number of people who use the Centre according to the users. Questionnaires where placed at the centre and completed by voluntary users. The completed questionnaires have been sent back to the research team.

(a) **Community Perception of the Centre:** The first question that the community members that visit the centre have to answer during the survey was related to the community perception of the centre as well as the reasons why. A large portion of the respondents (approximately 40%), indicated that the Ikageng MPCC is “very good and needed by the Itsoseng Community” with reasons for motivation such as:

“People are happy about all the services they receive from the centre”

“Because many people or children can learn what to do at the centre”

“Because people learn about computers”

“Because many people find work because of this centre”

“Some youth from the community are working as volunteers”

“It offers variety of services and is the only one around”

The second largest portion (approximately 14%) replied that the Ikageng MPCC is “essential and needed by the Itsoseng Community” and all respondents’ reasons were a “wide range of services are rendered by the Centre”. However, 13% of the respondents indicated that the Centre is “important for the Itsoseng Community” with the motivating response are “they don’t have to go far for such services provided by the Centre”. Another 13% of the respondents have the perception that the Centre is very important for “education support” and the reasons mostly are because “they educate and give us computer related training and information”. The rest of the responses were reasons such as “technology development, create jobs for the youth and information centre.” These statements were motivated with reasons such as ”information centre and different services available.”

(b) **Number of People using the Centre:** The community members using the Ikageng MPCC where asked a second question related to the number of people using the Centre and the reasons therefore. The feedback from the survey indicate that the perception of the community users of the Centre is that between twenty to a thousand people use the Centre on a weekly basis and between fifty-two and four thousand five hundred people per month. The survey further revealed that the perception of the type of services used by the community members are for example photocopying, typing of cv's and assignments, computer lessons, internet services and funeral programmes. Therefore, the Ikageng MPCC use three of the four identified operational components of the ICT-Hub Model (cf 8.10) for generating income.

(c) **Factors for Success and Failure:** All the respondents think that the Ikageng MPCC is a success. None have indicated that the Centre is a failure. Reasons given for the success of the Centre are:

"The MPCC Staff are always positive and the Centre is growing"

"Teaching the Community about Computer Technology"

"Various types of services are provided"

"Resource to the Community in terms of the current services it provides"

Most respondents said the services rendered by the Centre are needed in the Community. One respondent said: *"If it wasn't successful it could have been closed long time ago".*

However, the feedback indicated that the users of the Centre realise that the equipment is expensive and fulfil their current information and communication needs.

(d) **What Users like about the Centre:** The objective of any business or intervention is to understand what the users of the services offered like and don't like. This will enable the Centre to stay focused towards customer's real needs and not perceived needs. Listed below, is feedback from the Ikageng MPCC users regarding the things they like about the Centre?

"Friendliness towards the customers"

"Fulfil a need in the Community"

"Improving computer literacy and knowledge in the Community"

"Services not too expensive"

"It is central in Itsoseng"

"Creates employment opportunities"

"Provides Internet access in the Community"

"The staff members are good in fulfilling their job"

The following responses were received during the survey regarding the things that the users of the Centre do not like at the Ikageng MPCC:

"Limited resources e.g. one telephone line for internet, faxes and communication"

"It should be extended and have more computers"

"To small and no toilets"

(e) Afford to pay for services: The feedback indicated that the customers could afford to pay for the services. Most said that the prices are very reasonable with only one respondent saying that the business cards are too expensive.

8 THE ICT-HUB MODEL

From the previous sections, the purpose of this study indicated the need for a model to implement successfully information and communication technologies in rural communities (a technology centre in the rural communities). The Ikageng Multi-Purpose Community Centre (MPCC) in Itsoseng as a case study supported the need for a sustainable information and communication technologies (ICT) model for integrated service delivery to rural communities.

The focus of the research project is initially through training, to equip and empower the Ikageng MPCC members in the Itsoseng community, to build up the necessary computer and business skills to be able to integrate the use of computers into learning and business opportunities. Therefore the purpose of this research was to develop such a model supporting effective service delivery by a community centre equipped with ICT, with the best practices identified (cf 3) used as framework for the development of this model. This section addresses the issues regarding the effective utilisation of ICT in community centres, starting with the identification of the key services (cf 8.1) required by the community. Then group the various services into key operational components (cf 8.2) for the centre. After establishing the service needs of the community, the infrastructure needs (cf 8.3) and infrastructure components can be identified based on the service needs. This model takes it one step further by determining application needs (cf 8.4) and content (cf 8.4) for the applications identified. This model identifies tele-medicine and distance education as an application need. Human resources are needed to enable community centres to provide information and communication technology services to the community. Therefore this model addresses the human resource identification and capacity building (cf 8.7) activities along with the career path identification and development (cf 8.9) for the centre staff members to equip them with the necessary skills to provide an effective service delivery to the community at large. Once the infrastructure (technology), training (HR capacity), content (information) and customers (community) needs are identified, the best location can then be identified (cf 8.11) to support the drive towards sustainability (cf 8.12) for the community centre.

In South Africa and abroad, community service centres are playing a major role in educating and disseminating information to a spread of communities whether rural, peri-urban or urban. Historically, community centres have been meeting places for youth, pensioners and many other community activities organised in community halls, clinics and schools (Gómez & Hunt, 1999).
Therefore, community centres serve a variety of needs to the community as well as meeting points. However, the importance of the role that telecommunication plays in facilitating the activities and extending access to information to the community service centres, illustrated by various studies (Whyte, 1998; Jensen & Esterhuysen, 2001; Conradie, Morris & Jacobs, 2003), show that centres that are linked to other centres have greater access to a wider range of information (e.g. health, agriculture, tourism and education).
Considering the above stated information; the ICT-Hub therefore provides a structure that enables communities to manage their own development, by providing access to appropriate information, facilities, resources, training and services. However, in order to describe the ICT-Hub, is it important to formulate a definition of an ICT-Hub as summarised by the researcher:

> *"An ICT-Hub is a sustainable physical centre with the necessary infrastructure to provide generic services like tele-centres, desktop publishing, business support, training and*

information to the community and SME support through the use of Information and Communication Technologies"

The focus of the ICT-Hub will therefore be on addressing the problems related to ICT in a community. Some of these problems are listed below (Benjamin, 1998; Gómez & Hunt, 1999; Jensen & Esterhuysen, 2001; Conradie, Morris & Jacobs, 2003):

- Insufficient telecommunications services particularly in areas of lower population density;
- A basic lack of knowledge regarding the benefits of ICT among certain groups;
- A lack of skills to utilise ICT to best effect in a community;
- An inability to afford the costs of access to equipment and the network;
- Communities and locations with poor Internet availability are likely to be considered less favourable places for economic investments, thereby limiting enterprise development and job creation and restricting the growth of SMEs, currently seen as a key driver of economic growth of a developing country;
- For telecommunications to be most effective communities must identify first how they could use ICT and generate markets for goods and services which ICT would enable them to produce;
- Lack of awareness or understanding of the potential of the Internet to improve personal and economic well-being of a community;
- Insufficient Training and professional development in ICT Skills for Education Professionals and Community Advisors;
- Inadequacy of technical infrastructure in small towns and rural locations;
- Lack of new product developments in a community.

These are some of the problems experienced in communities where ICT could play a major role in the economic growth of an area. The ICT-Hub Model aims to address most these issues by identifying services and functions needed by communities. Needs in every community differ and therefore the functions and services will differ from community to community. This ICT-Hub model is developed from a practical implementation point of view. There are various guidelines and manuals available (Fuchs, 1998; Murray, 1998 & 1999; Universal Service Agency, 1998 & 1999; Jensen & Esterhuysen, 2001), regarding Community Centres, as reference for planning the set-up of a centre. But the ICT-Hub focus on a logic flow of events in order to assist a project manager with the planning and implementation of such a centre(s) based on previous experience and research. Proper planning of the various aspects of the ICT-Hub before hand, as discussed in this section, before embarking on the process of creating expectations in a particular community regarding their perceived needs and expectations.

The implementation of an ICT-Hub must be seen as a process to empower and grow a community to its full potential by identifying and utilising the local resources to achieve the community common goal and vision, and not a once off event of technology dump and go. The ICT-Hub can serve as information and communication learning centre for farmers, students, professionals, and entrepreneurs, NGOs, community leaders and other members of the community, including disabled people. Although it is advisable for an ICT-Hub to develop an initial focus, it is more than likely that the ICT-Hub expands as the focus area may change or broaden. It is important not to try and accommodate every need or interest of the community at first, but to leave room to respond once usage patterns emerge and active participant needs can be identified. The ICT-Hub solution is based on existing Tele-centres or Multi-Purpose Community

Centres, and therefore an existing Tele-centre or Multi-Purpose Community Centre can be transformed into an ICT-Hub where the focus will be more on ICT for the community it serves.

8.1. Identify Key Services or Functions

An important starting point to set-up an ICT-Hub is to identify and list the key functions and services that this centre must be able to fulfil. Therefore, provide in the needs of the targeted customers (community). A functional requirement or analysis of such a centre should be compiled.

In order to determine the type of services that are needed by the community, is it important to identify the potential **Target Groups** (e.g. schools, youth, farmers, women groups, etc.) in the area and match them to the services they require.

The ICT-Hub is likely to focus on a few priority sectors at first and then expand its focus as it develops. A good centre manager (Coordinator) will always have his or her finger on the pulse of the community and be looking out for new target groups or activities that require the ICT-Hub services. Jensen and Esterhuysen (2001) explore the **range of potential services** that MPCCs or an ICT-Hub could offer in their Tele-Centre Cookbook. Some of these services are telephone calls, e-mail and Internet access, word processing, desktop publishing, computer use, education and training, binding, laminating, etc. The information on the services that such a centre must deliver to their customers, determine the equipment requirements to offering these services. Once the services are identified for a specific community centre, the services can be group into key operational components for a Centre.

8.2. Identify Key Operational Components

The defined key services and functions of an ICT-Hub can be use to identify the operational components in order to create an operational model for the ICT-Hub to be deployed.
Each of the operational components of the ICT-Hub has specific service groups under an operational component. Therefore, each major component provides a range of services to the community at a fee. Identifying the service needs and operational components, will assist in determining the centre infrastructure and human resource requirements in order to operate the ICT-Hub sustainable and create job opportunities within the community it serves. A summary of the types of services within each component are given below:

- **Tele-centre Services** (Telecommunication and Internet services):
    - Make and receive telephone calls
    - Send and receive faxes.
    - Send and receive e-mail
    - Get on the Internet
- **DTP Services** (Desk top publishing designing and copying services):
    - Typing
    - Preparing professional CV's for job seekers.
    - Copying and Creating business cards and letterheads.
    - Designing brochures, pamphlets and advertising material for small businesses and making copies for distribution.
    - Designing and copying community notices like funerals and weddings.

- Assisting schools with copying, reports and question papers.

- **Training Services (Various types of training):**
  - Computer training, including operating systems, word processing, spreadsheets and databases.
  - Business training; including marketing, business planning, pricing and costing.
  - Project management training for community projects and SMEs.
  - Financial management of community organisations and SMEs.

- **Business Support Services** (Providing professional business support services):
  - Assistance with conducting viability studies, environmental scans and competition analysis.
  - Generating professional business plans.
  - Assistance with compiling funding and financing proposals.
  - Tender advice and assistance with responding to national, provincial and local tenders.
  - Financial management advice.
  - Assistance with implementation and maintenance of businesses through a system of aftercare, mentoring and ongoing support.

After key components one will also have to identify infrastructure needs.

8.3. Identify Infrastructure Needs (Technology)

Since the operational components of the ICT-Hub are established, the necessary physical infrastructure can be determined by analysing the service needs of the community.
The start-up costs of an ICT-Hub in terms of computer, telephone, other hardware equipment and capital investments should be minimised. It is not always necessary to purchase new equipment for the start-up of an ICT-Hub, although it would be ideal (Jensen and Esterhuysen, 2001). In this section only the basic infrastructure or technology needs are discussed, since Jensen and Esterhuysen have compiled a more complete list in their Cookbook for Tele-centres (2001).

- **Hardware and Equipment:** An ICT-Hub can make use of second-hand telephone systems, photocopiers, computers, printers and furniture from various organisations. However, new computer equipment will be the ideal in order to reduce the support during the implementation phase of an ICT-Hub. Regardless of whether new or second hand equipment is used initially, it is important to develop a good working relationship with a reliable supplier of computer equipment and software.
- **Computer System:** An ICT-Hub should start out with between three to five computers which can be linked with a standard Co-axial Ethernet cable or with a small 8-port hub at low cost. One machine will normally be a dedicated administration computer that is only used by the Co-ordinator and other ICT-Hub staff at the point of sale. If possible, at least four machines should be provided for ICT-Hub users. When it becomes necessary to increase the number of Computers at the ICT-Hub to accommodate more users, low-cost options for expansion should be explored rather than investing in brand new Computers. For example, it may be possible to add some older, recycled Computers. Companies that are upgrading their equipment may donate their old computer equipment to an ICT-Hub.

- **Printers:** An ICT-Hub ideally should have one printer for every 5 to 10 computer systems, all linked together over the LAN (Local Area Network). However a small or start-up ICT-Hub will operate with a printer attached to a single PC. There are a wide variety of different printers to choose from, and the choice will depend on the type of printing that the customers in the community want. An operational component of the ICT-Hub is desktop publishing work for their local communities. This type of work needs printers that are able to produce commercial, professional-looking jobs. The old dot-matrix printer is not suitable for the ICT-Hub, because the quality is too low.
- **Telephone Systems:** Generally, an ICT-Hub will aim to have at least three lines to start with – a voice line, a fax line, and a modem connection for the PC. If the ICT-Hub is small and phone services are not a big part of the planned operation, then it is possible to start out by sharing a single phone line for all services (voice, fax and Internet). This will not allow simultaneous use by all three and the phone line will have to be carefully shared. It is possible for 5 to 10 PCs to share the same phone line for simultaneous Internet access. E-mail can be provided off-line via the batched UUCP service, and the phone line need only be used for short periods to send and receive the mail. To enable the ICT-Hub operators to have control over the telephone bill, it is recommended that a pre-paid system be installed for better-cost control from the start. This will avoid the cut-off of telephone lines by the local telecommunication service provider due to late or no payments, as well as continuous service delivery to the community.
- **Internet Access System:** A modem is essential for Internet/data communications. It is the piece of equipment that enables the computer to send and receive data over telephone lines, and to communicate with Internet Service Providers to provide access to the Internet. Although many computers today have internal modems, it is better to buy external modems because of the rapid changes in modem technology. Internal modems have the constraints of operating at higher temperatures and can suffer more damage from lightning and power surges. With the telephone line plugged into a PC with an internal modem, a lightning strike can easily damage your computer. The term peripheral refers to all the equipment that is not part of the basic computer system package for the ICT-Hub. However, it forms part of the equipment to enable the ICT-Hub to provide an integrated service delivery to the community. (Jensen & Esterhuysen, 2001:44-47)
- **Photocopier:** A photocopier is essential for the daily running of an ICT-Hub as photocopying facilities are generally in demand. If a second-hand photocopier is bought or one is donated, make sure that the quality of copies is good enough for customers and that it can be serviced and maintained. It is not advisable to buy a very expensive photocopier to begin with. A photocopier that collates, staples and produces double-sided copies is wonderful to have, but not essential. An integrated 4-in-1 fax/photocopier/printer/scanner can be used for low-volume copying (1-10 copies) and a separate high-volume photocopier can be used for larger runs. It is important to decide whether the ICT-Hub should lease/rent or buy the photocopy equipment. Because of the high maintenance costs, renting or leasing may be the best option.
- **Binding Machine:** If there is a demand for large quantities of copying and print production work, a binding machine will be useful and can generate additional income. There are different types of binding machines to choose from, depending on the size of documents to be bound and the kind of binding used.
- **CD-Writer:** An ICT-Hub can distribute photo-albums, videos and music on CD-ROM, make back-ups, distribute web sites, save other databases and make copies of CD-ROMs. Cultural records of the community and newsworthy events can be recorded and stored in this way for future use. It is important to educate the ICT-Hub operators in the responsible usage of the device in order to prevent legal action from for instance software companies.

- **Scanner:** Flatbed scanners are the most popular. As with photocopiers, the material you want to scan is placed flat on a glass plate. Hand-held scanners cannot be used effectively for books or publications. The software for manipulating and editing scanned images is usually provided with the scanner.
- **Digital Camera:** A digital camera has become a popular item at an ICT-Hub as pictures can be transferred into documents or e-mail messages at no cost – the pictures are simply copied from the camera to the computer. A digital camera is particularly useful for an ICT-Hub servicing the needs of the local community; international travellers or visitors can easily generate additional income with a digital camera.
- **Laminator:** Laminators allow printouts to be preserved by covering them with a thin film of transparent plastic. There is a wide variety of sizes, shapes and prices. Where the community has indicated a demand for laminating services, it is important to be clear about the kinds of documents the ICT-Hub will be asked to laminate. For example, will documents primarily be A4 certificates or A3 posters?
- **Software Needs:** There will always be new software on the market making the appropriate software selection process difficult. Therefore the ICT-Hub will make use of commercial office application suites for example Microsoft Office for word-processing, spreadsheets, etc.
- **Introductory on-screen tours and tutorials:** Most software packages include introductory tours and tutorials, which can provide a starting point for learning how to use them.
- **Manuals and other texts:** Software packages usually come with manuals. Additional books and publications are available for the more popular software applications. Although an ICT-Hub should have a shelf of reference books and manuals, computer assisted training is more effective for new users.
- **Typing tutors:** Some users will certainly ask for a typing tutor program, which is an important addition to an ICT-Hub software collection. The best programmes give feedback and automatically provide tests, which are appropriate to the users' skills level. Mavis Beacon is a popular program.
- **CBT Material:** A range of multimedia training courses forms an integral part of ICT-Hub model training software collections that will give the practical skills needed to succeed in today's fast moving business world. Each course is a comprehensive and self-contained interactive learning environment that will rapidly equip the user of the ICT-Hub with a lifelong career skill. These type of courses take less than a minute to install and will run on any multimedia Computer.
- **Educational Software:** New educational software has developed more rapidly than many other software programmes, and the philosophy behind the software changes continuously. For example, in recent years there has been a shift in emphasis for educational software programmes to give learners more freedom to express their personal ideas and obtain individual feedback. In addition, an increasing amount of educational 'content' is delivered via the Internet, rather than as separate software that is purchased from a shop or supplier. It is important to note that these programmes should be used to supplement traditional Teaching, as learners still need the assistance of skilled teachers before they can use them effectively. It is very important for an ICT-Hub wanting to supplement educational courses, or to fill an educational gap in the community, to work together with the staff of educational institutions in the community and to find out what are the best programs to obtain.

- **Communications software:** One of the main aims of all ICT-Hubs is to provide access to the Internet. Dial-up services will be the primary means of access. Ideally, an ICT-Hub should be able to access the Internet for the cost of a local telephone call. Unfortunately, an ICT-Hub which is situated far from the nearest Internet Service Provider (ISP), may have to pay the high cost of long distance calls and this is likely to restrict use to e-mail only. An ICT-Hub should always aim to reduce operating costs so that users can pay lower prices for the services. The amount of telephone time used to transfer messages and information must be kept to a minimum. The local Internet Service Provider should provide an ICT-Hub with Internet access, E-mail and Web hosting services.
- **Stationery and Supplies:** The basic supplies are essential for an ICT-Hub (a more detail list was used during the research). Therefore, for every equipment in use, there must be stock available in the ICT-Hub to prevent the interruption of the services (for example an laminator must have enough laminating pouches in stock to serve the community needs when needed)
- **Furniture:** When introducing an ICT-Hub in a rural community, is it important to budget for the furniture needs of the ICT-Hub and not rely on using redundant furniture in the community. However, plan the furniture needs for equipment needed in the ICT-Hub to comply with the needs of the community (e.g. computer desks, chairs, cabinets and reception desk) bear in mind the reception area, computer area, office area and meeting rooms that might be required. The ICT-Hub is in the community for the community. Therefore to fulfil the furniture needs of the centre, make use of local carpenters to provide the necessary infrastructure for the ICT-Hub where possible.

8.4. Identify Application Needs

The ICT-Hub needs to identify application needs that will contribute towards the growth and development of the community and develop these needs in conjunction with the relevant institution. Some of these needs are captured and explained in the following table:

Table 5: *Application Needs for an ICT-Hub*

Application Needs	Explanation
SME	The ICT-Hub can assist small business initiatives in the community with communication, desktop publishing and business needs. It can facilitate business plan writing and funding applications.
Education	The ICT-Hub can provide distance education solutions for rural communities and training on computer aided mathematical instructions for teachers.
Health	Tele-medicine applications could be done through the infrastructure of the ICT-Hub (e-mailing health information for assistance from the specialists in the cities)
Agriculture	Small-scale farmers could use the ICT-Hub as a support mechanism for their agricultural needs.
Tourism	Community Tourism could be facilitated through the ICT-Hub.

8.5. Identify Content Needs

After identifying the relevant applications according to the needs of the community, the relevant content needs to be researched, created or populated to support the selected applications in conjunction with the relevant content providers or institutions in the field of interest of the community. Some of these content needs are explained in the following table:

Table 6: *Content Needs for an ICT-Hub*

Content Needs	Explanation
SME	An ICT-Hub should strive to improve the competitiveness and growth of small business (SMEs) in the community through the supply of relevant, value-added business information.
Education	Educational content could be hosted at the ICT-Hub and the ICT-Hub can be used for supporting teachers in the community with the education process.
Health	Health content could be hosted at the ICT-Hub as a source of basic health information for the community members, especially the youth, who would be more interested in computer technology.
Agriculture	Agricultural content in the form of "infotoons" can be digitised and hosted at the ICT-Hub to support food garden and farming activities in the community.
Tourism	Tourism information regarding the community could also be hosted on a server at the ICT-Hub and the ICT-Hub can act as an advertising agency for the community resources.
Information Dissemination (i.e. Government)	The ICT-Hub can be used for the collection and dissemination of Government information in the communities.

8.6. Identify Monitor and Evaluation Criteria

A continuous monitoring and evaluation action is recommended when implementing an ICT-Hub in order to measure the strengths and the areas of improvement of such a centre as well as gathering information to be disseminated through publications. The monitor and evaluation process should take the best practice characteristics identified into consideration when reporting on the progress status of such an ICT-Hub in a community.

8.7. Identify Human Resource Capacity

ICT-Hub Personnel Profiles: Different types of skills are needed to run an ICT-Hub effectively. The skills are based on three functions, which were derived from the key components identified, namely: (1) Business support, (2) Content creation and (3) Technical support. Each position is suited to a different personality profile. The personnel identified for training and implementation, need to conform to the following general profiles:

Table 7: *Personnel Profiles*

Aspect	Business Support	Content Creation	Technical Support
Minimum educational qualification	Matric and tertiary qualification in business or related field	Matric and tertiary qualification in related field	Matric and tertiary qualification in technical or related field
Business orientation	Proven entrepreneurial acumen and verifiable business activities in the community. Some experience in starting and maintaining a business.	Awareness of business principles and the economic conditions in the community.	Knowledge of the role and use of ICT in business.
People skills	Ability to motivate and mobilise. Thorough knowledge of the business environment in the community. Well-spoken and presentable. Can speak with authority on business issues. Able to do presentations.	Ability to liaise with community leaders and members on information issues. Knowledge of the community environment and issues relating to community development.	Understanding of support and training principles. Excellent customer service skills. Problem solving, troubleshooting, and technical support experience.
Computer skills	Basic awareness.	Basic word processing skills.	Basic competence in operating systems and productivity tools such as MS Office.
Language	English and local.	English and local.	English and local.
Responsibilities	Overall management of the centre. Business development. Assisting SMMEs with viability studies, business plans, financing proposals and financial management of businesses. Mentoring and aftercare of businesses.	Management of the Tele-centre and Desk Top Publishing tasks. Administration of income and expenditure. Content sourcing, formatting, data entry and distribution.	First level problem solving, troubleshooting, and technical support. System maintenance, efficiency and operations. Communications management. Content creation assistance.

ICT-Hub Personnel Functions: The following figure summaries some of the functions that personnel have to fulfil in the ICT-Hub. Therefore the importance of personnel to fit the ICT-Hub personnel profiles.

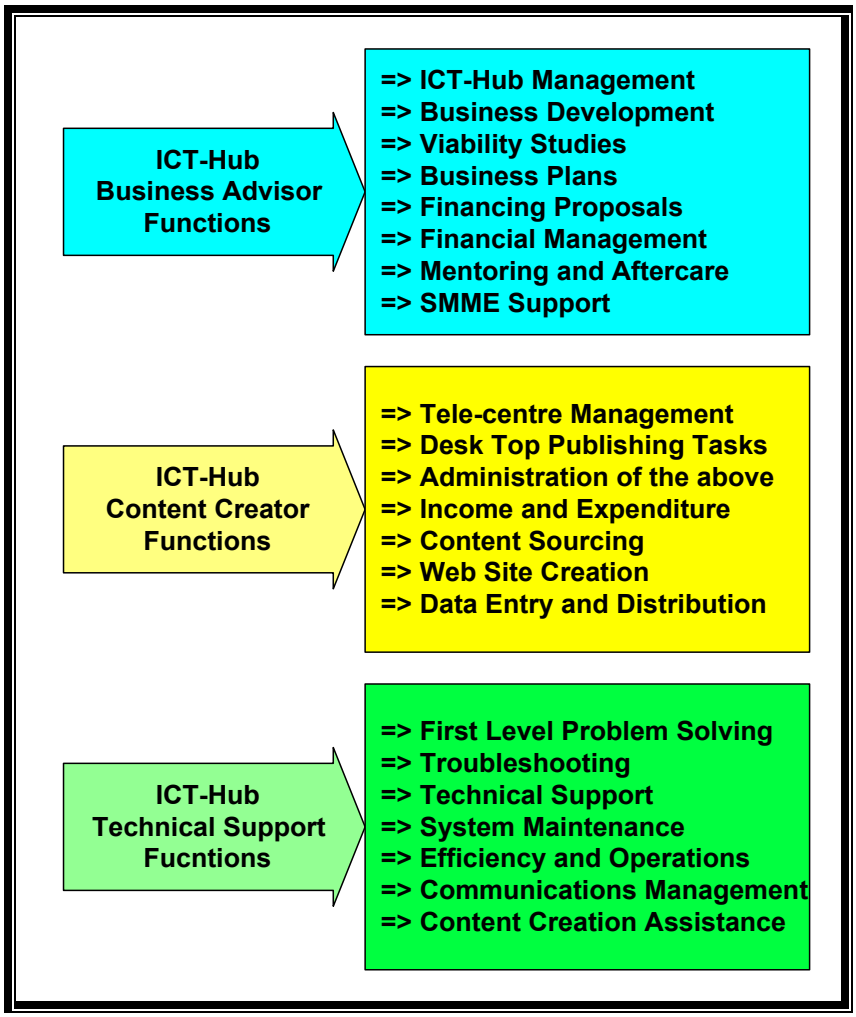

Figure 5: *ICT-Hub Personnel Functions*

ICT-Hub Centre Co-ordinator Profile: Finding a good Co-ordinator is probably the most important factor to ensure that the ICT-Hub achieves its goals. The Co-ordinator takes responsibility for the day-to-day management of the ICT-Hub. He or she is usually somebody from the community, somebody who is liked and respected, somebody who understands the community and can create the kind of atmosphere in the ICT-Hub, which will make it an important asset to the community. A good Co-ordinator will have a **vision** that incorporates his or her community and also expands beyond the community and even beyond the country. A good Co-ordinator needs to develop a sense of the value of networking, and the value of sharing information across boundaries and borders.

The Co-ordinator must account to the Management Committee of the ICT-Hub, but it is essential that they work as a team, with the Management Committee playing a hands-on role in providing the overall direction for the ICT-Hub and for the Co-ordinator. An ICT-Hub can collapse very quickly if the Co-ordinator does not have the right qualities for the job.

ICT-Hub Centre Coordinator Functions: Surely not all of the Co-ordinator's tasks will be the same for every ICT-Hub. However, there are certain essential functions like managing the day-to-day operations that a Co-ordinator will have to perform for an ICT-Hub. However, Jensen and Esterhuysen discuss the role of the Centre Coordinator in detail in the Cookbook for Tele-Centres (2001:71,72).

8.8. Identify Stakeholders and Influencing Factors

The ultimate success of an ICT-Hub is determined by the stakeholders of a community centre and influencing factors beyond the control of the various individuals that have taken ownership of the initiative. In order to reduce these risks, is it important to take the identified best practices (cf 3) into consideration along with the individual's political environment or factors they operate in. Therefore, the importance of getting to know the role players within the targeted community before the research and development of an information and communication technology centre in a rural area can take place as new influencing factors will arise during the process.

8.9. Identify Training Programme (Train-the-Trainer)

Training and Support Needs: The main objective is to establish a sustainable information and communication technology resource centre in a community. The focus will be on the ICT-Hub operations and business principles. Therefore the broad training objectives are as follows:

- **First level:**
    - Develop or consolidate basic computer skills.
    - Expand these skills into the business arena through the Microsoft Office system.
    - Establish the fundamental business skills required.
    - Integrate computer and business skills for application on site.
    - Create a business plan to run the components of the pilot sites effectively.
    - Understand how this business plan will be implemented effectively.
- **Second level:**
    - Consolidate the business plan for the operational components of the site.
    - Expand the range of business skills needed to provide business support.
    - Get to grips with assessing business ventures.
    - Develop business support and counselling competencies through case studies.
    - Be able to maintain the technology on site.
    - Develop the ability to generate quality documentation and meaningful information.
    - Establish an effective training facility.

The minimum training and support procedures for participants are given, based on the following considerations:

- All participants will need both training and support.
- Further attention needs to be paid to the weaker participants in the areas of computer literacy and business support.
- The support function is a critical extension of the training and development function.

Training and Support Minimum Requirements: The ICT-Hub model make use of members of a specific rural community, some of the candidates selected to participate in the establishment of the centre may have no prior computer experience. Therefore the importance in the selection of the training content and training approach of the community members to turn their weaknesses into strengths for the benefit of the community at large. The following table summarise the recommend minimum training and support requirements to establish an ICT-Hub:

Table 8: *Training and Support Minimum Requirements*

ASPECT	**RECOMMENDATION**	
Description	**Duration**	**Support material**
Computer literacy and Content creation		
Windows orientation	2 days	Win Tutor computer-based training CD or equivalent
MS Word orientation	2 days	MS Word tutorials computer-based training CD
MS Excel orientation	3 days	MS Excel tutorials computer-based training CD
MS Publisher orientation	3 days	Publisher tutorial
MS Front page orientation	5 days	Front page tutorial
HTML orientation	5 days	HTML tutorial
Total	**20 days**	
Business support		
Understanding business principles	2 days	BSSA: Your approach to business.
Marketing	3 days	BSSA: Marketing
Costing and pricing	5 days	BSSA: Costing and pricing
Business planning	5 days	BSSA: Your business plan
Compiling a business plan	5 days	Electronic template of BSSA business plan.
Total	**20 days**	
Technical support		
PC components	5 days	Technical support CD-ROM
Introduction to A+	5 days	A+ tutorial material
Total	**10 days**	
Support		
Computer literacy per application	2 hours	First site visit
	1 hour	Subsequent visits
Business support	2 hours	Per site visit
Frequency of visits	Weekly	First month
	Fortnight	Next 2 months
	Monthly	After 3 months

ICT-Hub Personnel Career Path: The table below illustrates the personnel career development path to equip ICT-Hub staff members to provide efficient services to the community. The purpose of this illustrated path is to ensure maximum usage of the technology in the ICT-Hub to assist with the economic growth of the area it serves.

Table 9: *ICT-Hub Personnel Career Path*

ICT-Hub Personnel Career Development Path						
	Operational Competencies				Specialised Competencies	
Business Advisor	Introduction ICT-Hub Model	Basic Computer Training	Basic Business Skills Training		Business Cases and Plans	Advance Business Training
Start →						
Content Creator	Introduction ICT-Hub Model	Basic Computer Training	Basic Business Skills Training		Microsoft Publisher and Front Page	HTML Training
Start →						
Technical Support	Introduction ICT-Hub Model	Basic Computer Training	Basic Business Skills Training		Microsoft Publisher and Front Page	A+ and N+ Training
Start →						

All participants have to understand the operational model of which they will take ownership to provide a service to the community through this ICT-Hub model as a resource to the community at large.

ICT-Hub Personnel Training Agenda: Training forms are a vital component when equipping the human resources of an ICT-Hub with the relevant skills to enable them to serve the needs of the community at large. Therefore the training approach must be carefully considered and compiled as well as the duration and time span from start to end. Conduct the training first before creating a technology thread with the candidates. However, there is a fine line with regards to technology dump versus technology push in a community.

This training model proposed a week of intensive training and three weeks of skill absorption and practice by the personnel of the ICT-Hub before the next week of intensive training took place.

However, the proposed period of establishing the ICT-Hub is twelve to eighteen months at least, within the first six months most of the intensive training must be completed to equip the personnel with the relevant operational competencies to operate towards a sustainable ICT-Hub in the community. The table below is a summary of a proposed training agenda over an eighteen-month period divided into a six-month period and a twelve-month period:

Table 10: *ICT-Hub Training Agenda*

ICT-Hub Training Agenda						
	ICT-Hub Operational Competency Training			Specialised Competencies		
	Fist Six Months Period			Twelve Months Period		
Business Advisor	Basic ICT-Hub Operations	Basic Business Skills Training	Business Cases and Plans	Advance Business Training	Advance Business Training	
Start	→					
Content Creator	Basic ICT-Hub Operations	Basic Content Creation Training	Microsoft Publisher and Front Page	HTML Training	JAVA Training	
Start	→					
Technical Support	Basic ICT-Hub Operations	Basic Content Creation Training	Microsoft Publisher and Front Page	A+ and N+ Training	MCSE and MCSD Training	
Start	→					

A detailed training agenda needs to be determined with the community stakeholders before any activity can commence. A summary of activities for the establishment of the ICT-Hub is captured in the table below:

Table 11: *ICT-Hub Summary of Activities*

Task nr.	ICT Hub Establishment Activities	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18
1	Social Facilitation	■	■																
2	Orientation and Training			■	■	■	■												
3	Specialised Training (Certification)						■			■	■	■			■		■		
4	Infrastructure Development				■	■	■						■						
5	Content Creation					■	■	■	■	■	■	■	■	■	■	■	■	■	■
6	Application Development										■	■	■	■	■	■	■	■	■
7	Support Period													■	■	■	■	■	■
8	Monitor and Evaluation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

8.10. Identify Management Model

The operational and business model is based on defining the income-generating potential of the main operational components of an ICT-Hub. The main operational components of an ICT-Hub are (1) Tele-centre Components, (2) Desk Top Publishing Components, (3) Training Components and (4) Business Support Components; with all services provided within these components have an income generating potential. The income generating components can be illustrated graphically in the figure below:

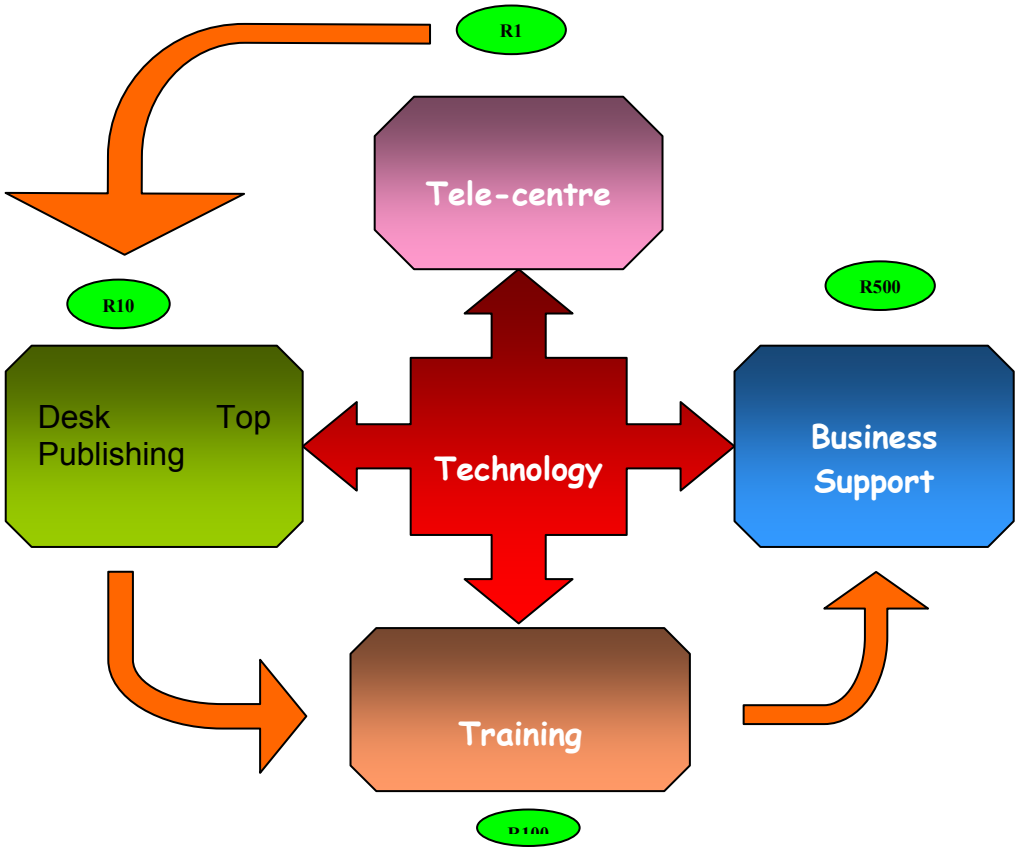

Figure 6: *ICT-hub income generating components*

8.11. Identify Best Location for an ICT-Hub

It is a costly exercise to research, design and build ICT-Hub premises from scratch in a rural community. Therefore ideally the community should provide premises for the ICT-Hub rent-free and maintenance free. If this not possible, an organisation(s) in the community might be able to provide the space or pay the rent as part of their contribution to the ICT-Hub, at least until it becomes viable.
There is the possibility to renovate a recycled shipping container; this can serve as adequate premises. Alternatively, an existing building can be transformed into an ICT-Hub. The costs of upgrading premises will vary from site to site. In some cases only the addition of a security system and paint will be required. The installation of electricity supply and a telecommunications link will be needed. In some buildings the roof will need to be fixed and an insulated ceiling installed. Insulated ceilings and/or air-conditioning is recommended to reduce the heating/cooling power consumption and to reduce the amount of dust.

As with all services aimed at the public, experience has shown that the right location is at the top of the list of key ingredients for the success of an ICT-Hub. A ICT-Hub that is far away in a side street, or hidden away in a location, will have to work very hard to make itself known to the community and is unlikely to attract any passing traffic. Therefore passing traffic is very important for the viability of the ICT-Hub. Sustainability hinges on an ICT-Hub's visibility and accessibility to

as many users as possible in the area it is located. Where highly visible premises is not available for the establishment of an ICT-Hub, marketing plans should take this into account, and relationships with other organisations in the community will be especially important.

An ICT-Hub can operate in almost any space that is available and affordable for the community, provided it has electricity (ESKOM or Renewable), a telephone connection and is reasonably secure. The number of rooms is determined by the various services the ICT-Hub needs to provide to the community. The preference would be separate rooms rather than one large room. If there is a choice of premises, look for space that is large enough to accommodate the expansion of the computer network and other small business activities.

8.12. Sustainability of the ICT-Hub

The operational components and business model is based on defining the income-generating potential of the main operational components of for example, an ICT-Hub. Each major component provides a range of services to the community at a fee. The typical transaction value of the components of service delivery follows an exponential increase from R1 through to R500 as illustrated in figure 6.

The low-cost, high volume business found in the first two components (Tele-centre and DTP) can create the fundamental cash flow needed to support the higher-level activities (Training and Business support). These elements have been combined with anticipated volumes of transactions to arrive at the target income and other aspects of the business plan, to analyse the potential for the ICT-Hub to support itself as a self-sustaining business. The ICT-Hub also reduces the digital divide.

The sustainability of the ICT-Hub will largely be determined by the increase in the number of members or users of the facility. Therefore the centre needs to be managed within the framework of a sustainable business plan.

9 CONCLUSION AND RECOMMENDATIONS

The motivation behind this study was to develop and investigate a mechanism to successfully implement information and communication technologies in a new or existing community centre of South Africa to contribute towards integrated service delivery mechanisms for rural and peri-urban communities.

An ICT Hub is a physical centre with the necessary infrastructure to provide generic services like tele-centres, desktop publishing, business support, training and information to the community.
The main purpose of the concept is to utilise existing government initiatives as far as possible to create self-sustainable centres by removing the burden on scarce resources. This model complies with all the requirements of the characteristics of a good model (Olivier, 2004:49), which are:

Simplicity: Miller's rule states that humans can only have seven (give or take two) concepts in short term memory at a time. A simple model makes it possible to comprehend the essence of the modelled concept as is evident in the concept of ICT provision to rural communities.

Comprehensive: Models often systematically address all (or most) aspects of a problem. This can be done because the model prevents you from getting lost in the detail of the actual problem. The more aspects of a problem the model covers, the

better. All aspects of the problem of ICT provision to rural communities are addressed in the model.

Generality: The more variations of a problem the model addresses the better. The model addresses all related issues of any MPCC/Community Centre (technology, business, training, communications and desktop publishing).

Exactness: If the model closely fits the perceived problem it is more likely to be accepted. For example the model addresses the problem experienced in the case study.

Clarity: The purpose of all components or facets of the model, the operation or use of each facet, and the interaction of flow between components should be evident. In particular one should guard against ambiguity. The proposed model does indicate the flow and importance of each facet and its sustainability.

Therefore this proposed model, as developed by the researcher, can be used or applied in any rural community to address and assist with the provision of ICT and integrated services.
It appears from the study that more research needs to be done regarding Governance of these Community Centres to develop processes and templates to improve the quality of the business results of an ICT-Hub and therefore improve sustainability.

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Wiring sub-Saharan Africa for development

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"The information revolution provides an invaluable new set of tools for all partners striving to achieve sustainable development. It makes empowerment both meaningful and effective and opens up for developing countries the prospect of leapfrogging over earlier communication technologies to become real participants in the global economy." Maurice F. Strong, former Secretary-General, the Rio Earth Summit (1992).

ABSTRACT

This paper discusses the uses of Information and Communication Technology (ICT), the dimensions of access and the digital divide, and the development of telecentres in the Sub-Saharan African region. It illustrates that the development initiatives perceived technical access to computers and other ICT as the only prerequisite to economic and social development when in actual fact extremely important social access to literacy, content, housing and health is not given much consideration in the development agenda. Finally, it discusses experiences at one of the telecentres, the Nakaseke Multipurpose Telecentre in Uganda, by drawing on data from the evaluative report of the International Development Research Centre (IDRC)-sponsored telecentres in Africa.

Keywords: *Access, ICT, digital divide, telecentres, development challenges, sub-Saharan African region*

INTRODUCTION

In an attempt to wire up the Sub-Saharan African region to the global information grid, international developmental agencies such as Canada's International Development Research Centre (IDRC) and the United Nations Development Programme (UNDP) are working in partnership with the governments of Sub-Saharan African countries, civil society groups and transnational corporations such as CISCO, Alcatel, and Microsoft to build the information communication infrastructures. Some of the projects that are being undertaken include:

- African Optical Network (African ONE[1]) that is geared towards building a fibre optic ring around Africa (see: http://www.lucent.com/press/0699/990604.coa.html);
- The sub-marine optic fibre cable South African Telecom 3-West African Submarine Cable-South Africa - Far-East (SAT-3/WASC/SAFE) project that is aiming to link Africa with Asia and Europe;
- The Regional African Satellite Communications Organisation (RASCOM) project that aims to provide satellite communication, and effective linkage between Sub-Saharan Africa telecommunication networks with those of the other continents.

To speed up the region's integration to the global information exchange system, governments of many Sub-Saharan African countries are also introducing institutional reforms such as

"divestitures of public enterprises and commercialization, liberalization and privatization" of the countries' telecommunication industry" (M'bayo, 1997:351).

However, with the free flow of information, privatization and liberalization doctrine at the heart of the 'new' development paradigm, concerns surrounding equity issues such as access, ownership and allocation of resources are becoming important. It is within this context of globalization[2] and the continued marginalization of Sub-Saharan Africa that this paper will discuss the uses of ICT, the dimensions of access and the digital divide and the development of telecentres in Sub-Saharan African region. Finally, it will discuss experiences at one of the telecentres, the Nakaseke Multipurpose Telecentre in Uganda, by drawing on data from the evaluative report of the IDRC-sponsored telecentres in Africa.

POTENTIAL BENEFITS OF ICT AND ACCESS CHALLENGES IN THE SUB-SAHARAN AFRICAN REGION

Although there is no consensual methodological approach to assess or measure the actual social and economic impact of ICT on Sub-Saharan African development, the potential benefits and contributions of ICT to sustainable development in Sub-Saharan Africa are never disputed by both critics and advocates of ICT for development (ICT4D). Some of the potential contributions or benefits of ICT include:

1. Using ICT for community development. For instance, the Internet could be used in developing "locally appropriate applications and services; …enable efficient regional, national and global organization efforts; … and enable rural young people to learn about computers and to have access to technologies and information available to their urban peers" (Richardson, 1998:174 as cited in Melkote & Steeves, 2001).
2. Accessing market information and prices on locally produced goods or farm products. For instance, Sub-Saharan African farmers and even government owned agricultural institutes might be able "to get real-time access to market data, information on standards and rules, prices and potential customers" (World Bank 2000:9 as cited in Polikanov & Abramova, 2003) for their products at both regional and global markets.
3. Stabilizing the financial markets and banking systems. With advanced technologies, cash and financial transactions could be processed faster and more securely. In addition, instead of time-consuming paper based book-keeping methods and manual approaches of counting money, computers and accounting software could be used to speed up transactions. For instance, Mauritius introduced electronic payment systems to modernize its service sector. Nigeria, and Cote d'Ivoire and some other Sub-Saharan African countries developed satellite information networks and computerized trade complexes in order to update information on their stock and commodity exchanges (Polikanov & Abramova, 2003).
4. Using ICT for educational purposes. Students and lecturers could access a variety of academic journals and papers via the Internet as well as through electronic databases. Also, multimedia materials could also be used for teaching purposes.

From the critics' standpoint, all these potential benefits are attainable if ICT is considered as a means (not as the end). That is, we need to be able to separate ICT from the information that they produce "and examine peoples' capacities to receive, process, use, and transmit information" (Melkote & Steeves, 2001:263).

Having technologies is one thing, but whether or not people can use them effectively is another thing entirely. If ICT is in place and people are unable to use it for their collective good due to constraints such as an absence of expertise and infrastructures to support the application of the

technologies, these technologies are apparently useless. In other words, “mere exposure to a technology does not guarantee usage, and, as such, the existence of information in society does not assure the use and concomitant acquisition of knowledge” (Oyelaran-Oyeyinka & Adeya, 2004: 68). ICT will support the learning and acquisition of knowledge processes, but not replace the learning and acquisition of knowledge (Mansell & Wehn, 1998; Alhassan, 2004). This means “a learning process must precede the application of ICTs” (Patterson & Wilson, 2000 cited in Alhassan 2004:100).

Therefore, in order to make ICT applicable and useful to the people, it is important that we extend access to ICT beyond the technical level - provision of new infrastructure or access points (such as telecentres). As will be discussed later in this paper in an analysis of the experiences at the Nakaseke Multipurpose Telecentre in Uganda, providing technical access (such as telecentres) does not necessarily facilitate effective uses of ICT for social and economic benefits. Social factors such as literacy levels and poverty are important in the use of ICT, and should be given important consideration in the planning and designing of ICT initiatives.

As Michael Gurstein (2003) has explained, access to either infrastructure or computer terminals is not the most significant thing. “Rather what is significant is having access and then with that access having the knowledge, skills, and supportive organizational and social structures to make effective use of that access and that e-technology to enable social and community objectives” (10). For instance, it is self-evident that an illiterate person who does not have “the usage skills and knowledge of English or the language in which the Internet messages are encoded” will not be able to access information on the Internet even if he/she has Internet access (Melkote & Steeves, 2001:264). Likewise, an individual who can barely afford two meals per day might not have money to buy or access ICT (Heeks, 1999). These social factors as well as other institutional structures, such as political regimes and economic systems, contribute to the social exclusion of a significant number of people, especially in Africa, from access to ICT and the uses of ICT. And as Alhassan (2004) suggests, these social factors should not be ignored when we talk about the digital divide.

DIGITAL DIVIDE

The digital divide is a term that is often used in describing “disparities in access to, and usage of, the telephone, personal computers and the Internet across demographic groups, within the same country, or between countries” (Sonaike, 2004:42). The International Telecommunications Union (ITU) defined the digital divide as "the division between countries and people within countries who have real access to ICT and are using it effectively, and those who don’t” (as cited in Gurstein, 2003). Of course, the continent of Africa provides ample evidence of the digital divide within the same country and between countries. It is not unheard of that in most African countries significant numbers of people living outside the capital cities or metropolitan cities have not made a phone call in their entire lives (UNDP, 2001). It is more than 50 times likely that people in the rural areas will be without a telephone, let alone an access to the Internet that can be prohibitively expensive. It costs at least $65 per month for Internet access in most parts of Africa, and this cost of Internet access “could exceed $100 per month when the cost of telephone calls is added” (Panos 1998 cited in Melkote & Steeves, 2001). As of 2000, 38 of 54 countries in Africa have less than 250,000 fixed telephone lines. Only Algeria, Egypt, Morocco and South Africa have more than one million fixed lines. For instance, “in East Africa in 2000, where 49 percent of the population was below the poverty line established by the United Nations, there was one telephone line for every 1,000 persons” (Franda, 2002:12). In fact, there are some cities within countries in Africa where telephones and other forms of ICT are “simply non existent let alone making it work for human development” (Sonaike, 2004:51).

It is obvious that Africa has poor Internet connectivity and it is at the periphery of ICT development. But the digital divide, as it is currently conceptualized in most discourses on ICT for development, has trivialized global imbalances in access to ICT. It has limited the global imbalance in the access to ICT, which I contend should be seen within the overall context of socio-economic imbalances, to technical access (that is physical access to computers, Internet connectivity, and telecommunication infrastructure and services). As Henry Jenkins put it: "The rhetoric of the digital divide holds open this division between civilized tool-users and uncivilized nonusers. As well meaning as it is as a policy initiative, it can be marginalizing and patronizing in its own terms" (cited in Warschauer, 2002).

As a result of these flaws in the conceptualization of the digital divide, social dimensions such as access to education and content are often ignored or given less attention in most ICT initiatives that are aimed to bridge the digital divide. Hence, the complex problem of access to ICT is simplified and thus the provision of computers and access points such as telecentres are prescribed as solutions. The digital divide is more than just technical access. It should also include social access, which includes literacy. Before the arrival of digital technologies, there have been various forms of 'divides' such as literacy (Alhassan, 2004). In addition to the digital divide, these earlier 'divides' still exist in one way or the other in our various geopolitical locations. This is why it is so important to emphasize that global imbalances in access to ICT should be viewed within the overall context of global socio-economic imbalances. Thus, to address the problem of imbalance in access to ICT, Mansell (2001) and Shade (2003) suggest adopting a social capabilities approach. "These capabilities include general education and technical competencies, the institutions that influence abilities to finance and operate modern organizations, and the political and social factors that influence risks, incentives, and personal rewards including social esteem" (Mansell, 2001:56).

IDRC'S ACACIA PROGRAMME AND TELECENTRE INITIATIVES

International developmental agencies such as Canada's IDRC have been working with partners in African countries to undertake innovative projects to connect the continent to the global communication backbone. In response to the Economic Commission for Africa (ECA) sponsored 1996 conference on the "Information Society for the African Society," IDRC initiated the "Communities and Information Society in Africa" (Acacia) programme in 1997. The primary goals of this four-year programme, as outlined in the official public document from IDRC, are:

- To demonstrate that the benefits of ICT can reach disadvantaged sub-Saharan communities, and the women and youth within these communities can amplify their inherent innovativeness and enterprise to help these communities solve their development problems. (http://www.idrc.ca/acacia/ev-6091-201-1-DO_TOPIC.html)
- To learn from Acacia's community-based research and experimentation and to disseminate this knowledge widely. (http://www.idrc.ca/acacia/ev-6091-201-1-DO_TOPIC.html)
- To build international momentum and buy-in [in] order to continue expansion of access to ICT by rural and disadvantaged groups. (http://www.idrc.ca/acacia/ev-6091-201-1-DO_TOPIC.html)

The Acacia programme is designed to "empower sub-Saharan African communities with the ability to apply ICT [for] their own social and economic development" (Hudson, 2001:159). The Acacia programme is now in its second phase[3] with the following objectives:

- To enhance understanding and knowledge of the effects of ICT on poverty reduction and human development in Africa; (http://www.idrc.ca/acacia/ev-5898-201-1-DO_TOPIC.html);

- To improve African countries' capacities to formulate and implement national policies that promote equitable access to ICT and information for socioeconomic development; (http://www.idrc.ca/acacia/ev-5898-201-1-DO_TOPIC.html);
- To contribute to research that supports the development and adoption of affordable and functional technologies for Africa; (http://www.idrc.ca/acacia/ev-5898-201-1-DO_TOPIC.html);
- To support research that increases African content available through ICT; and
- To learn from Acacia's community-based research and experimentation and to widely disseminate this knowledge. (http://www.idrc.ca/acacia/ev-5898-201-1-DO_TOPIC.html).

The first phase from 1997 to 2000 focused exclusively on four countries: Mozambique, Senegal, South Africa and Uganda. Some of the IDRC initiated projects in Phase One included the establishment of community telecentres, school networking activities, and the forum for ICT policy development initiatives. For the purpose of this paper, attention will be paid only to the telecentre projects because they have been hailed by the World Bank, some non-governmental organizations (NGOs) and developmental agencies such as IDRC as having a considerable potential for narrowing the "digital divide" in remote, rural and otherwise disadvantaged communities" (Oestmann & Dymond, 2001:1). Hence, the rest of this paper will be devoted to analysis of the telecentre experience in one of the IDRC established telecentres in Africa, the Nakaseke Multipurpose and Community and Telecentre. The Nakaseke Multipurpose Community Telecentre, which is located in Uganda in East Africa, was chosen because it is "reputed to be the first such facility in Africa" (Etta & Parvyn-Wamahiu, 2002: 71) and it is located in a rural area. Being a pilot project, it ought to serve as a model for subsequent ones to follow. That being said, the IDRC designed Nakaseke Multipurpose Community Telecentre was conceived with the intention to be differentiated from the private-run cybercafes that have dotted virtually every major city in Africa. The data that is used in the analysis is primarily taken from IDRC's evaluative report of its telecentre initiative in the Sub-Saharan African region. Before proceeding with the experience at the Nakaseke Multipurpose Community Telecentre, a brief introduction about telecentres and their common varieties in Africa will be provided.

Telecentres are usually "strategically located facilities" for public access to ICT-based services and applications (Oestmann & Dymond, 2001). Telecentres come in different sizes and offer various services depending on the location and availability of resources. Jensen & Esterhuysen (2001) classified various types of telecentres that are popularly found in Africa into four groups: micro-telecentres, mini-telecentres, basic telecentres and multi-purpose community telecentres. The first three- micro, mini and basic telecentres-are primarily an extension or an offshoot of the public call offices (PCOs), which normally provide payphone services, fax and photocopying services. The only major difference between these telecentres and the PCOs is that telecentres have computers that are connected to the Internet for the e-mail and web-browsing purposes.

Micro-telecentres are usually built-in public payphones with Internet access and possibly smart-card readers or compartments for coin and bill operation. They are often found in public spaces such as airports and train stations (Jensen, 2001). Sometimes, a micro-telecentre can also be found in a small kiosk with a computer with an Internet access. The owner of this kiosk usually sells calling-cards and air-time for mobile phones. Figure 1 shows a micro-telecentre in a small kiosk in Lagos, Nigeria. Mini-telecentres offer a single phone line, calling cards, printer, a computer with Internet access and sometimes a fax machine. Basic telecentres offer all the services of the first two, but with multiple access points (Alhassan, 2004:193). Multi-Purpose Community Telecentres, on other hand, are the most advanced telecentres and often promoted by the International Telecommunication Union (ITU) and development agencies such as IDRC. Multi-Purpose Community Telecentres provide all the services that are available in the first three

telecentres as well as providing information technology training and videoconferencing. In particular, they "function as community information centres, providing access to databases and receiving and posting information of general interest to local people (e.g., government notices, information on the spread of diseases, weather information, prices of farm products, educational opportunities)" (Oestmann & Dymond, 2001:4).

Figure 1: *Sample of a micro-telecentre in Lagos, Nigeria*
Source: Punch Newspaper, March 27, 2004.

Given that African communities have thrived on shared access practices in previous technological usages[4], the communalization of ICT access and usage in the form of telecentres is not a new phenomenon for most African communities and cities. In fact, having a communal telecentre, which houses technological facilities such as fax machines, photocopiers, telephones and computers, "helps to split costs among the large number of users, thus diminishing individual expenditures" (Polikanov & Abramova, 2003:46). In most African countries, it will cost billions of dollars to install basic infrastructures for the functionality of telephone, Internet and electricity in each house in every locality. As an example, for Nigeria to have one telephone line per 100 people, it would cost the country about $2-3 billion USD according to the World Bank (World Bank, 1997). Nigeria, which is one of the most populous countries in the world, has a population of over 120 million. Nigeria is not the only country in Africa with such a daunting challenge to achieve connectivity for the vast majority of its population. It is virtually all the African countries that are facing this uphill task. However, since governments have to decide on whether to spend billions of dollars on technological infrastructures or on the more important social programmes such as health care and education, communalization of ICT access and usage in the form of telecentres could be a short-term approach to facilitate people's accessibility to ICT, especially those in the rural environs.

IDRC's Acacia programme particularly targeted people in the rural areas. The model of telecentres envisioned in this context is a synchronized version of the various models that have been adopted in Scandinavian countries, Australia, North America and Western European countries, especially Britain and France. For instance, in Scandinavian countries, telecentres were established to stop the massive migration of people from rural areas to urban areas as well as to build local IT expertise. In some other European countries and in the US, telecentres are designed for creating new job-opportunities and supporting workforce. "In the UK and in France most centres function as telework centres providing facilities for teleworkers. This concept is also widely used in North America" (Falch, 2004:103). These telecentres are meant to enhance community development as well as to develop local expertise.

IDRC, in partnership with other funding agencies such as UNESCO and the ITU, emphasized the creation and funding of multipurpose community telecentres. Robins describes these as:

> *modeled on western projects to bridge the digital divide between haves and have-nots. The African Information Society Initiative of the UN Economic Commission on Africa touts the community telecentres as an alternative to the western infrastructure model of wiring every family home. The telecentres provide telephone, fax, email and Internet access as well as training to use them. The goal is to promote economic development, but also for political growth, social communication and education (Robins, 2002:238).*

Between 1997 and 2000, IDRC's Acacia programme established a total number of 35 telecentres in Benin, Tanzania, Mali, Uganda, Mozambique, Senegal and South Africa. With the exception of five that were jointly funded with UNESCO and the ITU, the rest were funded by the IDRC in partnership with businesses such as Nortel Networks, Canada's telecommunication giant (Robins, 2002).

IDRC and its partners created telecentres in belief that they would bring ICT closer to people in the rural and urban cities of these selected African countries. It is imperative to note that there were also hundreds of telecentres set-up by private local entrepreneurs and local elites in these countries for commercial purposes. In South Africa, however, the government initiated telecentres, and by the end of 2000, the South African government had set up 65 telecentres in the marginalized rural communities in nine provinces (Benjamin, 2001; Alhassan, 2004). These government initiated telecentres are part of the country's 1996 Telecommunication Act whose objectives are "to promote the goals of universal access to ICT" (Alhassan, 2004:194).

The Nakaseke Multipurpose Community Telecentre in Uganda is one of the Multipurpose Community Telecentres (MCT) established under the Acacia programme. This multipurpose telecentre aims to serve Nakaseke and its neighboring sub-county, Kasangombe. Its establishment was "facilitated by the enactment of the 1997 Ugandan Communication Act, which among other issues provided for the liberalization of the communications sector" (Mayanja, 2001:108). It was developed with the purpose of promoting universal access to ICT and empowering[5] the Nakaseke sub-county, which is about 60 kilometres from Uganda's national capital city, Kampala. Nakaseke, which has a population of about 18, 000 – 21,000, is made up of 24 villages. Farming is the major economic activity in this area. Also within Nakaseke and its neighboring sub-county, Kasangombe, there are 23 primary schools, six secondary schools, a university and a regional primary teacher's training college (Mayanja, 2001:109)

At the time the Nakaseke MCT became operational in March 1999, there was only one fixed telephone line in the area. In 2001, alongside with the telecentre, there were about 250 fixed lines and two public payphones in Nakaseke. In spite of this significant improvement, the telecommunication infrastructure in both Nakaseke and Kasangombe are still relatively low. Seventy-three percent of about 90,000 fixed telephone lines in Uganda are located in the nation's capital, Kampala. On the average, users in the rural areas have to travel about 24 km to reach

the nearest telephone (Uganda Bureau of Statistics, 2001 as cited in Etta & Parvyn-Wamahiu, 2002).

Since its independence from Britain in 1962, Uganda has been through economic turmoil, political instability and civil unrest including guerrilla war. Postcolonial Uganda has been described as a story of "unfilled promises" (Mutiibwa, 1992 as cited in Mwesige, 2004). While about 35 percent of the country's approximately 28 million population lives below the poverty level, there are estimated 125,000 internet users in the country. Only 2,692 internet hosts are available to all these 125,000 users. However, the country has more mobile telephone users. Based on figures gathered in 2003, there are 776, 200 mobile users in Uganda. This is more than 10 times the fixed telephone line subscribers. In 2003, there are 61,000 fixed telephone line subscribers in the country. Table 1 provides more statistical data on Uganda's infrastructure, economy and population.

Table 1: *Uganda: selected indicators*
Source: CIA World Fact book, 2005

Population (millions)	27.5
Life expectancy at birth (years)	51.6
Literacy rate (%)	69.9
Official language	English
GDP – purchasing power parity (US $)	$39.4 billion
GDP per capita: purchasing power parity (US $)	$1,500
Population below poverty line (%)	35
Fixed telephone subscribers	61,000
Mobile telephone subscribers	776,200
Radio broadcast stations	AM = 7; FM = 23, shortwave = 2
Television broadcast stations	8
Internet hosts	2, 692
Internet users	125,000

IDRC alongside with its partners – the ITU, the UNESCO and the Ugandan government –put down 60 percent of the operating costs for the Nakaseke Multipurpose Community Telecentre. In total, IDRC and its international partners budgeted $396,425 USD for this project. Its national and local partners were committed to invest "about US$124,000 over the three years of the project, including about US$68,000 from Uganda Telecom for the telecommunications infrastructure" (Mayanja, 2001:111). The remaining 40 percent came from the local community, which also provided the building and security guards for the telecentre. This building is valued at $25,000 USD. The building maintenance as well as the salaries of the telecentre's staff are also taken care of by the community (Mayanja, 2001).

Operating in an office space of about 178 metre square (m^2), Nakaseke MCT has four staff and a management committee primarily made up of the high-ranking representatives of the stakeholders in the project. The stakeholders are UNESCO, IDRC and the Uganda Telecom Limited (UTL). The management committee is responsible for the management and policy matters of the telecentre. There is also a local steering committee, which is made up of the Uganda based representatives of UNESCO, IDRC and the UTL. The responsibility of the local steering committee is not defined. A core-user group, which is made up of the users of the telecentre, is also set up to get feedback from the users on the services at the telecentre. Table 2 shows available equipment in the Nakaseke MCT.

Table 2: *Equipment available in the Nakaseke MCT*
Source: Etta & Parvyn-Wamahiu, 2002

Equipment	**Number Available**	**In Use**
Computers	7	5
Printers	2	2
Photocopiers	1	—
Telephone Lines	2	2
Facsimile	1	1
UPS	2	2
Speakers	3	3
Projectors	1	1
Television Set	1	1
Radio	1	1
VCR	1	1
Scanner	1	1
Inverters	2	2

The Nakaseke MCT offers library services, IT skills training, typesetting, word processing, video services, telephone services, faxing, photocopying, telemedicine services and Internet access for e-mail and web browsing. On the first visit, some personal information is gathered on the users before they are given registration numbers and cards, which are to be used in the subsequent visits. This information, which includes users' name, address, age, gender and occupation are stored in the database. The stored information is later used in evaluating the services offered at the telecentre, customizing services to the users' needs and for decision making purpose (Mayanja, 2001). Privacy protection measures are rarely in place at the telecentre.

While democratizing access to ICT and communalizing ICT through MCT might help in creating an information society in Africa, the statistical breakdown of gender, age and occupation of user groups of the Nakaseke MCT raises some concerns about the kind of information society that might be created. It is observed that over 65 percent of the telecentres are students. Also, 74 percent of the telecentre's users are male. Over 80 percent of the users are less than 35 years old. Table 3 provides a statistical breakdown of the gender and age of users from 1999 to 2001.

Table 3: *User groups of the Nakaseke MCT*
Source: Mayanja, 2001

Gender	**Percentage**
Female	25.8%
Male	74.2%
Age	
< 15 years	4.88%
15-20 years	54.47%
20-30 years	22.76%
> 30 years	17.89%

With over 70 percent of the users being male and over 50 percent of the users being between the age group of 15 and 20, it is still evident there are significant inequalities in information access and usage of ICT in this telecentre along social categories such as age, gender and occupation (Sonaike, 2004). These inequalities do have negative implications on the telecentre as a 'development' project because it is reproducing societal inequalities in terms of age, gender and socio-economic. Rather than closing the digital gap, the experiences at these telecentres show that they are actually consolidating the problem they ought to solve.

There are gendered divisions in access: female access to ICT is still remarkably low in comparison to male access because the gendered nature of the social, economic, policy and technological systems that frame opportunities for women is not being taken into consideration in most ICT initiatives (Robins, 2002). As Fontaine (2000) aptly put it:

> *The familiar and still formidable constraints are again rearing their ugly heads – poverty and illiteracy, lack of time, insufficient skills – with male-dominated, corporate control of the technology added to the list. This is the boy's party of the century, girls, and we are not invited (2000:32 as cited in Robins, 2002).*

It is the educated young male that monopolized the use of Internet and ICT-based services in the Nakaseke MCT. The profile of users in the Nakaseke MCT is similar to the profile of Internet users or ICT consumers in most parts of Africa (and some Western countries). For instance, based on the survey done by the UN Economic Commission for Africa (ECA) in 2000, it was also discovered that:

> *the largest number of Africa's 1.5 million Internet users were young (25-35 was the majority age), were predominantly male, were well-educated (e.g., 87 percent in Zambia and 98 percent in Ethiopia had university degrees), had above-average income, were English-speaking, and belonged to nongovernmental organizations, news media, private companies (especially IT and computer businesses), and universities (Franda, 2002:18).*

Likewise, the result of the ECA's survey and findings at the Nakaseke are consistent with the findings at other IDRC's sponsored telecentres and private-run cyber cafés. According to the evaluation report authored by Etta & Parvyn-Wamahiu for IDRC in 2002, fewer women use telecentre services in practically all of the countries and facilities. The report indicated that, in Mali, 77 percent of the users are men. In Mozambique, 63 percent of the users are men and 70 percent of the users in Senegal are men.

Another worrisome thing about data from Nakaseke and other telecentres is that the main activity of users is primarily e-mail – both sending and receiving e-mail from relatives and friends abroad. It is also to maintain ties with diasporic communities. Sometimes, the e-mail activity is also to apply for university admission in the US and other Western nations (Franda, 2002). Only a handful of the users actually use the telecentre resources for business or commercial purposes. "Between 1.0 and 20.0% of users visited the TCs (telecentres) for business or commercial reasons. Over 50% visited the TCs for entertainment" (Etta & Parvyn-Wamahiu, 2002:84). The findings in this IDRC report show that the telecentres and ICT are used primarily for "social activities[6] than development-oriented action" (Etta & Parvyn-Wamahiu, 2002:84). These activities are being performed at the expense of other ICT-based services and activities such as e-commerce (such as African entrepreneurial activities online) and academic research. If the ICT activities primarily comprise e-mail activity and online chatting, then can telecentres narrow the digital divide and empower communities, socially and economically? What is then going to happen to the multipurpose community telecentre if the majority of the users are only engaged in e-mail activities and clerical work?

There are no tentative answers to these questions at present. But, nonetheless, these questions do reflect the skepticism around ICT for development in Africa, and practically indicate some of

the challenges for Africa in getting 'connected'. Furthermore, the demographic figures from all these telecentres question the assumption that public Internet access is in ''the realm of the educationally and economically disadvantaged'' (Lee, 1999 as cited in Mwesige, 2004:98). And if care is not taken, the optimism of the World Bank and the IDRC that telecentres (and ICT in general) might narrow "the digital divide may appear far fetched" (Sonaike, 2004:44).

SUMMARY AND CONCLUSION

From what was seen at the Nasakeke, the telecentres, which are meant to close the inequality gap, are also legitimatizing the inequalities in the status quo in terms of age, gender, educational qualification and socio-economic status. While it is true that telecentres have increased access to ICT in the region, the 'development divide' between the region and the industrialized countries has not changed. However, this does not necessarily mean that all hope is lost. There is hope for the uses of ICT for development in Africa if there is change in the approach models for ICT initiatives in the region. Instead of paying more attention to the technical access, the focus shall be on the development of people's capability and skills for social changes.

Secondly, as showed in this paper, the applicability of the Western-model of development programmes and technology transfer without adequate consideration of the cultural needs and local socio-political institutions of the developing countries will not yield positive results. For the collective good of the Sub-Saharan African region, it will be better "to turn away from the dominant path and take off the Western ideological straitjacket" (Nulens & Audenhove, 1999: 469).

ENDNOTES

1. There is a big question on the continued viability of the African ONE project. In 2002, the American multinational company, Global Crossing, which is one of the leading partners in the project, filed for bankruptcy as a result of an accounting scandal. See this BBC report for more details: http://news.bbc.co.uk/1/hi/business/1870129.stm. Lucent Technologies, which is also involved in the project, is currently on the verge of bankruptcy as a result of a market slump in the telecommunications industry since 2001.
2. Given that globalization means different things to different people, I am using globalization in the way that Joseph Stiglitz used it in his book, Globalization and its Discontents. Stiglitz defines globalization as "the closer integration of the countries and peoples of the world which has been brought about by the enormous reduction of costs of transportation and communication, and the breaking down of artificial barriers to the flows of goods, services, capital, knowledge, and (to a lesser extent) people across borders" (2003:9). As he clearly explained in his book, globalization is driven by international corporations. The international institutions such as the IMF, the World Bank and the WTO oversee ("govern" in Stiglitz's word) globalization.
3. Fourteen countries are involved in the second phase of the Acacia, which will run from 2001-2005. These countries are: Tanzania, Kenya, Uganda, Rwanda Benin, Ghana, Senegal Angola, Namibia, Mozambique, Egypt, Tunisia, Morocco and South Africa.
4. When radio sets and television sets were initially introduced, it was not uncommon to find a whole hamlet sharing one radio set or television set. Often, people gathered at one location and watched the television programs together.
5. Empowering here refers to social transformation and economic growth.

[6] The report considered social activities as consisting of sending and receiving e-mail, making and receiving phone calls, sending and receiving of faxes, and chatting online.

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Elemental analysis of the online learning experience

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ABSTRACT

The following discussion will compare four contemporary methods of online teaching and learning: 1) student-centered, 2) subject-centered, 3) teacher-centered, and 4) teaching-centered. This paper argues that the most effective methods are those that engage six dimensions of human existence: physical, social, emotional, psychological, intellectual, and spiritual. However there is no golden rule or single instructional model that will guarantee effective teaching or learning in every situation. Guidelines should be chosen based on how well they meet the needs of the discipline being studied, the students involved, and the ability of the instructor. What engages one class may disengage the next. Learning, whether online or not, is a personal process. With an understanding of the personal nature of the learning interaction, the most effective teaching methods are those that engage individuals in an intimate way. The objective of this paper is to present and define four contemporary teaching models, their expressed or applied engagement of the dimensions listed above in the online environment and provide foundational concepts which may serve as starting points in the evaluation of one's own methods, philosophy, and practice.

Keywords: *online teaching and learning, student-centered, subject-centered, teacher-centered, teaching-centered, Maslow's hierarchy of needs.*

ELEMENTAL ANALYSIS OF THE ONLINE LEARNING EXPERIENCE

Education can be defined as an activity undertaken or initiated to effect changes in knowledge, skill, and attitudes of individuals, groups or communities. Learning, in contrast, emphasizes the individual where the change occurs (Knowles, Holton and Swanson, 1998). Based on this definition, the goal of the educator is to facilitate change in an individual that may be a member of a larger group or community. The degree and direction of this change is determined by the purpose of the educational activity itself. In the workplace this is usually defined in terms of corporate objectives and expectations, while academic institutions usually define objectives as discipline related competencies.

Regardless of its origin and purpose, learning must occur within the individual; education occurs from the outside, learning occurs from within. Further distinction is warranted between processes and experiences as they relate to education and learning. A process implies a prescribed set of procedures leading to the attainment of a predetermined objective. There are clearly defined boundaries in a process that are exclusive to its function and design. Both objects and people can participate in processes. Experiences, however, are totally inclusive of all aspects of an activity and are people centered. Generally, only people have experiences as they are described in terms of their physical, social, spiritual, emotional, intellectual, or psychological impact. Thus, the education/process, learning/experience relation is illustrated; education is a learning process undertaken to gain knowledge or skill, learning is the experience of gaining knowledge or skill. Learning is an experience; therefore it can be described using the six elements described below.

Dimensions

William Hettler (1984) proposed a six dimensional model that provided an objective representation of human experience and existence. This article refers to these dimensions as existential elements. The six original dimensions or elements were: physical, spiritual, intellectual, social, emotional, and occupational. Due to the importance of psychological mechanisms in the learning process the occupational element has been changed to psychological. This dimensional model provides a useful and objective method of examining an individual's experiences, as any experience can be described in terms of one or more of the dimensions. When examining experiences, we do not consciously separate each element from the whole; however, each dimension is affected in some way, negatively or positively. Experiences are typically described in relation to which dimension was affected most, although the whole is more than the sum of its parts; the entire effect of the interaction of elements is more than the effect on any specific one. When one dimension is affected, that effect is echoed throughout the other dimensions creating resonance. For example, a traumatic event or experience such as loosing a loved one is not difficult to describe in terms of its affect on each dimension, such as crying on the physical level or depression on the emotional level. The relationship that exists between these elements can further be described semantically, such as the closeness in meanings between intellectual and psychological or emotional and spiritual. Thus, the dimensions are completely interdependent.

The following definitions are adapted from the *Wellness Workbook* (Travis & Ryan, 1988). The elements below are defined in terms of activities or processes:

- Physical – Activities or process relating to the body; also physical security, skills, competencies, biological processes, behaviors, tangible assets and work environment.
- Social – Activities or processes relating to people, such as personal interactions, relationships, and communication; also the perception of being a valued contributor as well as a supporter of group activities.
- Emotional – This element addresses issues relating to personal feelings and those activities or processes involved in self-identity and self-regard and promoting individual security.
- Psychological – Activities that engage or utilize mental processes and behaviors; this element especially pertains to the expectation of outcomes and the realization of those outcomes in activities whereby understanding/meaning is derived.
- Intellectual – Activities or processes requiring the use of the mind; especially relating to critical or higher order thinking.
- Spiritual – Activities or processes relating to the spirit, the non tangible or non material, and the search for subjective meaning or intrinsic value.

This article argues that the most effective online teaching methods are those that engage all six dimensions; an environment conducive to personal change is provided by fulfilling individual student needs in each dimension. Maslow's hierarchy of needs (Huitt, 2004), although not empirically supported has been widely accepted, and is useful for this discussion as an example of a needs based growth process; a series of levels must be attained through a continual change or growth process, in order to progress to the ultimate goal of self-actualization. In a learning activity, the ultimate goal is the learning objective, which is also achieved through a change process. Salmon (2003) proposed a five stage model of online learning and teaching that demonstrates this growth process and bares significant resemblance to Maslow's model. Table 1 demonstrates the relationships between Salmon's, Maslow's and the existential models.

Table 1. *Relationships between Salmon's, Maslow's and the Existential Models*

Salmon's Online Learning Model	Maslow's Hierarchy of Needs	Existential Elements
Stage 1 – Access and Motivation	Physiological & Safety Needs	Physical
Stage 2 – Online Socialization	Belongingness, Love & Esteem	Social & Emotional
Stage 3 – Information Exchange	Understanding & Aesthetics	Psychological
Stage 4 – Knowledge Construction	Self-Actualization	Intellectual
Stage 5 – Development	Transcendence	Spiritual

Stage one of Salmon's model, access and motivation, is directly related to Maslow's physiological and safety needs as well as the physical dimension. Stage two, online socialization, is related to the needs of belongingness, love and esteem as well as the social and emotional dimensions. Stage three, information exchange, is related to needs of understanding and aesthetics as well as the psychological dimension; the psychological dimension is directly related to fundamental learning mechanisms and the creation of meaning through cognitive structures and processes. The fourth stage, knowledge construction, is related to self-actualization and the intellectual dimension which requires critical and higher order thinking. The final development stage is directly related to transcendence and the spiritual dimension; once a topic is understood, or skill is gained, the utility of that learning is measured in an individual's ability to apply it, transcending understanding and moving to application and utility. Analyzing a teaching/learning method's engagement of these dimensions, through study of techniques or strategies specific to the method, may provide a measure of its effectiveness.

CONVENTIONS: METHODS AND TECHNIQUES

In a study of university education, Verner (1964) distinguished between the concepts of method, technique and devices. Verner suggested that methods are the ways in which people are organized within an educational activity, and through the method a relationship is established between the learner and instructor. The methods analyzed in this discussion are: student-centered as proposed by Rogers and Freiberg (1994), subject-centered as proposed by Palmer 1997, teacher-centered as defined by Knowles, Holton and Swanson (2005), and teaching-centered in which students learn by teaching content to their classmates. The scope of this paper will limit the following discussion to a single technique specific to each method; techniques are the variety of processes that are utilized to further the learning once the method has been determined. There are numerous techniques available to online learning facilitators; those presented in this discussion do not represent an exhaustive list, rather the objective is to present a technique that is specific to the method being discussed. The techniques discussed in this article include: lecture, social discussion, teaching through the microcosm, and student teaching. Devices are things that support the technique and help to facilitate learning such as audio-visual aids (Conti, 2004).

METHOD I: TEACHER-CENTERED

The teacher-centered approach, or teacher-directed approach, is a pedagogical model that assigns the instructor full responsibility for making all decisions about what will be learned, how it will be learned, when it will be learned, and if it has been learned (Knowles, Holton & Swanson, 2005). The instructor is the focus of the learning interaction; the teacher has all the knowledge of the subject being studied and the student will only gain knowledge that the instructor allows or finds appropriate. There is no direct student-subject interactions, all interactions are mediated by the instructor. Teacher-centered method use in the online, adult classroom is debatable, as it fails to recognize the vast experiences, abilities, individuality, and intrinsic worth of the adult learner. The learner's previous experiences, knowledge, and skill are of little worth in the teacher-centered classroom; the knowledge and experience of central importance, is that of the teacher, textbook writer and devices producer. Therefore, transmittal techniques such as lecture and assigned readings are central to this methodology. The teacher-centered method however, is in common use online and in traditional classrooms and has proven to be successful for certain learning objectives. This method may be well suited to accomplish minimal learning objectives needed to obtain quick fix knowledge over a short period.

Based on the previous definition and discussion, this methods engagement of the six existential elements is variable and completely dependent on the instructor. The instructor alone determines how the students engage in classroom activities as well as social activities. In comparison to the other methods presented, the amount of engagement of the six elements is relatively low, as this method fails to utilize the individuality and creative personal power of each student. Table 2 demonstrates the variability of engagement of the elements and its dependence on the instructor.

Table 2. *Six existential elements of teacher-centered method*

Physical	The student's physical presence is the only required element
Emotional	Via Instructor
Psychological	Via Instructor
Social	Via Instructor
Intellectual	Limited to the intellectual abilities of the instructor.
Spiritual	Via Instructor

The techniques central to this method are focused on the efficient transmittal of information from the instructor to the student. Lecture, has been identified as the most preferred and most used instructional technique in the adult classroom (Darkenwald & Merriam, 1982). In lecture, information follows a linear path in one direction, instructor to student; a government study indicated that regardless of the delivery method, whether in a traditional classroom, through video, or printed format learning remained the same (Hall & Cushing, 1947). Online lecture techniques include: PowerPoint presentations, written lecture notes, streaming video, and do not require the personal presence of a lecturer. Recent research suggests that 77% of technology based learning occurs between a single student and computer without any outside personal interactions (Galvin, 2001); if lecture is accepted to be a transmittal instrument that follows a single, linear path, teacher to student or subject to student, than it may be assumed that lecture is one of the most common technology-based learning techniques used today. A study Table 3 analyzes lecture in terms of its engagement of the existential elements.

Table 3. *Six existential elements of lecture technique*

Technique	Lecture
Physical	Student must be physically present. Safety needs are generally not addressed though may be via instructor.
Emotional	Any emotional engagement is through material or process introduced by the instructor. Self-identity is not recognized, as the purpose of lecture is to efficiently relate information from student to teacher. Student knowledge, skill and ability are of little concern.
Psychological	Through lecture, a student may form understanding of the topic, but is limited to the ability of the instructor to explain and impart knowledge or skill.
Social	Social interaction is generally not warranted unless directed by instructor. Student need for social support and recognition is not fulfilled.
Intellectual	Student's understanding is limited to that of the instructor or learning materials and devices.
Spiritual	Transcendence from knowing to applying or assigning intrinsic value is based on the ability of the instructor to engage the previous elements and facilitate change.

The thesis of this article suggests that a method is most effective when it engages all six dimensions. The analysis above would indicate that a teacher-centered approach, using lecture, can be used effectively; however, the reliance on the instructor to fulfill all student needs may make this instructional environment unstable and too variable to guarantee consistent effectiveness. A type of codependence may occur in such a situation that would stifle the natural creativity, intellectual curiosity and growth that the students are capable.

Online Use

Regardless of the instability of this method, it can be effective due to the nature of the learning objective when new knowledge or skill acquisition is not of primary concern, but rather the course is focused on reinforcement and application of previous knowledge. Therefore, the fulfillment of student needs to facilitate change is not required. If compared to the Salmon model (2003) or the Maslow model (Huitt, 2004), this method used in an online course could fulfill the developmental element of Salmon's model or the transcendence in Maslow model.

METHOD II: STUDENT-CENTERED

The student-centered method is an approach that defines learning as an individualized, holistic, internal process that is controlled by the learner and is in a constant state of natural change and growth (Rogers & Freiberg, 1994). Guiding principles of this method include: adults are self-directed, adults are individual autonomous beings with goals, desires, expectations, and adults need democratic learning environments and experiences (Knowles et al., 2005). Students are responsible for the gaining of knowledge or skill and are expected to take the initiative to learn, under the guidance of the instructor. This focus shift from teacher-centered, in classic pedagogy, to student centered can be attributed to many factors. Growth in the literature and understanding of andragogy, increased adult participation in educational programs, and the variance of experience and abilities of adult learners are examples. The instructor in this method, unlike the teacher-centered approach, is no longer the focus of the learning experience and plays the role of participant, learning catalyst or facilitator and classroom manager. Due to the individualized, holistic approach of this method, it is well suited to engage all six dimensions as is exemplified in Table 4.

Table 4. *Six Existential Elements of Student-Centered Approach*

Physical	Student physical engagement is mandated to an extent by instructor who then allows the student to engage as much as they feel is necessary to fulfill course requirements. Students are encouraged to examine their environment in order to gain physical and personal comfort and security.
Emotional	Students are encouraged to define spiritual / emotional engagement through motivations or expectation statements, expressed socially or to themselves; hopefully solidifying expectations and intrinsic motivation. Self identification, and individual, personal identification is of great importance to this method as learning is considered an entirely personal experience.
Psychological	Fundamental understanding of the subject being analyzed is sought out individually and socially through information exchange and discussion.
Social	Fundamental to this method.
Intellectual	Limited by student who engages to the extent they deem necessary to fulfill course requirements or personal expectations.
Spiritual	This method is well suited to engage the previous dimensions and thereby create an environment conducive to change and growth.

There are situations in which this method may not be best. In work place environments where students are attending courses due to mandatory requirements, the intrinsic motivation of students that this method relies on may be highly variable with many unable to take the initiative for self study. When using this method in work related courses careful attention must be given to the planning of motivational factors or analysis of the actual motivations of the students involved; this approach may be best suited to academic institutions and courses. A technique fundamental to this method is social discussion. Table 5 analyzes social discussion in terms of the dimensional model.

Table 5. *Six Existential Elements of Social Discussion Technique*

Technique	**Social Discussion**
Physical	Presence is required, but the amount of engagement is left to the student to decide. Students respond when they feel comfortable and secure enough to do so.
Emotional	Students relate personal perspectives that are tied to experiences laced with emotions. The amount of emotional engagement is again student mandated. In social discussion, the individuality and personal experiences enrich the learning material and the sharing of such experience is encouraged.
Psychological	Personal understanding of material is shared, and actively or passively compared with the understanding of other participants. New perspectives are continually presented and through this process fundamental understanding and knowledge are formed.
Social	Activity is socially based
Intellectual	A Student's understanding is only limited by their initiative to learn and discuss the material.
Spiritual	As the previous dimensions are well engaged, and needs are met, transcendence is possible.

Based on the previous analysis, student-centered methods and techniques are highly effective in facilitating learning; effectiveness can be attributed in part to the collaborative focus of the method. Studies have indicated that socially based processes and activities increase learning, and current research is focused on defining specific factors that will increase the power of social learning (Cohen, 1994).

Online Use

The online environment is particularly well suited to student-centered methodologies. The online environment affords an open forum where ideas can be exchanged and critically analyzed at length, engaging the intellectual dimension; this is not always possible in traditional classrooms that occur in real time. The individual motivation that propels the learning interaction also encourages social collaboration between all students; traditional classes, due to time and other constraints may not be well suited for open discussion nor allow every student an opportunity to participate (Smith, Ferguson, & Caris, 2002).

METHOD III: SUBJECT-CENTERED

The subject-centered method is a philosophical approach to education rather than a quantitative process. The subject is given a voice of its own, just as real as that of the student's and instructor's (Palmer, 1997). Through the instructor, the students are connected to the subject and together they explore it. This focus on the instructor demonstrates the relationship that exists to teacher-centered methods, as proposed by Palmer (1997); however there are similarities to student-centered methods as well. The instructor is a participant and guide in the classroom, leading the discovery of the discipline being studied. Students are respected as individuals with experiences and perspectives of the subject and are encouraged to share them. Social collaboration is encouraged and expected.

This method is capable of engaging the six dimensions, and shares the strengths of the teacher and student-centered approaches as well as the weaknesses. There are differences in the two approaches; example of how subject-centered and student-centered approaches differ pertains to motivation. In the subject centered classroom the subject becomes a personal entity which motivates the students to explore it. The instructor's enthusiasm and skill in linking the subject with the student in a personal way are major motivating factors, rather than expecting motivation to be intrinsic or a natural phenomenon. Table 6 analyzes the subject-centered approach based on the previous definition.

Table 6. *Six Existential Elements of Subject-Centered Method*

Physical	Student physical engagement is mandated to an extent by the instructor. Security and Comfort needs are filled by the instructor.
Emotional	Students are recognized as individuals who have personal experience with and perspective on the subject being studied, however their engagement is determined by the ability of the instructor to link students with the material in a personal way.
Psychological	Foundational understanding of the discipline being studied is formed through association with experience of the discipline and through social discovery: discussion and exploration.
Social	Students are expected and encouraged to participate in personal discovery of the discipline in social ways. Mandated in part by the instructor.
Intellectual	Students are expected to become intimate with subject by exploring, discovering, expanding it in their own minds.
Spiritual	Transcendence from knowing to applying and assigning intrinsic value is based on the ability of the instructor to engage the previous elements and facilitate change.

A technique proposed by Palmer (1997) specific to this method is teaching from the microcosm. In this technique it is assumed that every discipline has a "holographic logic" that allows one to conceptualize the shape of the whole by examining any significant piece of it. This technique can be accomplished through social discussions of the topic and independent critical analysis activities or case studies of real world applications (see Table 7).

Table 7. *Six Existential Elements of Teaching from Microcosm Technique*

Technique	**Teaching from the microcosm**
Physical	Presence is required, but the amount of engagement is left to the student to decide. Comfort and security needs are fulfilled by the instructor.
Emotional	Emotional engagement is dependent upon how well the student is linked personally to the subject being studied. Each student is recognized to have understanding and perspective of the subject.
Psychological	The psychological dimension is engaged and
Social	Activity is socially based
Intellectual	Student's understanding is only limited by their initiative to learn and discuss the material with others, and the instructor's ability to motivate and engage; critical thinking is required in order to fully own knowledge.
Spiritual	Transcendence from knowing to applying or assigning intrinsic value is based on the ability of the instructor to engage the previous elements and facilitate change.

This method may be applied in many contexts, ranging from academic settings to work related trainings. Its focus on acquiring discipline related competencies may make it a valuable model for work related training. This method is also well suited to the online environment as social interactions and studies of real world application can be well initiated and managed in the online classroom.

METHOD IV: TEACHING-CENTERED

The underlying principle is that individuals learn best, or understand more deeply, when they must relate information and form understanding in others. There are similarities to active learning techniques, which are varied exercises that engage learners through participation; in research on effective teaching techniques, Galyan (1999) found that collaborative group exercises created an environment where all participants were both teaching and learning. However, as presented in this article, teaching-centered methods are focused exclusively on teaching as the learning objective. Method, as defined previously, refers to the ways in which people are organized in a learning activity. Students are the focus of teaching-centered methods, similar to the student-centered approach; however teaching is the primary technique whereby the learning-interaction is facilitated.

Through teaching, individuals gain subject matter expertise, the ability to communicate that expertise, and experience in applying knowledge. This method requires a great deal of individual motivation from students, similar to the student-centered approach. The instructor motivates as well by modeling dynamic and engaging teaching techniques or giving instruction and guidance in this area. Teaching is itself a scholarly activity, rather than an extension of scholarship (Gaylan, 1999) and therefore this method or approach may be best suited to teacher training.

This method is capable of engaging the six dimensions, however if not combined with other methodologies or approaches, it may not be as effective as a pure student, subject, or student-centered approach. Each student is given autonomy in order to discover the subject personally and then to teach their perspective and understanding. Like student-centered teaching, learning and understanding is formed through a social process. Table 8 lists the teaching-centered method's engagement of the dimensional model.

Table 8. *Six Existential Elements of Teaching-Centered Method*

Physical	Student physical engagement and security, is mandated to an extent by the instructor who then allows the student to participate as much as they feel is necessary in order to teach the material to the class.
Emotional	Students are accepted as individuals with strengths, weaknesses and understanding of the subject.
Psychological	Students form understanding through group collaborative efforts.
Social	Social interactions are fundamental to this method, as this is the means of knowledge creation and application.
Intellectual	Limited by students understanding and ability to teach the subject to others. Through a social process the subject is studied and expanded upon by the instructor and learner. Students are expected to become intimate with subject by exploring, discovering, expanding it in their own minds and relating their perspective with the class.
Spiritual	This method is capable of engaging the previous dimensions and thereby transcending knowing to applying.

The principle technique used in this method is teaching. In comparison to active learning strategies, where teaching could be used in role-play, or group interaction to reinforce, assess, or introduce understanding; teaching-centered methods are exclusively concerned with knowledge acquisition through the teaching process (see Table 9).

Table 9. *Six Existential Elements of Student Teaching Technique*

Technique	Student Teaching
Physical	Presence is required, but the amount of engagement is left for the student to decide. Safety and motivational issues may not be addressed if this method is used in conjunction with other educational approaches, such as student-centered.
Emotional	Emotional engagement is dependent upon how well the student is linked personally to the subject being studied. Individuality of the student is recognized and encouraged.
Psychological	Understanding if formed through teaching, direct application of knowledge socially.
Social	Activity is socially based
Intellectual	Student's understanding is limited by their initiative to learn and discuss the materials
Spiritual	If combined with other approaches, this technique may engage this dimension and facilitate development of knowledge.

Online Use

Teaching-centered techniques can be used in conjunction with a student-centered environment. For instance, all students enrolled in an online class can be required to teach a portion of the course; thus, understanding of the subject, facilitating online learning, is formed through application by teaching. The effectiveness of the course may be attributed to the use of a method that corrects the weaknesses of the technique; the method and technique are mutually beneficial.

DISCUSSION

A method should be chosen based on its capability to facilitate learning in terms of the discipline being studied and the ability of the instructor to utilize it. Economics may be, though not exclusively, suited to a student-centered approach while psychology to a teaching-centered approach. The previous analyses would suggest that methods that take advantage of the potential, skill, experience and personal creative power of students are the most effective in the online environment.

The student-centered and teaching-centered methods, based on their engagement of the dimensional model, have demonstrated effectiveness as a teaching/learning tool that is not entirely dependent on the ability of the instructor to facilitate learning. However, the teaching-centered method, due to its instability as a standalone method, would be best suited for courses focused on teaching. The student-centered approach, that utilizes techniques such as teaching, and social discussion, offers the most conducive environment to personal change and therefore would be the most effective method.

CONCLUSION

Although there is no single instructional method that will guarantee effective learning and teaching in every situation, current research (Knowles et al., 2005) would suggest the need to address the personal and intimate nature of learning in order to ensure success. The methods analyzed in this article are contemporary practices that have the capability to engage the six

dimensions of existence, and thereby create an environment that fosters change; however, the most effective methods are those that engage the elements without dependence on resources outside of the student. The student-centered approach provides fulfillment of student needs, through the initiative of the student. The work of Maslow (Huitt, 2004) and Rogers and Freiberg (1994) and others has shown that individuals will naturally pursue the fulfillment of these needs and continually seek growth and development. The student-centered approach provides an environment whereby students may utilize their own resourcefulness and initiative to continually develop, grow, and fulfill needs without dependence on outside resources, and therefore is the most effective method.

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Peer assessment and Computer Literacy for Junior High School Students in Geography Lessons in Hong Kong

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ABSTRACT

This is a practical experience in adopting an interdisciplinary approach to teaching geography to junior high school students. Some computer literacy lessons were given to 166 grade eight students for a geography assignment. The students submitted their work onto a central server at school using secure file transfer software. Then the students assessed one another's work using an online survey tool. The results revealed that in general, the students were satisfied with the use of online assignment submission and networked peer assessment. Recommendations were made at the end for similar attempts.

Keywords: *Peer assessment, Computer Literacy, High School, Student Satisfaction, Geography*

INTRODUCTION

Learners today are faced with the issue of information explosion. In order to better prepare our high school students for further studies or for work, it is not sufficient to just teach them subject-specific knowledge in the traditional way. To truly meet the needs of students, a high school should provide varied teaching and learning approaches and deliver a curriculum that is challenging, integrative, and exploratory (National Middle School Association 1995). However, in most high schools, computer skills are taught in computer classes and therefore the students learn them out-of-context (Eisenberg et al. 2004:8). It is recommended that when designing the curriculum, schools should "focus on learning with technology, not about technology" (President's Committee of Advisors on Science and Technology Panel on Educational Technology 1997). This study documents an interdisciplinary approach to doing geography peer-assessment and teaching basic computer literacy at the same time. It attempts to find out the attitude of junior high school student toward online assignment submission and networked peer-assessment.

In this study, a geography teacher taught 166 students some basic computer literacy skills so that the students could do online assignment submission and networked peer-assessment in a manageable manner. The tools used were general purpose software that the students could apply in other subjects. It was found that the students could apply the basic computer literacy skills in their geography assignments. Also, most of them had positive attitudes toward online assignment submission and networked peer assessment. The names of the software tools and some recommendations are provided to teachers who intend to try the same at their schools.

Structure of the Report

First, we will give some background of the school and students. Then we will describe how the

teacher helped the students build up some basic computer literacy skills. After that, we will explain the steps of online assignment submission and networked peer assessment. Then the results of a survey on their perceptions will be discussed. Finally, we will conclude the experience gained from this study and make some recommendations to whoever wants to attempt the same in their institutions.

The School

The students in this study were in the second year of secondary education (equivalent to grade 8 in North America) in a boy's school in Hong Kong. The students were male Chinese students aged between 13 and 14. There are totally 1255 students and 50 teachers in this school. In terms of number of students and teachers, there is a very typical secondary school in Hong Kong. There were no computer literacy subjects in most primary schools nor in the first two years of the high school in HK, so the students did not have many competencies in using computers in general or how to collect and organize information using digital media in particular. They usually just accessed the school intranet to look at announcements and download handouts. On campus, there were two computer rooms and the geography room also had computers installed. Geography was a compulsory subject taken by all high school students in the first and second years.

Peer assessment

Peer assessment is known to have positive effects on student satisfaction and learning effectiveness in different disciplines in higher education(Searby & Ewers 1997; Stanier 1997; Gatfield, 1999; Hafner & Hafner 2003). Lin et al. (2002) pointed out that while the validity and reliability of peer assessment in higher education has been well explored, researches on the feasibility and student satisfaction on peer assessment in high schools are rare.

On the other hand, managing the peer assessment process itself can be a challenge, especially when the work being assessed are paper-and-pen assignments, Isaacs (1998) mentioned that if the students' work were allowed to be taken out of the classroom, the distribution of student's work for peer assessment could create a substantial extra workload and logistics problems. Therefore, online assignment submission, in which students upload their work to a central server at school, is an effective way to overcome the logistics problem. In this research, online assignment submission is an integral part of networked peer assessment. While most high schools use some kind of learning management system, a lot of the learning management systems do not support formal assessments (CELT, 2004). So there is a practical constraint that if teachers are going to use online assignment submission and networked peer assessment without too much administrative and training overhead, they are likely to have to use general-purpose software. This constraint was also seen as an opportunity to teach the students some basic computer literacy.

METHOD

While there is purpose-built software for peer assessment (Freeman & McKenzie 2002; Lin et al., 2002), it was decided that general-purpose software would be used. This is because one main purpose of this study is to teach students some tools and skills that they can apply in other subjects or in their future studies or work. So the teacher decided to use only readily available free software that requires minimal training. The tools selected were WinSCP and the web-site FreeOnlineSurvey.com.

Computer literacy Lessons

Two lessons were used to teach the students some computer competencies in computer literacy. In the first lesson, the students were taught how to use the search engines on the Internet to effectively search for information. For example, when they do a search using the keywords “plate tectonics”, too many hits are returned and a lot of them might be too difficult for junior high school students. So they were taught to add another keyword “kids”, which reduced the hits only to those suitable for junior high school students. Also in the first lesson, the students were taught the basic skills in Microsoft PowerPoint to do simple presentations.

In the second lesson, the students were taught how to organize their presentation, such as including a table of contents, hyperlinks for navigation, and a reference list for acknowledging the source of information. Examples of some student slides are shown in figures 1 and 2. The students were also taught to use a secure file transfer software called WinSCP. Secure file transfer software, such as WinSCP, is required because, for security reasons, the school only allowed remote file transfers through a communication protocol called SSH (Secure SHell). (Boze, 2002) Therefore, the students had to install WinSCP at home before they could remotely and securely logon to the central file server at school and upload their assignment to it for all other students to review.

After these two computer literacy lessons, students were asked to complete an assignment called “Unstable Earth”. In that assignment, the students had to search for information related to tsunamis, volcanoes, and earthquakes on the Internet. The students were given a week’s time to finish that assignment either at home or using one of the computer labs at school. The students then had to make a Microsoft PowerPoint presentation of the information they had gathered. In order to make their work accessible to their classmates for review, they were asked to upload their presentation to a central server at school using WinSCP.

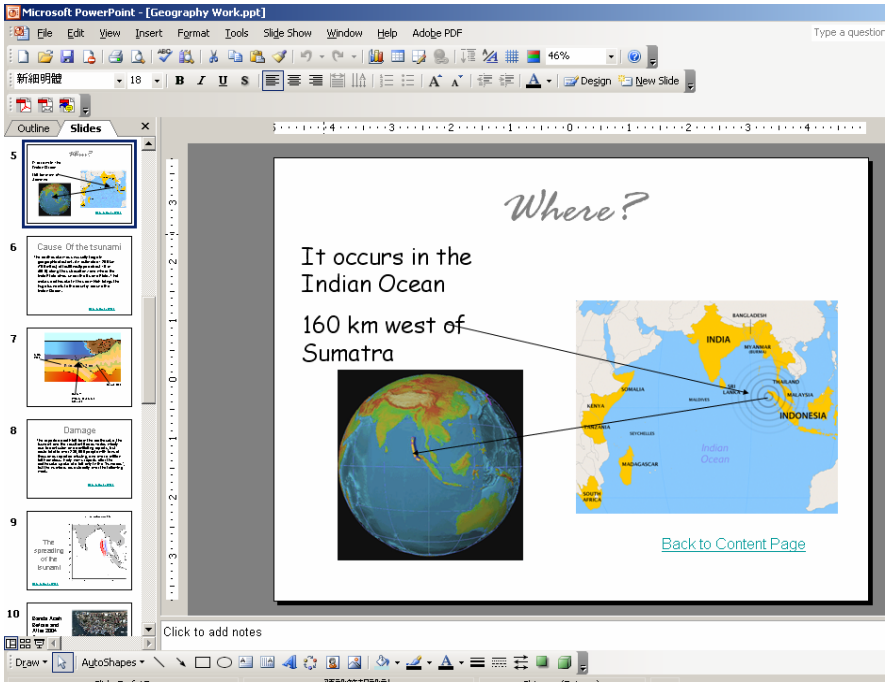


Figure 1: *One of the slides of a student’s presentation on the tsunami that occurred in December 26, 2004, showing the epicenter of the earthquake that caused the tsunami.*

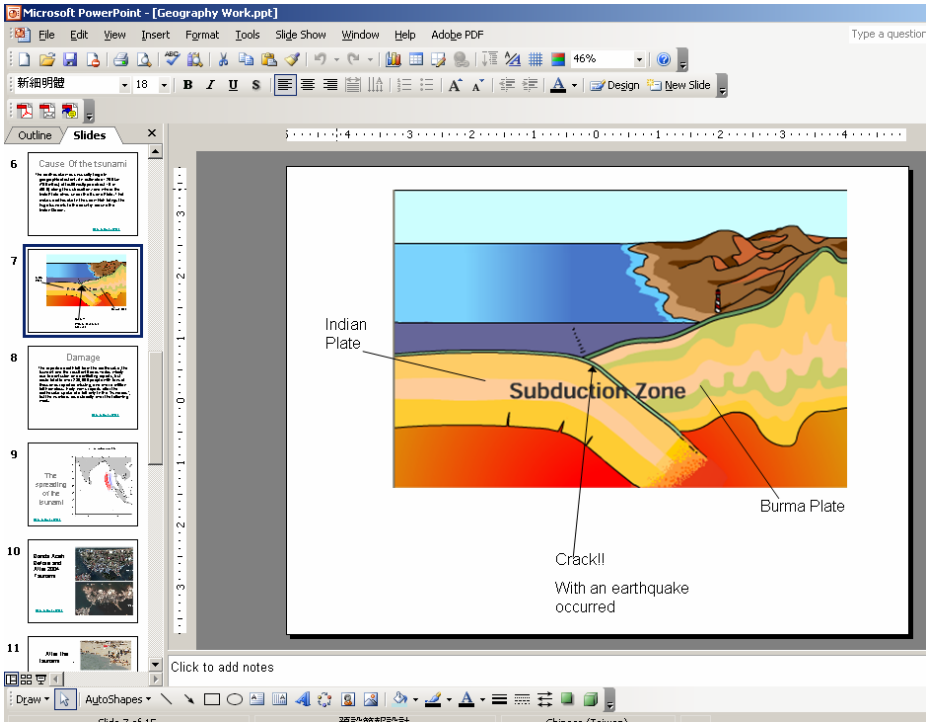


Figure 2: *Another slide of the student's presentation showing the plate tectonics movement that caused the earthquake.*

Networked Peer Assessment

Peer assessment can be defined as "an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status." (Topping, 1998). In lesson three, the students assessed the work of their peers by assigning scores using an electronic score sheet. It is important that the students be trained how to assess their peer's work, especially when doing it for the first time (Isaacs, 1998). Firstly, the assessment criteria were explained to the students. As they were junior high school students, the assessment criteria were made quite simple. Yet they contained the same categories and relative weights as the criteria that the teacher would have used if the teacher were to have marked the assessments.

The students were given a hyperlink to a web page containing the names of their classmates. When they clicked on a name, the work of that student was shown as Microsoft PowerPoint slide shows. In order to collect and compile the scores efficiently, the students filled out an electronic form to give the scores to their peers. The electronic form was actually an online survey questionnaire provided by FreeOnlineSurveys.com, with the questions modified so that the question number was the student number whose work was being assessed, and the students' responses represented the score that they gave to their peers (Figure 3). The student assessor remains anonymous.

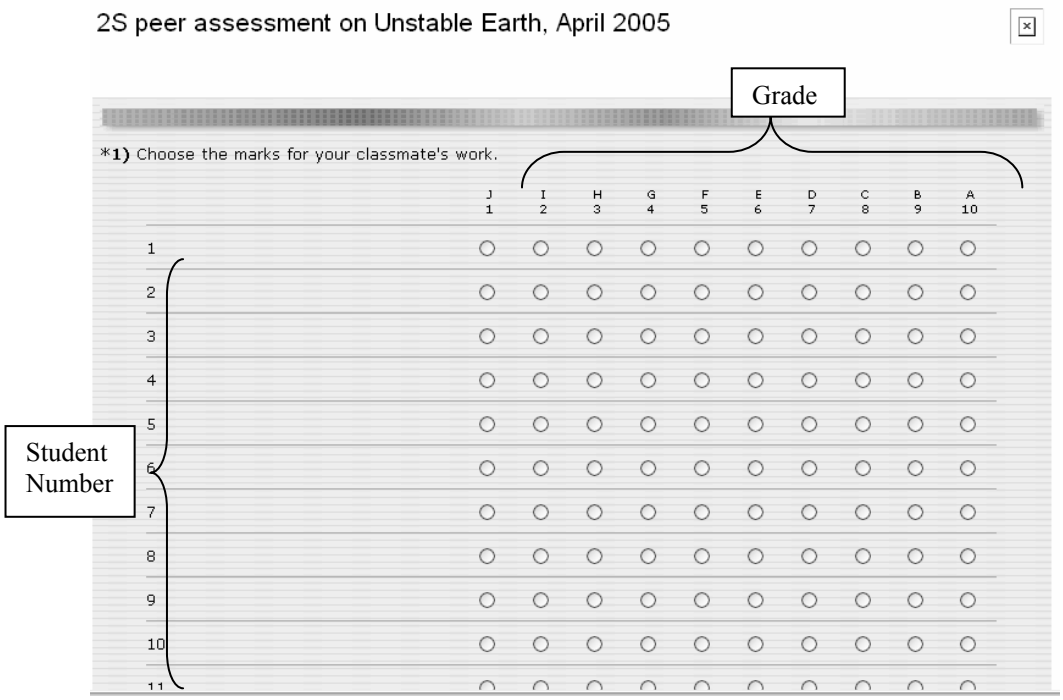


Figure 3: *The online survey form that was used as an electronic score sheet. There is only one question. The parts (1,2,3...) of the question on the left represent student numbers. The response choices (radio buttons on the right) represent the score corresponding to a particular student number.*

Survey

An online survey was done by inviting the students to fill out a questionnaire right after the peer assessment. The questionnaire consists of both structured questions and open-ended questions to survey the students' attitudes toward the use of online assignment submission and networked peer assessment. The structured questions were rated on a 5-point Likert scale in which:
"1 = Strongly Disagree", "2 = Disagree", "3 = Neutral", "4 = Agree", "5 = Strongly Agree".

The questions are listed below:

- *Questions related to online assignment submission:*
  - *Online assignment submission is easy to use*
  - *I prefer online assignment submission to paper submission*
  - *I would like to have more online assignment submissions*
- *Survey questions concerning peer assessment:*
  - *Peer assessment makes my learning more interesting.*
  - *I can learn from others by looking at their work.*
  - *I can find out my shortcomings by comparing my work with that of others.*
  - *I would like to have more peer assessments.*

Open-ended questions were also used to allow the students to freely express their opinions about the overall arrangement of the assignment submission and the peer assessment. The open-ended questions are listed below.

- *Please write down the things that you like about online assignment submission and peer assessment.*
- *Please write down the things that you DO NOT like about online assignment submission and peer assessment.*
- *Please put down any suggestions and comments that you want to make.*

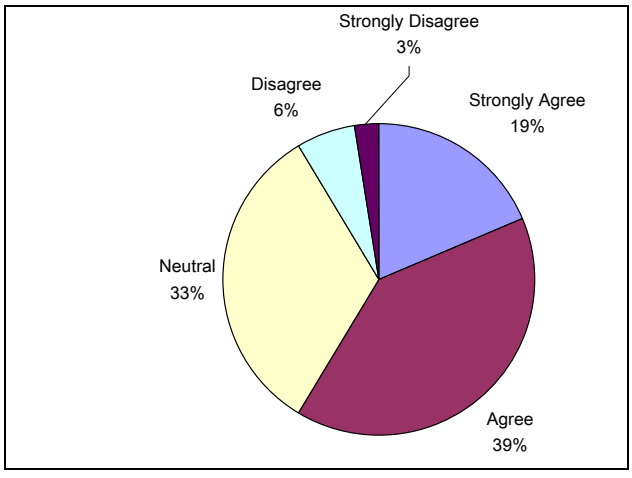
It is of pedagogical interest to find out if the use of computers in a traditional subject will affect student performance. Therefore, for students who performed either very well or very badly in this assignment, the teacher compared the grades of their work with the grades they obtained for their other assignments, which were done entirely using the pen-and-paper approach.

RESULTS AND DISCUSSIONS

Although the participation in the survey was anonymous and optional, the response rate was 71% (118 out of 166). This response rate was similar to another research done on high school students (Lin et al. 2002). The results of the survey and the teacher's observation are presented in the following paragraphs.

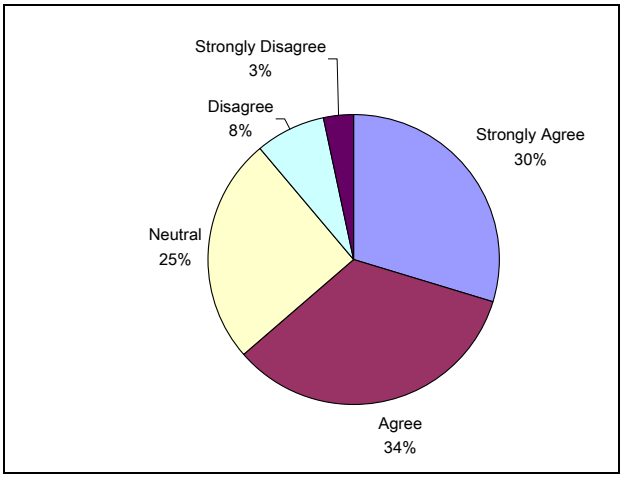
Online assignment submissions

Of the 166 students in this research, 30 students did not submit their work on time. So the on-time submission rate was about 82%. This is consistent with the teacher's experience of submission rates in this subject at this level. This means the use of online assignment submission did not cause any hindrance to the students. The results of the survey regarding online assignment submission are summarised in Figures 4 to 6.



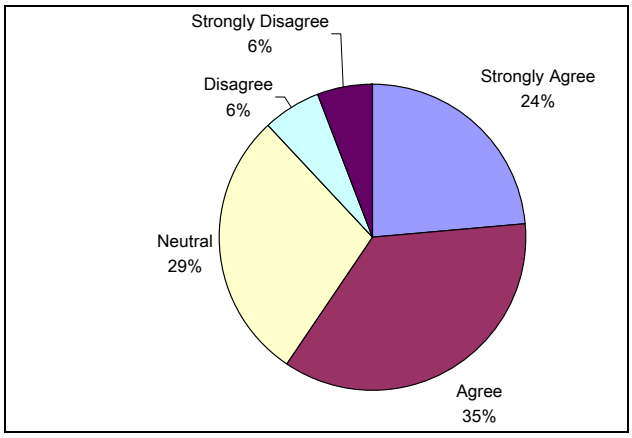
Mean = 3.66; Standard Deviation = 0.94
(1 = Strongly Disagree, ..., 5=Strong Agree)

Figure 4: *Student Responses to "Online assignment submission is easy to use"*



Mean = 3.79; Standard Deviation = 1.06
(1 = Strongly Disagree, ..., 5=Strong Agree)

Figure 5: *Student Responses to "I prefer Online Assignment Submission to paper submission"*



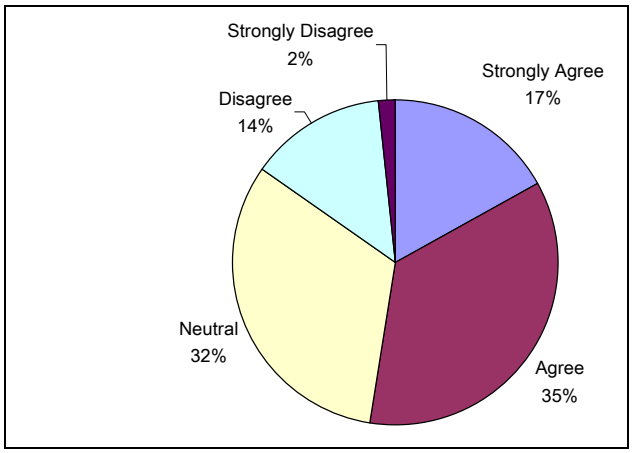
Mean = 3.65; Standard Deviation = 1.09
(1 = Strongly Disagree, ..., 5=Strong Agree)

Figure 6: *Student Responses to "I would like to have more Online Assignment Submissions"*

Overall, the results indicate that the students have quite positive attitudes toward online assignment submission. From figure 4, more than half (58%) of the students actually agree or strongly agree that online assignment submission is easy to use. The result is consistent with the answers to the next two questions. About 64% (figure 5) of the students prefer to use online assignment submission rather than paper submission. Also, about 59% 63% (figure 6) of the students would actually like to have more online assignment submissions in the future.

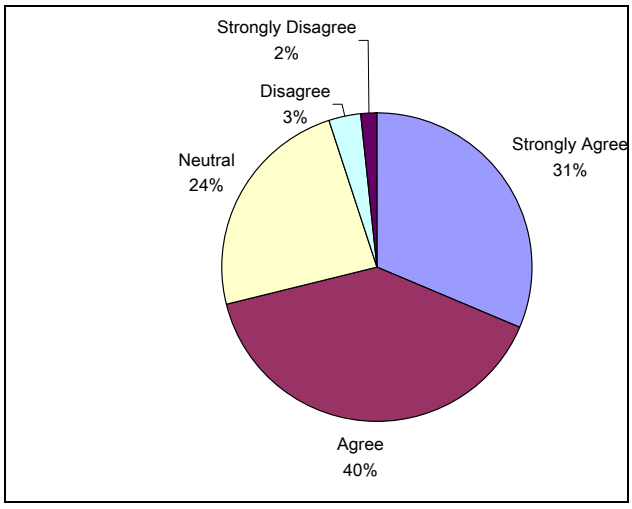
Networked Peer Assessment

The results on peer assessment are also encouraging. The actual results are listed in Figures 7 to 10.



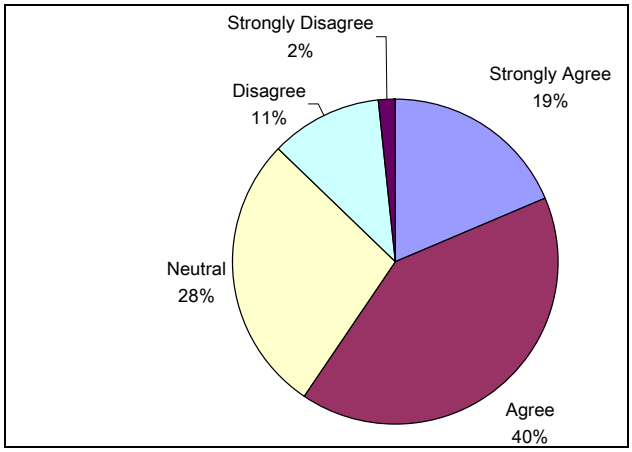
Mean = 3.53; Standard Deviation = 0.98
(1 = Strongly Disagree, ..., 5=Strong Agree)

Figure 7: *Student Responses to "Peer assessment makes my learning more interesting."*



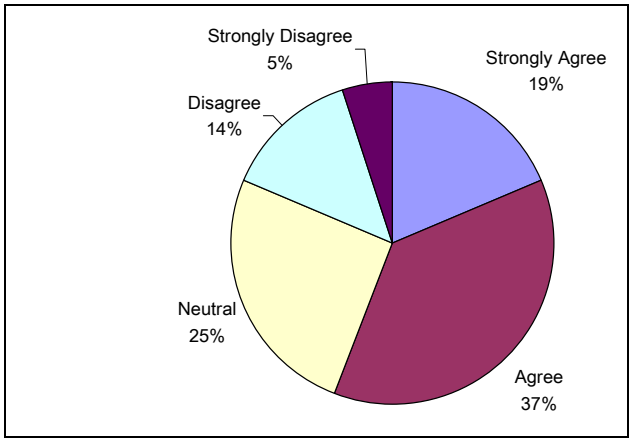
Mean = 3.96; Standard Deviation = 0.92
(1 = Strongly Disagree, ..., 5=Strong Agree)

Figure 8: *Student Responses to "I can learn from others by looking at their work."*



Mean = 3.64; Standard Deviation = 0.97
(1 = Strongly Disagree, ..., 5=Strong Agree)

Figure 9: *Student Responses to "I can find out my shortcomings by comparing my work with that of others."*



Mean = 3.51; Standard Deviation = 1.10
(1 = Strongly Disagree, ..., 5=Strong Agree)

Figure 10: *Student Responses to "I would like to have more peer assessments."*

In figure 7, almost half (52%) of the students indicated that peer assessment makes their learning more interesting. This is consistent with the teacher's observation that the students exhibited more enthusiasm than other students when they were taught the same topics in previous years, when no peer assessment was used.

In figure 8, the majority (71%) of the students mentioned that they had actually learnt from others by looking at their work. Interestingly, in figure 9, relatively fewer students (59%) indicated that they could find out their shortcomings by comparing their work with that of others. It seems that

the students find it easier to learn from the merits of others; but harder to see they might have made the same or similar mistakes as their peers.

Most of the students were ready to have more peer assessments. In figure 10, less than one-fifth of the students selected “Strongly Disagree” or “Disagree” when they were asked if they would like to have more peer assessments.

When the work of the students who performed very well and very badly in this assignment were compared with their other assignments, which were done using the pen-and-paper approach, it was noted that some students, who normally did not do very well in paper-and-pen assignments, performed surprisingly well on online assignment submission. Conversely, some students who had been quite good at paper-and-pen assignments did not do so well when they had to finish the assignment using almost only computers.

What the Students like about Online Assignment Submission and Peer Assessment

There were 43 valid responses to the question on the things they like about online assignment submission and peer assessment. The convenience of using the computer instead of paper was the most common answer (40%). The second most common response was that using computers made the learning more interesting (35%). The third most common response was that they could learn more by looking at the work done by others (26%). A few students mentioned that online assignment submission was more environmentally friendly (9%). The actual remarks given included the following items:

- It was more convenient than using pen and paper.
- It was funny and interesting.
- It was better to use the computer during lessons.
- I could learn from my classmates.

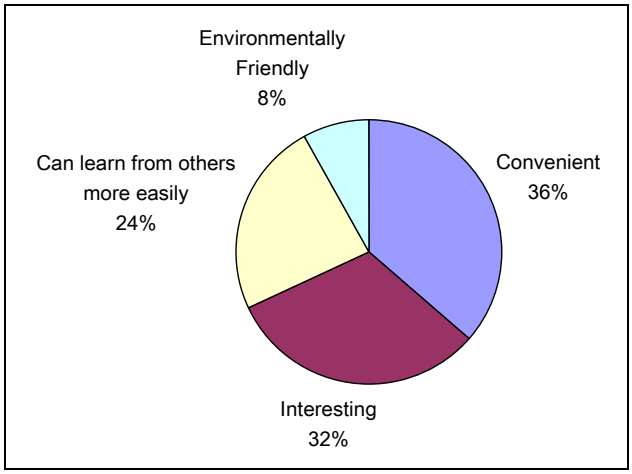


Figure 11: *What the Students like about Online Assignment Submission and Peer Assessment*

Many students stated that they just liked working with computers. This was consistent with the teacher's observation that most students were more enthusiastic when the lessons involved the use of computers. Many students mentioned that they learnt by reviewing their peers’ work. It could be explained as the students could quickly look at and compare the different ways of

explaining the same concepts. The teacher was also impressed by the abundance of materials that were so different from what was seen in the textbooks. It was also observed that the students got interested when they saw animations and videos. The students indicated they found online assignment submission very convenient because they could modify their assignments easily and that they could do it even when they were not at home or at school.

The feedback of an assessment should be made known to the student in a timely manner (Isaacs, 2001). Although only a very limited kind of feedback, the scores given by their peers could be shown to the students almost immediately. They were excited when their marks were actually made known to them at the end of the assessment session in the form of numbers and charts. (See Figure 12).

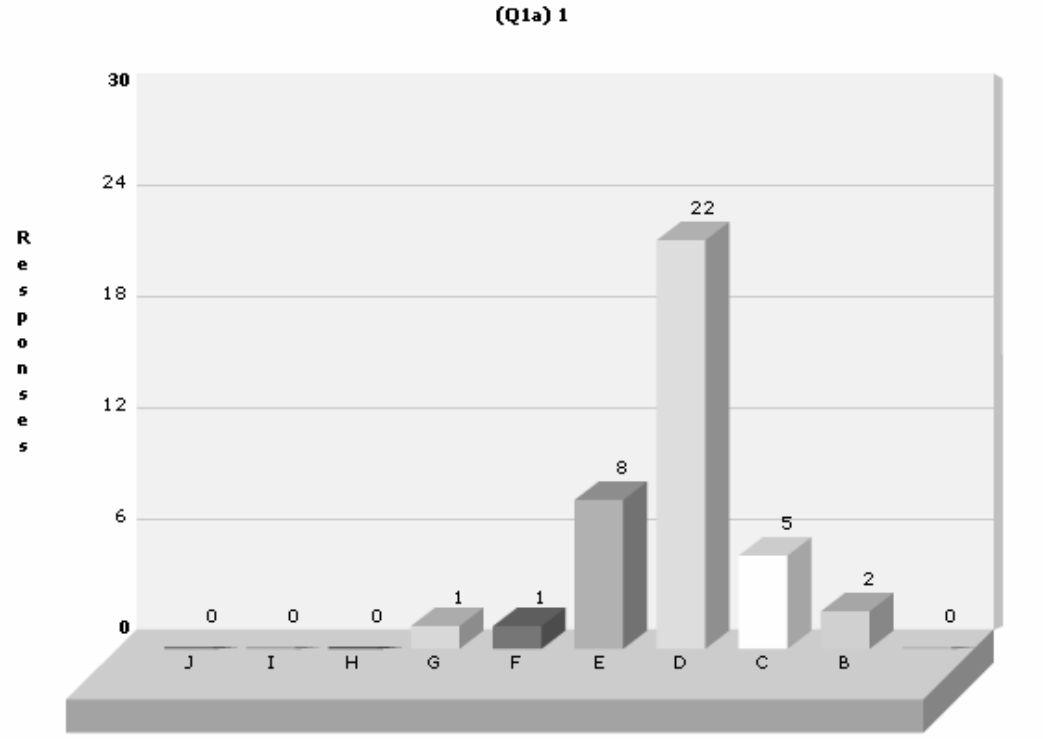


Figure 12: *The immediate calculation of scores for student are provided by the online survey tool. It showed 22 of the 37 students in the class gave his work a 7 on a scale from 1 (the worst, represented by the letter J) to 10 (the best, represented by the letter A). The software did not show the letter A because no students gave that score.*

What the Students do not like about Online Assignment Submission and Peer Assessment

There were 40 valid responses to the question on what they do not like about online assignment submission and peer assessment. The most common answer (59%) was that the procedure was time consuming. The second most common answer (17%) was that the procedures were hard to follow. The third most common answer (10%) was that the connection to the server through the Internet was unstable. Relatively few (8%) students indicated that the marking done by their peers was unfair. A few (3%) indicated they were distracted by other activities such as playing

games on the computer. The actual remarks given included the following items:

- The computer was very slow.
- Spent too much time on navigating the screens.
- My typing was very slow.
- The process was too complex.
- The whole system was unfair because some students gave very low marks.
- Some classmates were just playing computer games.

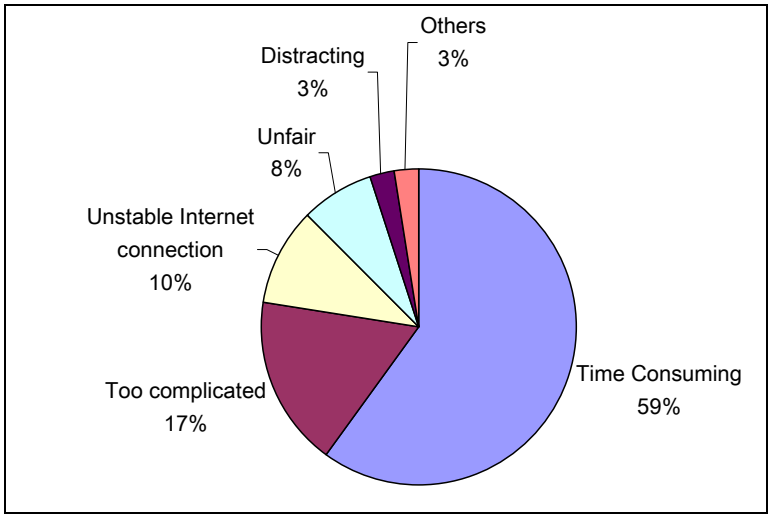


Figure 13: *What the Students do not like about Online Assignment Submission and Peer Assessment*

While most students find the idea of online assignment submission interesting, they didn't really like the procedures they had to follow. This is consistent with the findings by Lin et al. (2002).

The most common dislike was the long time it took to upload their own work and download their peers' work. This is because the computers in the geography room were not powerful enough by today's' standards. Also, a lot of the students included high-resolution pictures, slides with animations and even videos in their presentations. These exerted extra demand on the power of the computers and the bandwidth of the connections to the Internet. Some students reluctantly admitted that they didn't have a computer at home – which implied their financial inferiority. The solution was that they had to go to their relative's home to finish the assignment.

Suggestions and comments from students

There were 18 valid responses. Half (50%) of the responses indicated that the procedure should be simplified. About 28% of the responses indicated that they could get used to this type of online assignment submission and peer assessment easily. About 17% of the responses indicated that they needed more computers, faster computers and faster network connections. A few (6%) indicated that they need more time to do the assessment. The actual remarks given included the following items:

- The school should upgrade the computers in the geography room.
- The procedure should be simplified.

LIMITATIONS OF THIS STUDY

There were no gender, age or ethnic variations in this research because they were all Chinese, boys of the same age group attending full-time grade eight classes. So we could not infer any differences due to these parameters. However, there were a number of factors that might have limited the validity of this research.

The student whose work was being assessed was not anonymous. This may limit the validity of the scores in the peer assessment because one of the perceived drawbacks of peer assessment is the obstruction of friendship (Williams, 1992). Therefore, the scores from the peer assessment were not included in the students' actual assessment.

The computer literacy of the student and the teacher were important. Many students did not know how to download the software (WinSCP) even they could find the web page. As the teacher was the first to pioneer the use of this method in the school, she encountered many problems that occur when using a new system. If the students had been more computer literate, their attitudes toward online assignment submission might have been better. Actually, some students who were considered rather weak in doing paper-and-pen assignments produced surprisingly good work when online assignment submission was used. This suggested that computer literacy could be one of the factors. In fact, Brag & Busnardo (2004:65) pointed out that computer literacy is a central issue that must be considered by educators who want to use computers as a means for teaching and learning.

Isaacs (1998) pointed out that to minimize logistics problems, the marking should be done in a classroom session (Isaacs, 1998). In this study, the nature of the assignment used in this research contained a lot of visual elements (diagrams, pictures, maps and some videos) put in electronic form because they were mainly collected from the Internet. The combination of electronic presentation of visual elements allowed the assessment to be completed during lesson time. The student attitude could be quite different if they had been asked to assess textual assignments only.

Although assessor feedback would be helpful for the recipients of the assessment to enable them to get to know their strengths and weaknesses, in this research, the assessor only gave numerical scores instead of textual feedback. This is because assessors need special training in giving effective feedback (Isaacs, 1998). Also, if they had been asked to write feedback in text form, they would have needed more time and the assessment could not have been completed during class time. Students doing the assessment and writing feedback at home would have frequently missed the due date set for the assessment task (Isaacs, 1998).

RECOMMENDATIONS

Here are some recommendations for teachers and students who intend to do the same in their schools:

1. For junior high students, include visual elements in the assignment so that students can easily appreciate each other's work.
2. The computer support personnel should set a reasonable limit on file size so that students can upload files containing graphics and animations. If students are forced to 'hyperlink' to an external web site, it will slow down the peer-assessment process.
3. The computer support personnel should assign the same password to students when they

login remotely to upload their files using file transfer software such as WinSCP.

4. The assessor and the student whose work is being marked should be made anonymous.
5. If peers are allowed to give textual feedback electronically, the teacher should review and moderate the feedback.
6. It is best to provide computer literacy lessons in the beginning of the school year to allow students to build up their competencies in using computers and in searching, organizing and presenting information.
7. Make sure there are enough computer facilities so that less affluent students can finish all the work at school.
8. The students must be aware that scores from the peer-assessment will not be given much weight for formal assessment, especially when the students don't have much experience with it.
9. The students should adopt a reflection approach to peer-assessment, not a judgmental approach. Otherwise, they might simply focus on giving grades, without seeing how they can improve their own work based on what they see in work of their peers.

CONCLUSIONS

Given the fact that the students lacked basic computer literacy when the study was conducted, the result is very satisfactory. Therefore, it would be an interesting project to track the attitudes of this group of students as they progress to higher grades in high school. While the size of the population and duration of this study was modest in educational research terms, it does provide some pioneer experience for teachers in schools who also intend to attempt an inter-disciplinary approach in junior high schools.

We can conclude that given suitable training and facilities, junior high school students have positive attitudes towards the use of online assignment submission and networked peer assessment, even if they have to learn some computer literacy skills at the same time.

It is recommended that further research be done, possibly using factor analysis, to understand the factors underpinning the student attitudes towards online assignment submission and networked peer assessment.

As a final note, many students expressed interests in using the FreeOnlineSurvey web site and some had already set up their own surveys!

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MIS Sustainability in Sub-Saharan Africa: Three Case Studies from The Gambia

J. I. Sander, P. J. Bell & S. D. Rice

ABSTRACT

Many national and international aid agencies, government and non-governmental organisations (NGO), see the introduction of Information and Communication Technology (ICT) as a rapid way of helping the economies and governance of less developed countries (LDC) through improved management and more effective dissemination of information. Attempts to achieve these aims by the introduction of several aid agency funded ICT schemes in The Gambia – a typical LDC – have failed. This paper suggests that such failures stem from two fundamental causes: the aid agencies do not understand the operational – human and physical – environment in which the ICT systems are to operate and, equally, the intended beneficiaries are unaware of how ICT systems can be usefully employed in their day-to-day tasks. Failure to correctly employ ICT systems has resulted in the wastage of scarce development funds and the diverting of scarce local skilled personnel away from other, productive tasks. To achieve real and sustainable benefits from ICT schemes in such LDCs a phased implementation project model is proposed which includes, in addition to the provision of hardware and software solutions, ICT awareness building and training of user personnel as well as ongoing monitoring of the system's impact. Before significant ICT project development starts management must understand and agree that the scheme's introduction will benefit their work. Moreover, they must fully commit to change and adapt their working procedures in ways that will enable them to benefit from the added functionality provided by the ICT system.

Keywords: *Developing countries, information management, development issues, management information systems.*

INTRODUCTION

Purpose of this Paper

The benefit of introducing Information and Communication Technology (ICT) to developing countries as a means of boosting development has been widely discussed and is suggested as a way of assisting poverty reduction in less developed countries (LDC). Frequently ICT facilities are provided as an element of third-world aid packages by the World Bank, well-meaning non-governmental organisations (NGOs) and government overseas aid departments, such as the United Kingdom's Department for International Development (DfID) (DfID, 2003), Sweden's Stryrelsen för Internationellt Utvecklingssamarbete (SIDA) (SIDA, 2003) and, internationally, the United Nations Development Programme (UNDP) (UNDP, 2003). In reality however, attempts to introduce 'high tech' solutions to address perceived problems in LDCs often fail.

This paper identifies difficulties peculiar to LDCs that arise when introducing ICT and proposes a set of guidelines for project implementation targeted at achieving sustainability. These are based on the authors' observations and experiences during the period 2000 – 2004 with three systems installed in The Gambia[1]. Conditions for ICT in The Gambia may appear particularly severe but many similar criteria apply to other LDC environments. Indeed, an email discussion forum run jointly by the World Bank and International Record Management Trust (IRMT) during November

2003 through January 2004, participants from all corners of the world raised very similar concerns to those identified by the authors (WB/IRMT, 2003-4).

The authors contend that, based on their experiences, introducing sophisticated ICT schemes that might be suitable and indeed highly successful in developed countries can lead to costly failures in LDCs. This does not imply that such systems have no place there, but their introduction does require more detailed analysis and planning than might be necessary in developed countries. Assumptions about prospective users' appreciation of the benefits of ICT, appropriate to developed countries, need thorough review in LDCs.

Differences Between LDCs and Developed Countries' Environments

ICT Awareness

ICT has had a long period of development and use in developed countries and has become accepted as a part of daily life for most people. A significant awareness has been built up over a lengthy period of the benefits of ICT in work and everyday life. This contrasts with LDCs where only very few people have any experience or understanding of the capabilities of such technology. When introducing ICT into LDCs the project plan must therefore include the building of appropriate ICT awareness amongst user management and staff.

Costs of Failure

Introducing systems that do not serve a useful purpose equates to money wasted. This is particularly serious for LDCs where development capital is generally in very short supply. It is, moreover, not only money which is squandered. To be sustainable, introducing ICT schemes inevitably requires involvement of highly trained and skilled local staff, usually a scarce commodity in LDCs. This diverts those staff from other tasks. If the introduction of a scheme fails this represents wasted useful productive effort by those scarce staff. The effect of scarcity means that the impact of failure is likely to be greater in LDCs than corresponding failures would have in developed countries.

Underlying Factors

Failures might be avoided by sound analysis of the problems facing the intended uses of ICT systems. Specifically, both the physical and cultural environments in which systems are to operate need to be evaluated and understood by system designers. Consideration must be given to issues such as:

- **Expectations and ability of available local staff** - In The Gambia the quality of both the primary and higher education systems are generally poor when compared to developed countries leaving individuals ill-equipped to deal with ICT systems.
- **Physical infrastructure problems such as inconsistency or perhaps even unavailability of water and electricity** - There are always exceptions to this such as the Gambia telephone system that is very reliable and utilises some of the latest technology. Infrastructure should not be taken for granted and realistically evaluated.

ICT must not be regarded as an end in itself but a tool for improving ways of achieving useful results by better use and management of information. Critical to the successful employment of any ICT system is that all parties concerned – donors, implementers and final users – must, from the outset, recognise that users will have to adjust their working-procedures if practical benefits

are to be achieved. The nature of the changes to working-procedures must be evaluated, understood and agreed by all stakeholders before the scheme is implemented.

Evaluation must therefore include not merely hard- and software requirements of the project but also staff capabilities, training needs and the willingness of staff to benefit from the introduction of technologically advanced schemes.

Long-term Sustainability Needs

Sustainability requires that realistic provision is made to ensure the scheme's long-term operating costs – consumable items, maintenance and spares, ongoing staff training, telephony costs, etc – are fully covered. This is a non-trivial matter in LDCs where budgets are frequently diverted and where even the cost of paper for printing is frequently regarded as a significant item. When planning the introduction of ICT schemes it is important to recognise that after the installation is complete there are on-going costs involved in the operation of the system. Plans must ensure provision is made to cover those continuing costs.

Scope and Structure of this Paper

The paper relates to three separate civil service Management Information Systems (MISs) in The Gambia, West Africa. The authors, who have many years of professional ICT experience gained in Europe and North America, were assigned for periods of 2 – 3 years to Gambian civil service departments as (volunteer) advisers under the aegis of the British NGO VSO[2]. In sections 2, 3, and 4 of this paper the authors each describe the respective system on which they worked, their experiences and the problems which arose. Section 5 identifies some common elements and section 6 proposes some guidelines for project implementation in similar environments.

The three civil service departments concerned, their respective ICT systems, and the responsible advisers (authors) are listed in table 1 below.

Table 1: *Details of the three Management Information Systems*

DEPARTMENT	SYSTEM	AUTHOR	DATES
Personnel Management Organisation (PMO), a Department of State which had responsibility for recruitment and general human resources management within the civil service; the civil service included most education and medical staff	PMIS	J I Sander	September 2000 through April 2002
Department of State for Education (DoSE), responsible for all stages of education from early childhood to tertiary including curriculum, educational standards, school management, teacher management including teacher posting, textbooks and financial management	EMIS	P J Bell	January 2002 through January 2004
Department of State for Health and Social Welfare (DoSH&SW), responsible for health care delivery throughout the country	HMIS	S D Rice	January 2002 through December 2004

CASE STUDY 1: THE PERSONNEL MANAGEMENT INFORMATION SYSTEM (PMIS)

The Functions of Personnel Management Office (PMO) and Public Service Commission (PSC)

PMO is the central human resource (HR) management and planning department for the Gambian civil service. As a department it was (in 2000 through 2002, the period to which this section of the paper refers) headed by a Permanent Secretary (PS). The PS reported to the Secretary General, who as head of the Gambian civil service, was answerable to the Office of the President. PMO had responsibility for maintaining information on the staff of approximately 11000 full time civil servants as well as a number of people employed on a daily wage basis. All Gambian teachers in state schools were civil servants as were most nurses and other medical staff. The PMO staff were themselves civil servants. A number of other state employees also existed though apparently outside PMO's immediate management orbit. These included groups such as the police, army and certain health workers.

PMO handled the administration of all civil servants career developments, ensuring that they followed the correct procedures and defined rules. Amongst PMO's other functions were the development of a civil service grading structure, the definition of different career cadres within the civil service, setting the rules governing qualifications needed for different cadres and the terms for promotion, etc. PMO also managed the training programmes for civil servants including the training budget. Payment of civil servants was not PMO's responsibility but PMO did liaise with the Accountant General's department on payroll issues.

Crucially, PMO's procedures and operations were in turn supervised and scrutinised by an independent body, the Public Service Commission (PSC), comprising a chairman, deputies, and a full time secretary. The PSC functioned as an appointed board, separate from the civil service procedures. All civil service applicants had to be approved by the PSC; any decision relating to a civil servant made by PMO had to be referred to, and ratified by, the PSC.

Objectives

The PMIS was designed and installed sometime around 1998 -1999 but it was in fact never seriously used by PMO's staff who viewed the data it held with suspicion. By September 2000, on arrival of the author, all documentation relating to its design and implementation, if in fact any had been produced, was missing.

The objectives assigned to the author were:

1. To organise formal operating procedures for the system;
2. To bring the data it held up to 95% accuracy.

Developing a set of simple operating procedures was not *per se* a difficult task though explaining the need and persuading the PMIS operations staff to adopt them was less straight-forward. However, the occasion of a fire in an adjacent department with the loss of a very large amount of paper-based information, did serve to demonstrate the value of disaster recovery planning and management procedures!

It rapidly became evident that there were other, more difficult problems, to solve:

1. Ensuring that the PMIS data already entered was accurate.

2. Devising an effective, accurate and timely procedure for the capture of new and changed information.
3. Getting the system recognised as a potentially useful tool for PMO's operations.
4. Explaining to PMO's staff how to use PMIS.

These problems were closely linked.

Information Management within PMO

In the year 2000 PMO held information on all full time appointed civil servants within its jurisdiction in two separate formats:

1. Data held in a conventional paper based filing system.
2. PMIS, digital, records in the database (probably implemented 1998-99).

Paper-Based Filing System - For each civil servant PMO maintained a file containing the accumulated information relating to his or her career progression, the so-called P-file. The P-file should, according to agreed rules, contain all PMO and PSC official papers relating to the individual. As a minimum they include: birth certificate (to verify age), original application form, documentation covering educational achievement and qualifications, copy of letter of appointment, 'confirmation in appointment' (when applicable), copies of all correspondence between PMO and the civil servant e.g. relating to promotions, career changes, disciplinary matters, etc.

Digital Records in Database - The database was apparently designed to hold information similar to that in the P-file system though it made no provision either for storing or referencing any of the correspondence. The main personnel records were modelled on the civil service 'Application for Employment' form though the database also made provision for some additional records covering career progression, time spent on secondment, and other significant events and episodes. Some areas of the data structures employed were poorly designed (indeed reflecting the employment application form!). In particular, the education and training sections were quite inadequate either for recording meaningful data or identifying individuals with specific characteristics and competencies.

DfID had paid for hardware and software in the form of an aid/grant to PMO. The ostensible reason for introducing a database was to improve 'good governance' by improved record keeping procedures. PMO staff stated that a European Consultancy Group had implemented the database. However PMO had neither records identifying the “Consultancy Group” nor how they had been selected and appointed.

No background information was available within PMO explaining how the system had been conceived or by whom. No written details or specifications relating either to the planning and design of the database, or to its testing and hand-over, existed within PMO. There was, crucially, no information suggesting that any ideas relating to its intended usage had ever been discussed with PMO's management or staff. Apparently no thought was given to the purpose and role of the database system within the PMO organisation, nor on its impact on PMO's method of working. This is a major cause for the system remaining virtually unused by PMO, effectively becoming a complete 'white elephant'.

System Configuration & Operation

The system was based on four or five Personal Computers (PCs) linked using a peer-to-peer network and housed in a special air-conditioned office. The database was implemented as a conventional relational database scheme using Microsoft™ Access™.

The system was run by a relatively senior civil servant as manager, a deputy who handled the technical aspects, and two data entry clerks. The system, including staff, was initially known as the Human Resources Information System (HRIS) but later renamed the PMO Management Information System (PMIS) to align it with the EMIS, HMIS and other planned Gambian government MIS schemes.

Data Collection and Input

After development of the system a major exercise was undertaken by PMO, primarily HRIS staff, to acquire and enter the personnel data. To gather the data HRIS produced a questionnaire requesting civil servants to supply the information required. PMO staff then travelled around the country, visiting every civil servant at their place of work, explaining the issue, and getting them to complete the questionnaires. The data entry clerks then entered the resulting data into the HRIS database.

Several problems arose from this procedure resulting in numerous, serious discrepancies between the PMIS and P-file data:

1. It was difficult to verify the information provided by civil servants on some topics as many did not have copies of relevant correspondence, forms, etc and relied on memory.
2. When the information from the forms was input by the data entry clerks no attempt was made to check the accuracy of the data entry operations.
3. Most significantly, no crosschecks were made comparing the information gathered on the forms with that on the corresponding P-files.

Failure to Incorporate PMIS in Working Procedures

The operational procedures within PMO were never changed to make use of the PMIS database; paper files continued to be used for all PMO's work. When occasionally the PMIS was interrogated differences frequently existed between PMIS and P-file information. PMO's staff were familiar with the P-files with their information in written form. They regarded the P-file information as accurate and thus the PMIS data as unreliable. This became one of the nails in the PMIS coffin: Why use suspect data when (apparently) accurate information is at hand?

Later, when PMO were persuaded to carry out a verification exercise checking both the P-files and the PMIS database against reality, it was discovered that there were serious discrepancies in the paper system's information too. In fact the database information was, in general, much more accurate than the P-files! (A lot of bad filing and bad records practice, e.g. letters with wrong or quite commonly, completely missing references, had resulted in an accumulation of errors in the P-files over many years; errors of which the PMO staff had been quite unaware!)

Data Changes and Update Procedures

The personnel data was, of course, not static. Civil servants change their roles quite frequently. Those changes had to be reflected in the PMIS to maintain its accuracy. However the PMIS was not used in any meaningful operational way for making decisions on individual civil servants and

the changes in their careers. Instead, decisions were based on information laboriously dredged from the individuals P-files. The decisions were then communicated to the person and a letter sent as confirmation with a copy placed in the P-file as a record.

The procedure for updating the PMIS database was separate. A copy of every letter written in PMO was included in the so-called 'running-file' and circulated to all managers within PMO including HRIS. Each week the HRIS data entry clerks sifted through the current running-files and used the relevant letters to update the PMIS. As a result the PMIS was always at best one or two weeks out of synchronisation with reality. There were no checks on the update procedure. It was not difficult to miss one or more letters in the running-file or to transcribe the information incorrectly. Moreover there was no certainty that the running-file was itself complete, thus increasing the risk of inaccuracy of the PMIS.

The Data Access Problems

There were two very serious problems concerned with PMO's general staff accessing the PMIS data and these taken with the ones already discussed almost certainly rendered the overall system as originally conceived effectively useless:

1. No training or explanation had been provided to the PMO staff outside HRIS on what a database might be used for nor what information the PMIS contained.
2. If, in spite of this, a member of PMO staff did want information from the PMIS they had to come to HRIS office and ask the PMIS staff to obtain it for them; they did not have terminals on their desks or indeed anywhere in the offices where they worked – where indeed the information was needed.

PMO staff were very busy, indeed generally overworked, and the idea that they might take time out to visit HRIS to learn how to use the PMIS (which, as previously explained, most staff believed held flawed data) was totally unrealistic. It did not happen. Some senior staff who had come across databases while studying abroad did occasionally make requests, particularly relating to statistical information, but the overall use was extremely low. It appeared that, generally, staff had no understanding or interest in the capabilities of the PMIS system.

Planned System Upgrades

Three major changes were proposed for the PMIS which, taken as a whole, formed a realistic attempt to demonstrate that the database could in fact be a very useful asset to PMO, speed up the work done, and improve the quality and accuracy of PMO's output:

1. Acquisition of additional PCs / terminals to be placed on selected staff desks and linked to the PMIS providing easy access to the information
2. Train PMO staff to use the PMIS, show what information it held, how to extract it and how use it in their work
3. The PMIS would be integrated into simple, day-to-day, PMO operations. It would be set to trigger certain date-driven actions on a proactive basis; used to generate text of standard letters, e.g. confirmation of promotions, whilst drawing information from the database and automatically updating the database on a real-time basis.

The upgrade scheme was designed to show how the PMIS might benefit PMO's operations without seriously disrupting PMO's way of working. The long-term objectives were for the PMIS to gradually take over increasing amounts of PMO's workload. It would be quite feasible to develop the PMIS to handle many of the routine tasks. Every decision made by PMO (and the PSC)

currently involves numerous movements of files amongst members of staff and management, and each movement has to be recorded. PMO's arcane procedures could be greatly simplified and the time to make decisions greatly reduced. It would also permit the redeploying of many of PMO's staff to other tasks where their abilities might be better used. The first essential step, however, was to build confidence in the PMIS's capability amongst PMO's management and staff. Only then might it be practical to introduce more sophisticated human resource management objectives.

The proposed upgrade plan needed additional investment. No money was available from PMO resources but a small grant was provided by DfID enabling a pilot project to demonstrate the PMIS's ability to create standard format letters while simultaneously updating the database. This did however not resolve the real problems of PMO staff access to the PMIS, nor did it provide the training in database use or explain its capabilities. The PMIS thus inevitably remained unused, a wasted asset.

CASE STUDY 2: THE EDUCATIONAL MANAGEMENT INFORMATION SYSTEM (EMIS)

Introduction to DoSE

The Department of State for Education (DoSE) is responsible for all facets of education within The Gambia. It includes over 700 schools with over 6,000 teachers providing education from primary up to university level.

Major issues facing the Department in 2000 included:

- Inefficient and poorly resourced management
- Lack of accurate statistical data for the sector
- Use of significant proportion of unqualified teachers
- Primary Net Enrolment Rate (NER) of around 75% in some areas
- Gender inequality in pupil enrolment and teacher recruitment and deployment
- Unsatisfactory curriculum

Project Outline

DfID has a history of supporting the development of the education sector in The Gambia. As part of this development an Education Management Project (EMP) was inaugurated in early 2000. This project was extensively researched and discussed with DoSE senior management when it was being designed. It had a planned duration of two years and specifically targeted the management of the sector through:

1. Provision of new systems including EMIS, staff appraisal system and training needs system.
2. Strengthening of human resources and IT capacity.

This paper is primarily concerned with the EMIS component of this project and does not consider the staff appraisal aspect although this encountered very similar difficulties.

The project team comprised:

- Team Leader

- EMIS System Designer
- Human Resource Specialist - Principally concerned with the staff appraisal system

The team was supplemented by a Systems Analyst from VSO and by local staff who received more training under the project.

The DoSE Information Technology and Human Resource Department (ITHRD) had previously commenced work on an EMIS. The EMP Team Leader's report of this aspect in April 2002 stated:

> *"ITHRD had conducted a survey of teachers in 1998 and data was still being entered under difficult conditions. Data control systems were non-existent…. The data entry system was similarly unsystematic, with three separate databases maintained and no system to prevent duplicate entry, and no permanent identification system for records.' There were also severe resource constraints in terms of the number of computers, network facilities and general administrative arrangements." (DoSE, 2002)*

A work-plan was produced for the System Designer and Systems Analyst and this was, in general, executed as planned:

- User needs assessment;
- Review of current information flows;
- Design of EMIS on the basis of the user needs;
- Develop EMIS;
- Review IT training needs of ITHRD staff;
- Review EMIS training needs of DoSE users.

The resulting EMIS product was distributed on a CD that included the necessary procedures for installation on user PCs. It was intended to provide a comprehensive, accumulating statistical view of the education system in the country. It did not provide for end-user feedback of amendments and corrections.

System Components

The system was composed of the major data elements shown in Table 2:

Table 2: *Major data elements*

Data Source	***Contents***
School	Description, Location, Enrolment, Physical facilities, Special Needs pupils and facilities
Centre	Description, Location, Enrolment, Physical facilities
Financial	Actual expenditure, Budgets
Staff	Individual details including qualifications and working history of both teachers and administrative staff
GIS	Location data for all educational establishments

Reporting

Extensive reports at establishment, regional and national levels including analyses by age, gender, grade and school type. Statistics included Gross and Net Enrolment Rates, Pupil/Teacher ratios, promotion and drop out rates in accordance with international definitions.

Technical Overview

EMIS was developed in Microsoft™ Access™ (version '97 and 2000) being used so as to provide compatibility with the versions of this software currently in use within DoSE. The GIS component was produced with MapInfo.

There are a number of different functional components involved in the production process:

- Data entry system for establishment descriptive and enrolment data
- Data entry system for staff data
- Regional databases for use in the Postings process
- Form tracking systems for the management of data collection and entry
- Ad-hoc data manipulation for the other data sources
- Operations Database for automated combining of new elements of data into the master version, other items of system administration and the final 'publication' in CD format.

The two data entry systems were operated separately from the master version of the data. Once data entry was complete the Operations Database managed the loading of the new data into the master version.

The final product, the two data entry systems and the operations database all had a similar structure in terms of a front-end database and a core database that are joined by the "Linked Table Manager" in a way that is transparent to the users.

Project Implementation

Under the direction of the System Designer most of the work was carried out by the VSO System Analyst who in turn directed a Peace Corps volunteer (who developed the GIS component) and two Gambian Systems Analysts who had been trained in Microsoft™ Access™ under the project.

Development Period

During the active life of the project (i.e. until March 2002) the system was developed broadly in accordance with the work-plan and the system design as modified in the light of user feedback.

- Appropriate systems (PCs, network servers, network components, printers & UPS) were purchased and installed.
- The software development moved forward steadily and there were a number of releases during this period as data was captured and more functionality was provided. The VSO System Analyst was the principal driving force in this period.
- Capacity building of relevant staff was initiated. Technical staff receiving more advanced training were tied to government employment by a bonding scheme that imposed financial penalties if they left government service before the end of a contracted period.
- A recommended annual operational schedule was defined and progressively introduced.

In March 2002 a formal ceremony marked the end of the development project and the departure of the team members. At that point the status of EMIS was:

- **Software Development** - Most major components completed, some minor elements outstanding. Formal quality assurance and testing not performed.
- **Documentation** - User Manual and Operations Manual – complete in line with software.
- **Technical Training** - Complete except for one Network Administrator in UK on MS Certification course and one System Analyst continuing a distance-learning course.
- **User Training** - User workshops had been provided for all appropriate education management staff. Further workshops had been carried out when subsequent versions were released.

Post Project Period

The closing ceremony proved to be a high water mark for the system. Over the next two years there was a progressive decline in the staff situation within DoSE and especially with the EMIS team. Generally the management staff levels across DoSE were well below the establishment figures with the more competent individuals being moved around according to changing priorities.

In the EMIS team individuals trained under the project were either moved away or left as soon as they could at the end of the bonding period associated with their training[3].

The remaining development team were heavily occupied in the routine operation of the system and operational problem solving which left inadequate time for new development. Software problems were encountered with various statistical production modules within the system and these proved too complex for the existing staff to correct.

Recruitment of suitable replacement staff proved impossible because of management reluctance and, even more significantly, because of the lack of suitable candidates. The Gambian education system, like many other countries in Sub Saharan Africa, is heavily based on rote learning and positively militates against constructive thinking:

> *"The school curriculum has little relevance to the needs of the community. Often, its goals are too ambitious and its content too encyclopedic [sic] given the realities of the situation. This explains, in large part, the high rate of student failure. The teachers usually have only a modest level of education themselves and little systematic training. They tend to emphasize rote learning rather than using active methods and have little experience in how to organize a programme that can cater to students of different ages and achievement levels. Very few countries have effective programmes of continuing education and training for teachers to help them overcome these weaknesses." (WB, 1997)*

Management of the EMIS during this time was provided by another VSO volunteer (the author of this section) who was supposed to act as an Advisor in support of a Gambian departmental manager. However the person eventually appointed for the latter role was fully occupied with other ICT activities and took no part in EMIS. When the author departed in January 2004, in the week of his departure a Gambian with minimal experience was appointed to take on those responsibilities. Therefore no proper hand-over or training was possible.

The power supply throughout the country worsened progressively with particularly significant impact in the regional offices with negative consequences especially on the postings process (see section 3.63 below). Funding had been allocated for fuel for a generator for the DoSE building in which EMIS is based but these funds were often not made available for that purpose.

The equipment maintenance situation deteriorated progressively. The local maintenance organisations are of limited ability and capacity. Minimal funding was identified for maintenance in annual budgets.

Data Collection

The annual data collection exercise was a critical part of EMIS since it was the source of the majority of data loaded into the system. The key element was the completion of a 14-page form by the principal of each educational establishment covering detailed enrolment figures and the establishment facilities. Training was provided each year for school heads in each region to equip them for this exercise.

Each year different methodologies have been used for the issuing, collection and validation of these forms. No satisfactory and cost-effective approach has yet proved successful in terms of the speed, completeness and accuracy of form completion.

Although head teachers had the importance of this process explained to them each year, they saw little if any direct benefit coming to them or their schools and consequently they often lacked motivation and delegated the task to less appropriate individuals. The resulting forms required extensive validation before data entry.

Postings

The annual process of allocating teachers to schools was identified as one of the principal ways in which EMIS could provide benefits to DoSE management. To date this has not proved to be the case mainly because of operational difficulties that have made the relevant information available to the Postings Committee either too late or in incomplete form. The failure of EMIS to provide real benefits in this respect handicaps the reputation of the system within DoSE management.

Observations

- The project design and development was carried out with comprehensive investigation and consultation phases. The development phase followed the agreed work-plan including significant user review elements. However the available development team were not able to complete and test the system as designed in the time available.
- The outstanding items would not have prevented proper operation of the system had adequate technical and operational staff been available once the team departed.
- Most of the Gambian staff who had received training under the project were either moved away by DoSE management, lacked the aptitude or ability for the role or left government employment as soon as they could on completion of the bond period. The assumption had been made that adequate technical staff would be available to operate, manage and further develop the system as a result of the training that would be included in the project. In hindsight this appears to have been a false assumption.
- This severe lack of suitable local individuals for identification and training as technical staff to operate and further develop the system implies that it will be dependent upon non-Gambian

resource for the foreseeable future. This lack is principally due to the poor quality of education and rigid methodology employed in Gambian schools.

- Elements of the local infrastructure (power supply, computer maintenance companies, availability of software development personnel) were a serious obstacle to the ongoing development of this system and to ICT developments in the country as a whole.
- DoSE management were not prepared to devote resources to the EMIS once the project team had departed and did not appear to have any grasp of the management or technical demands of IT systems.

CASE STUDY 3: THE HEALTH MANAGEMENT INFORMATION SYSTEM (HMIS)

Introduction

The Department of State for Health and Social Welfare (DoSH&SW) is responsible for providing health care to the people of The Gambia. Delivery of health care has been focused at the primary level, that is, within the community itself with village health workers and community health nurses providing key health services to the public. Secondary and tertiary services were provided by 4 hospitals and approximately 40 health facilities with more than 500 health posts at the primary level though there were also facilities provided by private and Non-Governmental Organization (NGO) clinics. The "Mission Statement" of DoSH&SW is:

> *"Provision of quality health care services within an enabling environment, delivered by appropriately and adequately trained, skilled and motivated personnel at all levels of care with the involvement of all stakeholders to ensure a healthy population." (DoSH&SW, 2001)*

DoSH&SW was aided in the provision of these services by ICT equipment scattered in offices and health facilities throughout the country. Most of this equipment was donated to the department or acquired by funding agencies such as the World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF). Some equipment was also purchased using credit from organisations such as the World Bank. In the past most of this equipment was used for basic word processing and spreadsheet purposes with little consideration of their use for more advanced analytical and planning purposes.

In recent years there has been an increasing demand for accurate health information on which to base sound decisions. Previous decisions were made based upon surveys with limited applicability or by "generally accepted" situational analysis. The information necessary to make effective decisions was simply not available. It was accepted that ICT could potentially play a significant role in this effort and it was further hoped an effective Health Management Information System (HMIS) would be able to provide this information.

Project History and Overview

The need for a HMIS was initially recognised by a survey undertaken by the Management Sciences for Health organisation in 1994 (MSH, 1994). The African Development Bank funded this initial survey but specific HMIS funding was not secured until 1998. At this point the World Bank funded Participatory Health Population and Nutrition Project (PHPNP), a five year project (subsequently extended), identified the HMIS as part of its efforts towards "…improving the quality of, and access to, family health services, including reproductive, infant and children health services, nutrition services, and the management of such services in The Gambia" (PHPNP,

1998). PHPNP included HMIS as part of its "Capacity Building and Policy Development" (Component IV, "Management and Implementation of a Family Health Project", sub-component 1). PHPNP identified the following as components of the HMIS:

- **Health Indicator System** - Containing information specific to the generation and management of key health indicators currently entered at the divisional level through the use of spreadsheets. The idea behind this system was to create a database system that would allow central analysis of data both at the divisional and central levels.
- **Finance and Accounting Information System** - Containing information regarding the day-to-day financial activities of DoSH&SW
- **Maintenance Information System** - Containing information regarding the management and repair of various medical equipment, vehicles and facilities throughout DoSH&SW

Since the initial PHPNP proposal various events occurred that caused adjustment to the scope of the HMIS including:

- Establishment of the World Bank sponsored Integrated Financial Management Information System (IFMIS) in the Department of State for Finance and Economic Affairs (DoSFEA). This promised to provide much of the functionality originally identified as the "Finance and Accounting Information System" so this component has been removed from the scope of the HMIS implementation. In recent years the viability of the IFMIS has been called into question with continuing delays and seemingly over-optimistic goals.
- The Human Resources Information System financed by the African Development Bank identified in the initial HMIS proposal never materialised so this critical piece needed to be added back into the implementation of the HMIS.
- Updating the National Pharmaceutical Service Inventory and Drugs Information System required higher priority in order to improve service delivery, resource management and cost-efficiency.

Project Implementation

Project Focus

The HMIS had the advantage of being implemented after the initial attempts at establishing MISs by PMO (PMIS) and DoSE (EMIS). In conversations with key individuals involved in the development of these systems a number of critical issues linked to their perceived failures were identified.

These conversations and other influences caused the HMIS implementers to re-consider their activities with regards to the following:

- **Limit the Scope** - One of the shortcomings in both the PMIS and EMIS was that of trying to do too much. On review it was seen that the original scope of the HMIS was also too wide therefore the PHPNP decided to focus on the establishment of a solid foundation for the HMIS rather than the actual implementation of such a large system. This focus narrowed the original requirements such that out of eight core components identified in the HMIS policy (DoSH&SW, 2002) only three were to be implemented as part of the PHPNP.
- **Sustainability** - Every effort was made to ensure that HMIS activities were looked at from the perspective of how these activities would be continued in the future (if required) and how the DoSH&SW infrastructure could maintain the results. One of the reasons for this focus included the fact that both of the key HMIS staff involved had worked for organisations that

have this as a stated mandate. The concern was also based upon the observation that many of the activities that have failed in The Gambia have not taken sustainability into consideration. This concern also drove the decision to focus on the development of a solid, core foundation on which the system was to be built in order to attempt to ensure its long-term sustainability.

- **De-Centralisation** - With the government passing into law the "Local Government Act" it was vital that the HMIS took into account the power that would eventually be transferred into the divisional offices. HMIS tried to build divisional capacity by providing the divisional staff ICT training and installing essential ICT infrastructure including computers and network equipment.
- **Inter-Departmental Communication/Co-Operation** - The team implementing the HMIS saw the communication with other government departments regarding common needs in the development of IT systems as critical to its success. It was perceived that previous project failures were due to a lack of this communication. These types of discussions are crucial in light of the interdependencies HMIS has with IT systems in other departments such as PMO and DoSFEA. The team encouraged the development of an "Inter-Departmental MIS" group as well as the active participation of DoSH&SW in any and all inter-departmental ICT forums such as the recent e-Government program of UNECA.

Establishing the Core Infrastructure for HMIS

To identify the state of ICT within the department an initial assessment of all ICT resources (both computer equipment and personnel) was performed. This assessment was used to determine what specific activities needed to be carried out to establish the fundamentals for the HMIS. The activities identified included:

1. **Training** - The level of ICT understanding in the department was quite low so it was identified very early in the process that some level of ICT training would be required. This training was carried out by local institutions for personnel at all levels within DoSH&SW. It was critical that training also be held for staff stationed in the six divisional health team (DHT) offices who are often neglected due to the lack of professional training resources outside of the capital area. This has meant that HMIS has sponsored very successful training sessions held up-country. This training was also intended to help build the capacity of the divisions in support of future DoSH&SW decentralisation. Additional training was carried out for key personnel in Data Analysis since there was a requirement that competent staff be available to analyse the data the HMIS would generate. It has been widely accepted that the educational system in The Gambia does not produce many analytical thinkers so training in this area was critical to the goal of implementing a HMIS.
2. **ICT Acquisition and Installation** – PHPNP purchased computers and networking equipment for use throughout the country. For sustainability reasons the necessary protective equipment (including UPSs, Voltage Regulators and fused Power Strips) was also purchased. Due to the erratic power supply in the country this additional equipment was absolutely necessary. Both the establishment of a long-term maintenance strategy and the acquisition of a Department-wide anti-virus solution provided additional support of this infrastructure. Prior to this investment loss of critical health data and information was common due to out of date anti-virus software or, in most cases, lack of any anti-virus software at all. There were yearly subscription costs associated with providing anti-virus software so efforts were also been made to include these costs in the departmental budget. Computer networks installed throughout the country also facilitated communication and co-operation between the various units as well as providing communications with the rest of the world using a high-speed Internet connection. Later in the project it was realised that with a

little extra effort networking would be possible at the six Divisional Health Team (DHT) offices located throughout the country so an integrated wired and wireless solution was identified, procured and installed in these offices. Professional communication was also facilitated with the establishment of a departmental web site (http://www.dosh.gm) as well as another web site specifically targeted for the public (http://www.healthgambia.gm, though this site has not been fully developed).

3. **Policy and Standards Development** - HMIS has largely been responsible for the implementation of a "Computer Use Policy" to govern the acceptable and responsible use of ICT in the department including how an Internet connection should be used and how computer equipment should be cared for. Monthly training sessions are held to inform employees of what the "Computer Use Policy" is and what it means to them. All employees are required to sign the "Computer Use Policy" to indicate their understanding and acceptance of its restrictions. ICT and HMIS staff were always watching for violation of this policy and taking the necessary actions to address them. Standards providing minimum acceptable specifications of ICT equipment (both for new purchase and donation) have also been established which has been critical in avoiding the acquisition of inappropriate or insufficient equipment. Largely the role of HMIS in this area is the sensitisation of employees to the policies, guidelines and standards including continual reminders of their existence. It should be noted that all of these policy initiatives were of the non-Gambian HMIS personnel, as it seemed local DoSH&SW staff were unable to grasp their importance. Over the years since the policy has been implemented the local employees have begun to see that these policies are designed to protect and further the ICT interests of DoSH&SW and are for their benefit so the enthusiasm for them has increased.

Establishing the HMIS

Early in the planning process it was seen that a central repository for all HMIS data would be required. This repository would allow any system requiring DoSH&SW data to easily access it. It was determined that this database would have to be capable of handling multiple concurrent access but with budgetary considerations commercial products such as Sybase SQL Server and Oracle were not seen as viable solutions. After long discussions the Open Source database server software MySQL was chosen and implemented. This database was eventually populated such that it contained the core set of information for future (and existing) HMIS components.

After the core database was implemented, basic versions of the following components were implemented and were largely operational at the end of the author's services:

1. **Health Indicators** – Essentially the same as the “Health Indicators System” envisaged by the initial PHPNP proposal, this component would contain statistical data regarding the delivery of health care in the country intended to support the Epidemiology and Statistics Unit (ESU) of the Directorate of Planning and Information (DPI). Generally this involved the extraction of data entered at the divisional level in spreadsheet form into a central database. It is with this extracted data that key indicators for the country could be determined such as those related to maternal mortality rates and immunisation coverage. A preliminary system was developed in 2002 using local contractors but the solution developed was not adequate for the needs of the department. There was a new system developed by the VSO volunteer hired to assist with HMIS implementation before he left the country. There was also a severe back-log in the entry of divisional information by the local data entry clerks with some personnel reassigned or resigned from the service.
2. **Drugs, Vaccines and Other Medical Supplies** – This component would contain inventory and ordering information for medical supplies throughout the country and was implemented by a consultancy firm from Ghana. Initial indicators after implementation were that the system

was not being used correctly (if at all). It was suggested that this failure has been due to the fact that the personnel could not see the benefit of the system and that full accountability was not something they truly wanted.

3. **Human Resources** – Before HMIS there was little accurate information about DoSH&SW employees available within the department and even within the department supposedly responsible for it: PMO. To address these concerns a Human Resources component was identified to store information about all DoSH&SW employees. A rough data-entry system was created to store the information gathered from a questionnaire sent to all employees to establish a core set of data about all staff. All data received was entered into the system and the information was being validated with information that was received from PMO at the time the author left the country. It was hoped that this system would eventually be regularly synchronised with the human resource information of PMO.

A number of components of HMIS were yet to be implemented including:

- **Vital Registration** – This component would be used to store key information regarding the registration of births and deaths. The Births and Deaths Registration Unit were managing this process and, while they had computer equipment, it was largely unused as all information gathered by the unit was being entered manually into large registration books. This system led to widespread abuse and inconsistencies in the data. Due to political issues this component was not developed but was awaiting direction from senior management. Recently a proposal was put forward to fund the creation of a Vital Registration system as part of the United Nations Economic Commission for Africa (UNECA) African Information Society Initiative (AISI) framework (adopted by African Countries in 1996) however the outcome of this has not been revealed.
- **Logistics** – This component was envisaged as containing a complete inventory of all medical equipment as well as maintenance scheduling facilities. This component was only partially implemented by the end of the authors time with all ICT equipment existing in an inventory database along with management of any problems related to that equipment. This information was used to derive key statistics for future ICT resource planning. The aspects of this component related to medical equipment were not yet implemented with no future plans for their development in place. This was partially due to the fact that the key local staff member involved with and driving the implementation had left the service before the system could be completely specified and implemented.

Current Status of Project Personnel

The current HMIS Consultant and the VSO systems analyst assisting her have now both left the country. There was hope that the time allotted would be sufficient for this role of establishing the firm foundation for future development however it seems that this is not the case.

It should be noted that since their departure both consultants have continued to support the HMIS by providing support via the telephone and electronic mail. It is hoped that these continuing efforts will in some small way sustain the foundation that they have helped establish.

Difficulties

A number of critical issues were identified throughout the development of the HMIS including:

- **Lack of High Level Support for ICT Activities** - A large number of the difficulties experienced in the implementation of the HMIS could have been addressed with the support of high-level managers. There seemed to have been little appreciation of the utility of ICT resources nor a consensus as to how to use the information that is generated. Frequent changes in top-level management have made long-term plans difficult to implement thus the planning process was considered wasted effort. Senior managers much prefer to retain the short-term control afforded by *ad hoc* decision-making to more demanding information-based decisions. *Although a MIS can make information more available it cannot compel its use.*
- **Inability of Donors to Assess Need** - A number of donor agencies seemed to be willing to implement systems or donate ICT equipment to vertical programmes without first assessing needs of the programme itself, or of the health system in general. Inappropriate computer equipment was often purchased to the extent that there are units in the department that had more computers than people. Often systems were installed as part of a worldwide effort even though they had little relevance to the country and caused serious disruption to the running of the health care system. Largely, it seemed, the attitude of the donors was one of "we know what is best for you" and "do what we say" rather than "what do you want?" or, more importantly, "what do you need?" Admittedly, it is difficult to assess need in a country such as The Gambia when every response is geared towards saying what the donor wants to hear. The donors are to be kept happy since they are the source of current and future funding. DoSH&SW was only too willing to accept advice unquestioned rather than thinking about its own requirements. Recipients were adept at using all the correct words while not fully believing in them or understanding their implications. Donors have more responsibility to assess the actual level of commitment to the use of ICT and MIS than was often made.
- **Sustainability** – Long-term plans for maintaining and using any MIS must exist and be realistic. While maintenance of resources was rightly the responsibility of recipients of major donations, specific planning for the ongoing upkeep and use of complex systems must be part of the initial donor process. It is not adequate for the donor to assume that it is out of their hands, nor for the recipient to assume “someone” will take care of it in the future.
- **Inadequate Basic Education of Personnel** - Basic analytical skills were missing in most personnel within the department. This was largely seen as the fault of the education system in the country. With education mainly focused on teaching young people by rote they were not encouraged to develop the analytical or planning skills necessary to survive in the global world of today. University level education began in The Gambia less than ten years ago focusing on liberal arts and economics with science, engineering and technology poorly represented. Although more and more graduates of secondary schools and university were computer-literate at a basic level, the thinking and analytical skills needed to maintain, use and develop a useful MIS were yet to become widely available.
- **Inadequate Basic Technical Infrastructure** - Power and water were not reliable throughout the country (though most pronounced outside of the capital area) which caused problems when making use of ICT requiring the use of alternate power sources such as solar power and (more often) petrol generators. It should be noted that The Gambia was fortunate, however, to have a very reliable telephone system with fibre throughout.
- **Lack of In-Country ICT Development Expertise** - There was a serious lack of qualified ICT system analysts and development personnel throughout the country leading to systems being written outside the country or systems being implemented poorly. Part of this was likely due to the quality of the education system (see above) but also due to the fact that any local

qualified personnel are very valuable and they find better opportunities elsewhere. Such personnel were highly sought after by the private sector that regularly draws such staff away from DoSH&SW and other government departments. Ironically, it was often multi-national NGOs that recruit staff away from the countries they are supposed to be assisting.

- **Expense of Acquiring Legal Software** - There was little understanding or support for developing countries in the acquisition of legal copies of computer software. While £300 may mean nothing to a large company in England, to a developing country such as The Gambia this represents much more than a year's salary for most people. While companies such as Microsoft™ have made it less expensive for educational institutions they have not yet seen the difficulties of public institutions in the developing world where the resources are much more constrained.

OBSERVATIONS AND DISCUSSIONS

Several issues can be identified as being common to the design and implementation of these three systems as described above:

- **Technology was not a factor in the success or failure of project implementation** - It is clear from the three cases cited in this paper that technology was not an issue when in came to the success or failure of the given systems. In all of these cases it can be seen that the effectiveness of management was critical to the success or failure of the project.
- **Infrastructure problems severely impacted project implementation** - It should not be underestimated the impact of the lack of an appropriate infrastructure will have on project implementation. In The Gambia the lack of power and telephone services[4] for extended periods of time severely impacted the implementation of each of these systems. These factors should be understood and allowances made during project design.

There are a number of factors that can be seen as critical for project success:

Understanding Cultural and Contextual Differences is Key

In The Gambia the poor quality of the educational system was often ignored which led to a "developed world" solution being implemented in an immature management context.

The three authors have come from cultures in which ICT has been introduced slowly over time and integrated into the society as a whole. In developing countries to implement advanced technological solutions without this cultural context is irresponsible and most likely to lead to failure. *It must not be assumed that the recipients understand or appreciate the impact of the system being implemented.* This "technological cultural gap" cannot be addressed by simply training individuals in the use of technology but there must also be a gradual sensitisation process whereby an appreciation for the cultural impact of technology is made clear. Technology is not simply a matter of computers it is also a state of mind -- an entirely new way of thinking.

It should also be understood that in many ways managerial staff in developing countries are likely to agree to anything proposed by ICT implementers for numerous reasons relating to aid dependency and perceived expertise on the part of the ICT professional. There should be concerted effort to ensure that the recipients understand the full ramifications of the project.

Long Term Project Sustainability

In many cases a project is implemented by a funding organisation over a fixed duration after which the project is considered complete. Before embarking on an ICT project serious thought must be given to the long-term sustainability of the project once it has been completed.

Development projects funded by donor agencies normally specifically exclude running costs such as:

- Hardware and software maintenance costs
- Telephone and Internet charges
- Consumables such as paper, printer cartridges, and backup media
- Higher salaries required for the retention of technical staff

Therefore the project should address these matters by ensuring that senior management recognise this issue and that adequate provision is made in the budgetary process for the new system. This is an area in which senior management will often say that provision will be made at the start of the project but financial constraints are often imposed during the budgetary process. These recurrent costs are not perceived as being 'mission critical' and are often therefore dropped. There is a common belief that 'some other donor' can be found to fill the resulting gap when something breaks down.

PROJECT IMPLEMENTATION GUIDELINES

Based upon their experiences, the authors would like to propose the following guidelines for successful MIS implementation in developing countries such as The Gambia. It should be noted that this section is not intended as a comprehensive project management manual but identifies aspects that require particular attention in such environments.

Project Planning

During the planning process for the project there are a number of factors that should be considered:

Ensure Project Applicability

It may appear obvious but there needs to be a true understanding of the needs of the recipient and any proposed system must address those needs. It is possible to implement a system in a country with little regard to whether or not the country such a system serves any useful purpose. While it is true that the donor may have its own reasons for wanting the system, this should be weighed in light of the real and practical needs of the recipient. Where the donor has a particular set of requirements for the system these should take into account the needs of the recipient as well adjusting to the local requirements.

Realistic Scope

A realistic scope and time-scale for the project should be identified and communicated to all key players. There is always a pressure when funded by large agencies that the project achieves (or is perceived as achieving) the most within the budgetary constraints. This temptation should be weighed in light of the likelihood of the long-term success or failure as well as the value of the project to the recipients. The needs of the recipient should be balanced with the needs of the

funding agency. It should be seen that it is in the best interests of the donor to see to it that the project is a success and, therefore, take necessary steps including the narrowing of scope to ensure that this is so.

Management Commitment to Project Success

Ensure that there is genuine management commitment to the successful implementation of the project. There should be no assumptions made of their knowledge of ICT issues. It is essential to ensure the necessary understanding exists before soliciting key decisions. It may be necessary to consider the training of key individuals in management issues so they are more capable of making appropriate business decisions.

Clear Project Goals and Success Indicators

All parties should understand what the goals are of the project and clear indicators for project success should be developed. Such understanding by the recipient agency middle management should be to the level of being able to explain to others what these are in their own words instead of repeating simply the terminology and phrasing laid out in the project documentation. There should be a focus on the real understanding and appreciation of the impacts the project will bring to the recipient.

Long-term Financial Planning

The financial planning of the project will naturally include all identifiable items during implementation. The project costs should reflect the additional sensitisation and consequent longer project duration than would be appropriate in western circumstances. However from the very beginning attention should also be given to the long-term financial sustainability of the project with efforts focused on obtaining long-term funding for the recurrent expenditures required after successful project implementation. The inclusion of such expenses into the budget may include lobbying and negotiating for necessary budget funding or talking to other long-term donors. This process can, potentially, take a considerable amount of time (perhaps even the duration of the entire project) so efforts should be made to start this as early as possible. The financial management of the project should be paramount. The adoption of separate bank accounts, not under the control of the recipient, should be used to fund the project[5]. Similarly, the provision of ring-fenced funding[6] to cover the various ongoing costs of running the finished system and its further development should be given serious consideration.

Project Implementation

Phased Implementation

Ensure that projects are implemented in a step-by-step manner with clear and achievable goals in each phase. These goals should be associated with the identification of easily quantifiable indicators. All parties should have a clear understanding of these goals and be continually striving towards their achievement. Each phase of the project should thus result in a system that demonstrates functional benefit to the recipient's management and staff. Implementing a project using the "big bang" is a recipe for disaster particularly when the lack of cultural understanding identified in the previous section.

If possible the decision as to whether or not to proceed to the next step of project implementation should be based upon the confirmation that the previous step has been successfully implemented. Continual checks and balances should be made throughout the implementation of

each phase with adjustments made as necessary to ensure successful implementation. It may be possible to link the achievement of the goals of each particular phase to financial incentives to stimulate this process.

On-Going Training and Sensitisation

Before and throughout the implementation, training should take place for all relevant recipient agency staff in the *use of the MIS as an adjunct to their working procedures*. This includes technical personnel, management and system users. This training should be accompanied by project sensitisation sessions to ensure widespread understanding of the system and the benefits it will bring. Often such sessions are left until after the project has been implemented but this may cause resentment in that the system is implemented seemingly "out of nowhere" with little consideration given to the potential users. Appropriate sensitisation should also be provided for other staff members (e.g. secretaries, filing clerks) who have no direct contact with the system but whose working practices will be affected.

Organisational Change Management Unit

A dedicated Change Management Unit should be created within the organisation to control the impact of the new system on working practices. This would be used for attempting to ensure the successful implementation of the project but could also be useful for the development of management skills within the recipient agency and subsequently for other, non-project related activities that could be more effectively implemented. The perception may be that such a unit would slow project implementation down. While this may be true such a unit could ensure the long-term sustainability of the project and, therefore, the associated goals.

This unit could serve as a training unit for people in change management techniques beginning with one individual trained in such techniques passing these skills onto others in the unit.

Were such a unit to be proposed it is essential it is mandated and facilitated by the recipient agency itself. Without this involvement it is unlikely that such a unit would survive past project implementation.

Project Implementation Checklist

In summary, the following is a checklist of the attributes that must be a part of any successful project implementation:

- Clear definitions of the project rationale and anticipated impact
- Achievable project scope
- Demonstration of management commitment
- Communication of project goals and success indicators
- Project financial planning to cover implementation
- Long-term financial support provided by recipient agency
- Incremental implementation linked to identifiable deliverables with demonstrable benefits
- Training and sensitisation of all appropriate staff in the recipient agency
- Use of a dedicated Change Management Unit

CONCLUSIONS

It can be seen in this paper that there are two fundamental issues:

- ***Failure of aid agencies to understand the environment in which their ICT is to operate*** – In the PMIS DfID supplied equipment but seemed to have no understanding of where or how that equipment would be used. Would DfID have even contemplated EMIS if they had known DoSE would just let all the project staff leave without replacing them?
- ***Failure of aid recipients to understand the benefits of ICT for their jobs*** – If this understanding had been in place, would the management of DoSE allowed the EMIS to stagnate? Would PMIS have continued for year after year to contain patently inaccurate information? Would the HMIS have taken so long to implement?

Notwithstanding these difficulties however, the authors are satisfied that ICT projects, correctly implemented, with due regard for sustainability and staff training, can yield very significant benefits in in LDCs. Much of the development needed in LDCs would greatly benefit from access to, and effective analysis of, information. Each of the three schemes discussed, if correctly implemented and applied, had the potential to yield clear benefits in terms of improving the efficiency of the departments concerned whilst reducing reliance on scarce, trained and skilled, staff resources. The “phased” approach suggested in the “Project Implementation Guidelines” goes a long way towards anticipating these requirements and addressing the related issues.

Much of the information access and analysis can only realistically be achieved by ICT. The shortage of educated and skilled staff has been flagged as a specific problem for development of ICT schemes but it is equally a serious factor in virtually all areas of administration, business and industry in The Gambia. The introduction of soundly planned ICT systems does therefore provide a possible means of employing scarce resources more efficiently and benefiting the country's economy.

Finally it should be noted that, although many difficulties arise with the introduction of ICT in The Gambia this does not reflect hostility towards technology in general. As in so many Sub-Saharan LDCs, the wide acceptance of cars and motorised transport, and, even more recently, the extensive adoption of mobile telephones in The Gambia is clear evidence of this. This demonstrates that, when people in The Gambia perceive a benefit that is readily available, they are quick to take advantage of new ideas and, very importantly, develop the infrastructure necessary to support that technology. For ICT to become accepted in The Gambia, its benefits too must be adequately explained and it must be made available in a usable and sustainable form.

Endnotes

[1] The country's official name is 'The Republic of The Gambia'; the colloquial name 'The Gambia' is generally accepted and will be used in this paper.

[2] Formerly Voluntary Service Overseas (VSO). Cf. http://www.vso.org.uk

[3] "Bonding" is the process of contractually obligating civil servants so that they must continue employment within the government (or even, more specifically, their department) for a specified duration.

[4] It should be noted that although the telephone system was generally well-developed government departments were frequently cut off because of non-payment of bills.

[5] It is acknowledged that the setting up of such bank accounts may be difficult as demonstrated by the "Drug Revolving Fund" within DoSH&SW which required an act of the National Assembly before it could be implemented.

[6] Funding that is allocated for a specific set of activities.

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Experimenting eLearning with a large class

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ABSTRACT

An experimental use of web based material to supplement the teaching of the course GEC121 – Computing and Information Skills Fundamental I, in the University of Botswana was carried out between August and December 2003 to a class of over 750 students in the Faculty of Social Sciences. The course was taught in a one-hour class, with two-hour lab sessions every week for each student. The face-to-face sessions were supplemented with course outline, lecture notes, laboratory manuals, quizzes and bulletin board on the Learning Management Software called WebCT, while the laboratory sessions were done using only WebCT. This paper looks at the areas of application of eLearning for large classes and how it was applied at the University of Botswana for the GEC121 course, students and tutors view of the course, as well as experiences from its use.

Keywords: *Botswana, large class, elearning, blended learning*

INTRODUCTION

Since 2001 the Educational Technology Unit (EduTech) in the Centre for Academic Development (CAD) at the University of Botswana (UB) is spearheading the eLearning initiative to enhance teaching and learning with appropriate use of Information and Communication Technologies (ICTs) at the University of Botswana.

The definition for eLearning used by the University of Botswana is as follows: *"eLearning is the appropriate organisation of information and communication technologies (ICTs), for advancing student-oriented, active, open, and life-long teaching-learning processes".* This definition is inclusive, encompassing all forms of ICTs such as overhead and digital projectors, power point presentations, video conferencing and online learning, using the eLearning platform WebCT, to name a few.

In December 2002, eight eLearning pilots were selected within the University, to serve as best practices for the eLearning strategic rollout planned for 2004. These pilots have been developed in the first six months of 2003 year and follow a blended learning strategy, combining online and face-to-face teaching and learning. All these courses have an online component within the UB WebCT learning Management System.

One of these pilots is the "*GEC121 Computing and Information Skills Fundamentals I*" course. This course is part of the General Education Courses at UB and introduces first year degree and diploma students to basic concepts of Information Technology and Word Processing

COURSE OVERVIEW

The course "GEC121 Computing and Information Skills Fundamentals I" is meant to instill basic computing and information literacy skills in year one students. This project covers only the computing skills aspect. The GEC121 course uses a blended learning approach, combining face-

to-face classes and online learning during the lab sessions. A similar computer literacy course was delivered by Morris (2002) in a purely online form, including submission of all assessments. This approach allows for targeting of learners with different learning orientations or at different levels of learning.

The course consists of two major components: the face-to-face lecture and practical hands-on laboratory sessions. The face-to-face aspect is divided into modules and the structure is as follows:

M 1: Basic Concepts in Information Technology
M 2: Introduction to Windows and File Management
M 3: Introduction to Word Processing Using Word
M 4: Basic Concepts of IT - Computer Hardware
M 5: Basic concepts of IT- Computer Software
M 6: Computer Networks
M 7: Computers in Everyday Life
M 8: IT and Society, Security, Copyright and the Law

The laboratory sessions is also divided into modules:

Lab 1: Computer Basics
Lab 2: Working with Mouse and Windows
Lab 3: Using Email and WebCT
Lab 4: File Management
Lab 5: Creating a document using Microsoft Word
Lab 6: Formatting with Microsoft Word
Lab 7: Creating Tables and Graphics
Lab 8: Practise Exercise

The division and sequence of the course was carefully planned based on skills required in the application of theories before the laboratory sessions as well as consideration on skills that were required in one laboratory session in order to complete other laboratory sessions.

The 2003/2004 session group had a total of about 750 students. The face-to-face is managed in four (4) groups a week, while the laboratory sessions were divided into 24 groups of 30 students each.

BACKGROUND AND MOTIVATION FOR THE EXPERIMENT

In the past various obstacles were encountered teaching this course: The classes are large with over 750 students. There is one lecturer responsible for the whole class and only one demonstrator available during a session of two hours to a group of 30 students. There is no recommended textbook for the students. Photocopying handouts for a class of over 750 is not economical. It is also difficult for one laboratory demonstrator to support a group of 30 students in laboratory sessions with different level of skills and motivation within a two-hour period.

Lucas & Hoffman (2000) quoted Moore & Kearsley (1996) as contending that the medium removes some of the less pleasant aspects of face-to-face conversations. Students can ask questions online without disrupting a class. For large classes, eLearning seems to be a solution where students can feel closer to the materials and lecture. Larsen (2000) says one of the major benefits for large enrolment of courses is the help that can be provided for the ‘administrative side’ of a offering course. It provides a great help in assessment management. Some of the highlighted benefits of electronic submission of assessment materials include easy tracking, time-stamped enforced deadlines and easy return to students (Douglas & McNamara 2002). The issue

of students claiming they submitted scripts when they did not will be eliminated. This was another major problem faced in previous offerings of the course, and another motivation to use eLearning.

For large classes, eLearning seems to be a solution where students can feel closer to the materials and lecture. Furthermore, they have the opportunity to practice outside the laboratory hours. Students with "techno phobia" now have a chance to go over and over the materials till they are confident.

THE ONLINE COURSE

The following pages were created for the course: Welcome/Homepage, Meet Mr. PeeCee, Syllabus, Calendar, Content Modules, Self-Tests, Laboratory Sessions and Communication Tools, like Email and Discussion Forum. A more detailed description of the course design and pedagogy is covered in Eyitayo & Gianinni (2004)

The laboratory sessions were purely done using WebCT. Laboratory sessions for the course are mandatory; the students were given orientation on how to make use of WebCT during the second laboratory session. The first session was dedicated to getting familiar with the computer environment itself. This was done by the course demonstrators who had to be given initial orientation on the use of WebCT. The students from then were expected to get their instructions from WebCT.

STUDENTS' USE OF THE COURSE

This section deals with the actual use of the course. WebCT kept track of students' visits and activities on the Web.

Laboratory and Lecture Modules

The content is broken down into small learning nuggets, so that students can grasp the concepts with ease. Each module has a clear objective. Pages use headings and subheadings. Where possible text is substituted or accompanied by graphics and animations to clarify concepts. All pages share the same basic layout grids, graphic themes, editorial conventions and organisational hierarchies. Texts are divided into smaller chunks.

Analysis of the use records show that the laboratory modules were used much more than the lecture modules as shown in Figure I. This is probably because the lecture modules have a face-to-face supplement while the laboratory module does not. The use of the lecture module declined over time, while that of the laboratory session increased and only declined towards the end of the course. Students also used more of the content module when it was referred to in class.

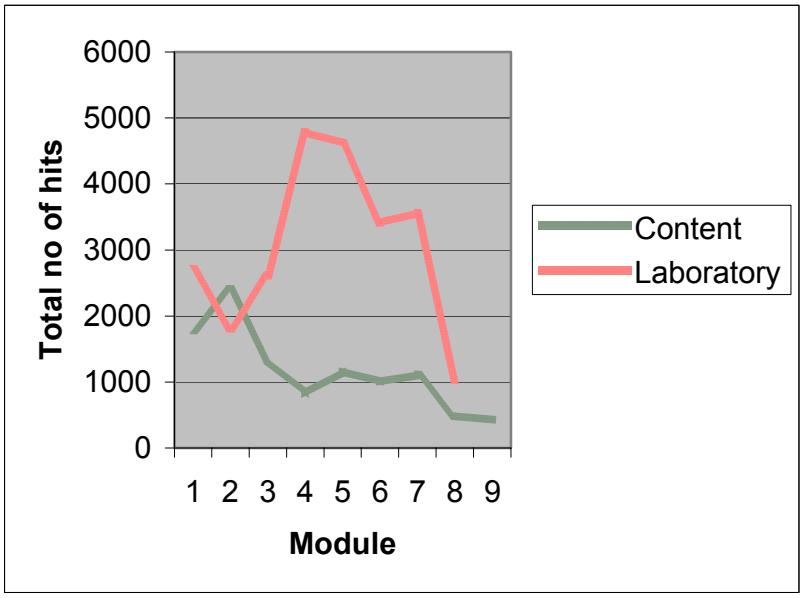

Figure I: *No of hits of the lecture versus the laboratory module*

Communication

Experiences with online courses seem to show that it facilitates interaction among students, with content, and between students and instructors (Pennsylvania State University n.d.). Within the system designed, there are two different ways for students to communicate with the lecturer, the laboratory demonstrators and colleagues: the email tool and the discussion forum.

The email tool allows the student to send an email to a selected person or group. The lecturer sent a total of three (3) messages to all the students. One of such messages was sent after the mid-semester, it was a note through email to find out how the students were doing. The responses received were quite re-assuring. It showed that the students were learning and enjoying the course. They used such phrases as 'great' 'interesting' 'no problem', 'thanks', 'fine', 'doing well', 'benefiting a lot'. During the course, a total of 122 messages were received from the students, ranging from personal well wishes, as well as questions about the assignment and examination.

The discussion forum is divided into sub-topics reflecting the modules of the course. It also has another section divided by the student's laboratory groups. The sub- topics serve mostly as Frequently Asked Questions pools to assist laboratory demonstrators and the lecturer in answering students' questions. The discussion forum allows the student to post or respond to a message, which can be read by everyone and responded to by everyone.

Students were also divided into groups to discuss on various applications of computers based on their laboratory group using the discussion forum. Each student was expected to post a minimum of 1 item to the discussion group. 21.3% posted nothing, 52.7 posted the minimum and only 26.2% went beyond the minimum. The table I show the details of postings done by the students.

Table I: *Postings by the students*

No of Posting	Frequency	Percent
1	384	52.7
2	112	15.4
3	66	9.1
4	10	1.4
5	1	.1
6	1	.1
Total	574	78.7
Missing	155	21.3
	729	100.0

Table II shows how students read the postings to the discussion forum. The result shows a lot of students were silent readers. 55.3% read between 6 and 234 items in the discussion thread. 24% did not read anything, which is about the 21.3% that did not post any thing.

The discussion forum was probably not fully utilised because there were no marks allocated to student's contribution to the forum. There was therefore no motivation for the students to use the forum.

Table II: *Analysis of student reading of discussion forum*

No. read	Frequency	Percent
1- 5	151	20.7
6-15	147	20.2
16-35	182	25.0
36-50	40	5.5
51-100	28	3.8
100-234	6	.8
Total	554	76.0
Missing	175	24.0
Total	729	100.0

Assignment

As part of the course, students were asked to submit their assignments through the system. Over 99% of the students managed to submit. It was during this the submission exercise that the few students who had never used the system were discovered. The assignments were graded and students were given feedback through the system.

Self-Assessment Tests

The Self-Tests are designed as a set of about fifteen (15) multiple choice quizzes to be used after each module. Students are given immediate feedback on wrong and right answers. Self-tests are used to help the students know how well they have grasped the concepts. Table III shows that most of the students (91.4%) used the self test less than four (4) times.

Table III: *Use of Self-tests*

Frequency	Percentage
0.00	22.9
1.00-2.00	52.4
3.00-4.00	16.1
5.00-6.00	4.9
7.00-8.00	2.3
9.00 and above	1.2

There were no scheduled times to use the self test. It was not compulsory. Students had to do it at their own convenience. This was probably not fully utilised due to lack of enough computing resources.

STUDENTS' VIEWS OF COURSE

At the end of the course during the last laboratory session, online questionnaires were administered to students, 477 students responded to this questionnaire. A focus group discussion was done with eight (8) randomly selected student volunteers by the Educational Technology Unit, the department coordinating eLearning for the University.

A look at the quantitative data in the online questionnaire revealed that 67.9% agreed that it was easy to navigate, 56% felt the design of the course was 'just Ok' and 39.8% really liked the design of the course. 60% of students felt that the amount of material in the course was just enough, while 35% felt it was too much. 93.1% felt the presentation was very useful and 78.4% agreed that it met their learning needs. 92% agreed that it made the course better. 57.4% of the students said that the tutors were helpful.

Students were asked what they liked and what they did not like about the online course. The responses were then re-categorised and results are as shown in tables IV and V. The results show that students liked a whole range of things about the course. About 8% said they liked everything about the course. The students liked the contents best. The other things that stood out in what they liked include email, practical laboratory session and the self-assessment questions.

Table IV: *What students liked about the course*

	Frequency	Percent
contents	103	20.7
Other	79	15.9
practical	55	11
Communication/email/Discussion	54	10.8
self assessment question	46	9.2
All	42	8.4
assignment	22	4.4
flexibility	17	3.4
ease of use	15	3
illustrations	12	2.4
don't know	10	2
presentation	5	1
Total	498	100

About 45% did not find any fault with the course. There were also a whole range of things student did not like about the course. The major complaint was that access was difficult.

Table V: *What students did not like about the course*

	Frequency	Percent
nothing	212	45.6
other	67	14.4
access difficult/confusing	49	10.5
assignment	21	4.5
difficult to understand	20	4.3
no time	19	4.1
too much work	14	3
Discussion/email	11	2.4
lab session	11	2.3
boring	9	1.9
content	9	1.9
typing	6	1.3
don't know	5	1.1
quiz	5	1.1
too fast	4	0.9
communication	2	0.4
outline	1	0.2
Total	465	100

The report from the focus group discussion showed that students agreed that the WebCT part of the course helped a lot. WebCT was found to be very user friendly and easy to navigate. It made interesting by the practical sessions, it assisted students in other courses because they were able to type other assignments. Overall they feel they were comfortable with computers and have learnt a lot. Difficulties encountered included the fact that time was not enough, computers were not enough for further practice, most students don't pay attention in class because they know they would get notes on WebCT, and WebCT outside UB is very slow to open .

Students confirmed that they did get enough support from the lecturer. They were able to communicate using email, though not as often as they would have wanted. This is due to the limitations in the number of computers available. They however requested that laboratory demonstrators should have more patience for the sake of those who had no previous experience in computing.

ANY RELATIONSHIP WITH FINAL ASSESSMENT?

At the end of the semester, a final examination was given which was a set of multiple-choice questions. This result and two assignments make up the overall course results. Overall, 94.6% of the students passed. The results as shown in Table VI show that there is a very high correlation between the course results and the number of pages visited, the number of hits as well as the visits to the discussion forum.

Table VI: *Correlation of overall course result with various variables*

		No of Hits	Total Exam Mark	Quiz	Articles Read	Original Posting	Number of different pages visited
Overall Course Result	Pearson Correlation	.373(**)	1	-.015	.143(**)	.049	.417(**)
	Sig. (2-tailed)	.000	.	.724	.001	.241	.000
	N	728	728	585	553	573	726

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

In comparing the final examination result with the number of hits and pages visited, a scatter diagram was drawn as shown in Figure II.

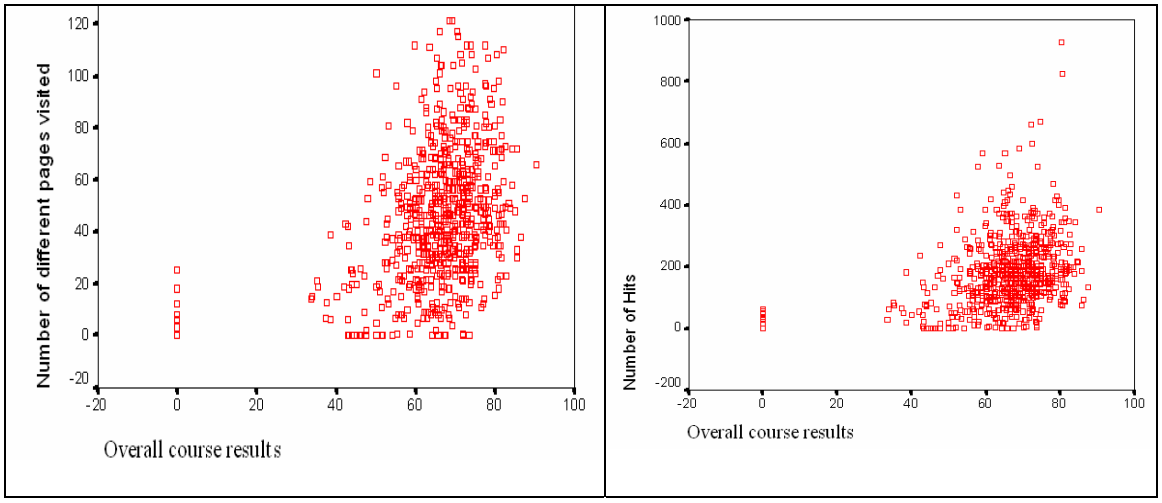

Figure II: *Relationship of use with overall course results*

This confirms that the exam marks are closely related to how many sites were visited, how many times the student used the site, as well as how well he visited the discussion group.

The self-test module and postings done had no significance to the overall course result. This is likely because the self test module was not well used by the students (See table III).

Berger (n.d.) however, argues that this correlation might not mean anything, that the real independent variable is probably motivation and the lasting effect on student overall performance which is hard to determine in this study.

PROVISION AND SUPPORT

What makes WebCT work more than anything is the support (Miller 1999). Support is crucial every step of the way. Educational technology department dealt with student accounts to use with the software package. The Faculty Information Technology Unit supported the computers. Laboratory Demonstrators were there during laboratory session to assist students.

EXPERIMENT RESULTS

Advantages

I felt communication with students was much better than I have experienced in previous years with the course. It was possible to respond to more students needs at individual levels through e-mail. I also felt the topic various applications of computers using the discussion forum were better covered than it would have been in a one hour class. There was also evidence that student read postings by other students.

Luckily, out of the five laboratory demonstrators, three had taught without eLearning the previous year. An interview with this three to find out what they felt about the use of eLearning showed they were very enthusiastic. They felt the students had a better grasp of the course and could use the computers more comfortably than students from the previous year. They also confirmed that

they were able to manage the laboratory better with fewer questions, this they attributed to the fact that the students had the instructions in front of them.

Course Assessment was also another area that was quite beneficial. Collection was better and easier through electronic submission. We eliminated the problem of missing scripts. Marking was more thorough. It was easier for us to detect student mistakes in the electronic version which we would not have detected in the paper copies – for example when students were asked to use the header/footer feature in Microsoft Word, we could detect if this was used or if they simply typed what they were asked to do at the top of the page. It was also easy for us to give a detailed feedback to the students through the system. Each student when they check their scores will find a detail on how the work was marked by section, and also comments on what mistakes they made. We had a template which we copy and paste to each student's remark section and then fill it in for that particular student. It was almost an impossible task with the manual marking; it was also a difficulty distributing the paper back to the students. It also provided the advantage that there was to time spent having to record 750 student's assessment, which is also error prone in that some student's scripts were accidentally skipped in the past. This was done into the system as the marking was done and at the end we could export the marks into an Excel Spreadsheet.

Overall, I felt satisfied with the course. Students used the materials extensively. They learnt more skills than were required in the syllabus. I could sense I was dealing with confident students. This is quite different from previous years where some students will complete the course and still have 'techno-phobia'. Within a few weeks students had learnt to switch between screens and use the eLearning materials as their reference. I also had many appreciative students who sent comments about the course through e-mail.

This is also in line with Berger (n.d.) finding when he experimented with web-based material to support a large class. He concluded he had a better rapport with his class; he was able to easily respond to student questions, there was strong correlation between web use and final marks.

Disadvantages

Solving the problem of missing scripts also created another problem with students submitting wrong files and blank files. This created some management problems of allowing students to re-submit and in some cases, it was after the student results were out that they realized that they got a zero (0) in the assignment. Such students were allowed to re-submit and the dates the files were created checked that it was not beyond the deadline.

Though the electronic assessment had its own benefit, it actually needed more time to mark than the paper version. This is partly because of the added time it takes to open and close a file. There are also additional things to check, for example the view the student saved the file will determine if you would see the header and footer. This might mean changing the view before marking. Other things that could have added to the time included the individual comments given on each marked script as well as some students not following instruction.

As a backup, in the event WebCT goes down, there is a paper version that could be photocopied for the students. This fortunately happened only with one group, once through the semester. So it was easy to organise a make-up for the group.

Also, when students submitted assignments, a back-up was downloaded on a stand- alone machine in case there is a network problem during the marking period. This actually occurred, but it was for a short period, and so we did not have to use the back-up copy.

CURRENT SITUATION

The use of eLearning in the course did provide great help. The same course is now been used for August to December 2004 for a new batch of students. Due to its usefulness, it has also been adopted by all faculties in the University. The current population using it is over 3000 students.

CONCLUSIONS

eLearning is no substitute for what is done in lectures but is a very useful support tool. The used of eLearning for the class did support the views in literature on the benefits found in literature about large classes. Some advantages it provided were based on the fact that activities are independent of time and place. This created greater freedom for students. Apart from during classes, they could log in any other time and examine their course and laboratory session as well as take part in any available online discussion. WebCT also provided the ability to track assignments submitted and assessed. It also provided a way of easy feedback for the students. Other advantages from using the course included more interaction with the students through email and online discussion. It was easy to manage students' assignments. There was also enough evidence that students felt it added value to the course. There was also a strong correlation between its use and overall course results.

Although it provided benefits, it is apparent that to use it students need to have access to computers where they could have access to the materials. There is therefore the need to ensure a reasonable student to computer ratio. There is also the need for provision of adequate technical support for it to be successful. There should be adequate support staff for hardware, software and training. There is need to have a 'back-up' plan for delivery as well as assessment in case there is a problem with the system. This could include provision of paper copies for laboratories or having off-line versions on compact disk for delivery, as well has off-line versions of the assessment, in case there is a network failure.

Assessments should be well planned. There should be a 'back up' plan for students who submitted wrong copies or blank files. There should also be enough more time allocated to the marking of assessment to allow a detailed feedback to the student.

Discussion groups should be well planned and probably carry some marks in the overall course result to motivate students to use it. Provision could be made during laboratories to allow students to fully utilize the self assessment tools.

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