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Exploring the Challenges and Opportunities of M-learning Within an International Distance Education Programme



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Abstract

This chapter provides a case study of a mobile learning project, involving postgraduate distance learning students based in the Southern African Development Community (SADC) region. The project explores ways of enhancing the programme design and delivery, within the broader context of a global programme with students in over one hundred countries. The use of e-learning tools alongside traditional print-based approaches has created a more connected learning community that makes increasing use of interactive learning

resources. However, new challenges have emerged in providing equivalent access and support to students based in developing countries. The authors outline the practical ways in which mobile learning tools help address the problems identified, and provide opportunities for innovation in design and delivery of distance learning. The approaches explored provide insights and not a prescriptive solution, since they are contingent on diverse and dynamic contexts, the student profile, and the nature of the problems arising.

Introduction

The Wye Distance Learning Programme (DLP) has offered postgraduate distance education degrees awarded by the University of London since 1987, and runs programmes for the School of Oriental and African Studies (SOAS)⁷ and Imperial College London.⁸ In August 2007 it was transferred from Imperial College to form part of the newly established SOAS Centre for Development, Environment and Policy (CeDEP). The DLP has over one thousand students located in over one hundred countries, with many students based in Africa and other developing regions. The spread of students is illustrated in Figure 1 below. The courses offered have an emphasis on social science, and relate to the following thematic areas: “Sustainability and Development,” “Environment and Biodiversity,” and “Applied Economics and Business.” DLP students are typically mid career professionals, with more than 75 per cent of the student body in the 30-50 year age range, and approximately one third being female.

There are currently over forty course modules, and most of these are supplied to students as printed study guides accompanied by text books and bound sets of copyright cleared reading materials. In the late 1990s the DLP took on a pioneering role by developing an Online Learning Environment (OLE) for distance learning students to use, which was adopted by the University of London External Programme. More recently it has been creating interactive CD based versions of the study guides, and fifteen course modules now exist in this format.

7. www.soas.ac.uk/cedep

8. www.imperial.ac.uk/dlp

Education (CDE), and commenced work on a two year m-learning project titled “Developing an educational model for delivery and support of post-graduate distance learning in Southern Africa that incorporates m-learning.” The project is being implemented in close collaboration with the Department for Education Innovation (EI) at the University of Pretoria, and directly involves DLP students based in the Southern African Development Community (SADC) region in contributing to the design and testing of suitable m-learning approaches.

This chapter provides a case study telling the story of our experience so far. This is illustrated with qualitative data drawn from interviews, country visits, and direct feedback. The primary focus is on piloting of m-learning approaches in the Southern African context that complement and enhance existing distance learning approaches. We take the reader through the steps followed in the design and implementation of the project, highlighting some of the important considerations and challenges and suggesting areas where further research would be useful.

The study covers an investigation of the context and potential value added of mobile learning, considering the pedagogic and practical models being used by the DLP. An initial phase where four students were identified and became involved in the planning of the project is outlined. Work is currently being undertaken (2007) involving a larger group of students testing out course materials, activities, and tutoring approaches that have been designed for the mobile phone. The instructional design and pedagogical approaches being followed are described, and some of the initial outcomes and feedback are discussed, together with preliminary ideas on the development of a holistic learning environment to support mobile learners, as well as incorporating the strengths of e-learning and traditional distance learning approaches.

Background

We will start this background section by providing more insight into the design of the study environment and learning materials, as this is important in providing an understanding of the nature of the problems we seek to address through m-learning approaches. This is followed by a review of literature related to educational theory of relevance to mobile learning design, and reference to project examples and experiences that we have learned from in relation to m-learning in the developing country context.

i) The Current Status of E-learning Within the DLP Programme Design

Until the advent of the Internet in the 1990s, most communication with students was by airmail and then increasingly through email. At the time all Tutor Marked Assignments (TMAs) that students submitted for marking and feedback were optional, due to the unreliability and slowness of the postal system and difficulties in authenticating the work.

As the Internet became more widely available in the late 1990s, the DLP quickly saw the opportunity for creating an online community. At the time commercial and open source learning environments were not particularly advanced, and did not meet the requirements of a widely dispersed student community with slow Internet access. For this reason an in-house OLE (subsequently called Effect) was developed and subsequently adopted by the University of London External Programme.

The OLE homepage is illustrated in Figure 2, and from the outset design features have taken account of the developing country context of many of the students. These features include (a) limited use of graphics with minimal file size to facilitate fast download, (b) attempts to design a single click access to most of the key areas of the OLE to speed up access, and (c) offline synchronisation of content (though this has proved problematic to implement).

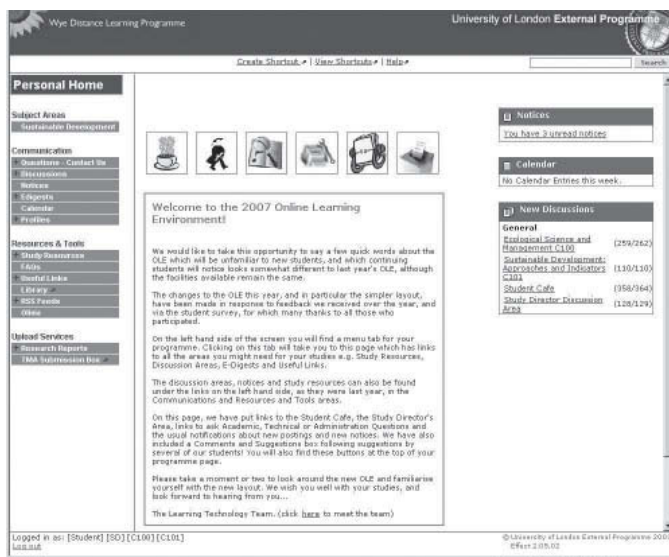


FIGURE 2 Screenshot of the DLP's 2007 Online Learning Environment homepage

The OLE has acted as a repository for downloadable learning materials and programme documentation, but has been primarily used to support academic discussions among students and tutors. The reality is that roughly one-third of the student community make regular use of the OLE, one-third uses it occasionally, and the remaining third never login. There are a wide range of reasons for this, with some students simply preferring not to participate in the learning community, and students based in developing countries do not find it easy to access the OLE regularly. Reasons for this will become clearer later in the chapter.

Since the introduction of the OLE, the DLP's investment in tutoring has grown considerably, and has reached the point where the teaching alongside the design and delivery of study materials is becoming the frontline activity and a major selling point for the programme. Interaction with tutors is no longer an occasional occurrence based around optional assignments. All DLP students now have an expectation of access to tutoring irrespective of their location or quality of Internet access.

The second major initiative within the DLP has been a move over the last five years to make the study materials available digitally. The driver for this was pedagogic innovation, but there was also a financial motivation to keep fee levels affordable and invest more in educational technology rather than printing and dispatch. Initially this process involved providing PDF or Word format copies of the study guide to students via the OLE, but a more ambitious agenda to enhance the materials also began to be implemented.

This involved developing ways to make the content more interactive, and developing a flexible authoring model that would support reusability of content and ease of maintenance. Due to the type of subject matter, which is typically narrative or economic models, there needed to be a careful assessment of what would add value to the student experience. This leads to a focus on interactive content that helps explain difficult concepts, self assessment questions, and search features to support revision. There was also the hope that in time greater use would be made of audio visual learning materials and live weblinks to further study resources.

Due to the diverse location of the students, it was decided to distribute the materials on CD-ROM. Figures 3 to 5 provide illustrations of the CD courseware linking together ten units of content, interactive materials, and quizzes. The content was actually designed using HTML, Flash, and JavaScript to enable viewing with common web browser software. This means

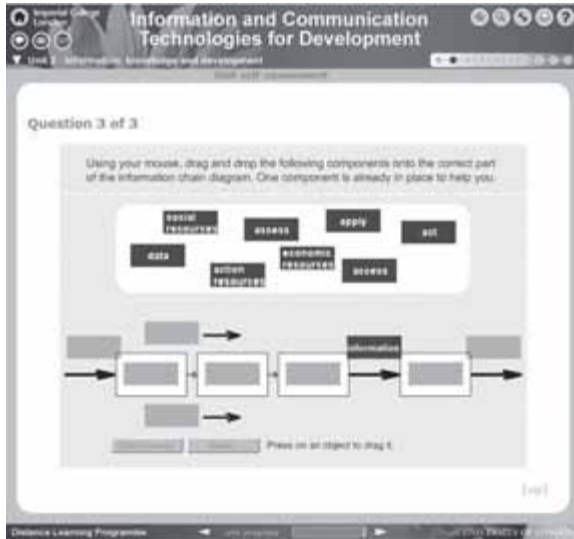


FIGURE 5 CD courseware example of interactive content

ii) Review of Relevant Literature and Examples of M-learning in the SADC Context

We will now briefly consider relevant educational theory and review experience and examples drawn from the SADC region context where the students involved in the pilot project are mainly based. Before commencing with any specific development work we sought to answer three further questions:

- What insights can we gain from relevant literature in relation to the context, educational and pedagogic approaches, and technical alternatives?
- What can we learn from the experience of others who have sought to develop m-learning approaches, particularly in the southern African context?
- What can we learn directly about the context that might influence our project approach?

The third question will be addressed when we provide an overview of the project. The first two questions are considered at this point.

LITERATURE REVIEW

In examining relevant literature, we sought to explore the evidence of mobile phone diffusion in Africa, gain insights into the type of mobile device and the application environments and standards, identify suitable models for

m-learning, and examine the pedagogical and instructional design approaches that would be suited to the DLP piloting of mobile learning.

Barker et al. (2005) state that Africa is lacking technological development and that this has a negative effect on education there. In contrast with the diffusion of other technologies the continent is experiencing very rapid growth in mobile phone usage. Various sources confirm this growth which can facilitate the integration of mobile learning within educational models used in the region.

It has become increasingly difficult to make a clear distinction between the different mobile devices as the functions of mobile phones, smartphones, and PDAs integrate and share characteristics (Kukulka-Hulme and Traxler 2005). Whilst mobile devices may have different operating systems, most recent models now support similar application development tools and standards including WAP, Java, WML, and XHTML (Extensible HyperText Markup Language). Mobile users are often used to accessing the Internet from their desktop or notebook computers, and phones that use XHTML have an advantage (compared to WAP) of working well with mobile versions of web browser, giving access to a fast growing variety of services and academic content likely to be useful to distance education students.

Various m-learning models have been designed and proposed for adoption in Africa. One of these models was designed by Andreas Barker and colleagues from the Department of Information Systems at Rhodes University in South Africa. They describe this as follows:

A model for m-learning adoption contains an m-learning environment, which is underpinned by the traditional learning environment and also supported by effective m-learning policies and guidelines. Within the traditional learning environment, as indicated in the model, learning can still take place through desktop PCs. The proposed model demonstrates that the mobile devices can be used as academic support for learners via online assessment, providing course content and access to the Internet. The mobile devices in the proposed model for m-learning adoption enable learner-to-learner communication, as well as learner-to-teacher communication. (Barker et al., 2005)

A range of studies, reviews, and reports have been published suggesting frameworks or models for the integration of mobile devices in learning at various levels of education across the world. Attempts are being made to find suitable learning theories or models for m-learning that try to find new

teaching and learning practices for the new mobile technologies and apply existing learning theories to the findings. In most instances learning theories such as behaviourism and constructivism were investigated along with collaborative, informal, and lifelong learning methods. The integration of mobile technologies within the DLP activities described in this paper specifically draw on the integration of constructivist, situated, collaborative, and informal learning theories and activities. Drawing on Naismith et al. (2004), these can be described as follows:

- Constructivist activities enable learners to actively construct their own new ideas or concepts based on both their previous and current knowledge.
- Situated learning activities takes place in an authentic context. Mobile devices are well suited to authentic context-aware applications.
- Collaborative activities promote learning through interaction. Mobile devices can support Mobile Computer Supported Collaborative Learning (MCSCCL) by providing another means of coordination without attempting to replace human-human interactions.
- Informal and lifelong learning activities support learning outside a dedicated learning environment and formal curriculum.

Ally (2004) indicates that the use of mobile devices for learning has direct implications for instructional design. He proposes the following principles for designing m-learning materials:

- It is important for designers to use presentation strategies that enable learners to process the material efficiently due to the limited display capacity of mobile learning devices.
- Information should be organized or divided into smaller pieces to facilitate processing.
- Information should be organized in the form of a concept map identifying the important concepts and showing their relationships.
- As information is presented in small pieces it is important to use advanced organizers to allow learners to make sense of the new content.
- The interface must coordinate the interaction between the learner and the learning materials and must include good navigational strategies.
- Learning materials should take the form of learning objects which are electronically available and reusable.

The University of Pretoria Experience

Many of the DLP's students in the SADC region are Commonwealth Scholarship students, and, under the terms of the scholarship funding, the DLP has been collaborating with the University of Pretoria (UP). Over the last five years strong links have developed between UP's Department for Education Innovation (EI) and the learning technology team within the DLP. EI has an established reputation in m-learning, so a useful starting point for this project has been to learn from the UP experience, which is now briefly described.

The use of mobile phones in distance education in Africa has been implemented with success at the University of Pretoria since 2002. The Faculty of Education presents a postgraduate diploma in education through distance education. The integration of SMS messaging with a paper-based programme resulted in an increase in attendance for contact sessions and a better response to information provided in SMS messages. Mobile support to the students was implemented to provide administrative and motivational communication to both large and small groups of students.

The university proceeded to investigate the possible use of SMS messaging with academic functions in 2004. A task team investigated the integration of bulk SMS and Instant Voice Response (IVR) as well as development of an SMS assessment tool. A pilot project investigated four categories of asynchronous SMS academic interventions which included the IVR system through which the student can phone a FAQ number and receive answers from a pre-programmed system. Students also receive Multiple Choice Questions (MCQs) to which they can reply via SMS. They can also ask questions about a pre-selected topic and receive answers automatically based on the comprehensive programmed text database.

The UP pilot proved highly successful in establishing that most students had access to mobile phones. Students were comfortable using their own phones to make use of these new SMS related services and for academic purposes. Increased commitment of students exemplified by timely completion of tasks by a greater percentage of students was also noted. The first generation handsets available to students supported text and voice calls at the time of the UP pilot in 2004, and three years later the potential uses of the more recent smartphone and 3G handsets for supporting a broader range of academic activity within education in Africa are considerable.

The Pilot Project: Developing an Educational Model for Delivery and Support that Incorporates M-learning

Before making any major investment in a new approach to tutoring or course authoring, it is important for the DLP to carefully review the practicalities and benefits, since the update of learning materials is a major task with significant cost implications and requiring implementation against the background of five year student registration periods. A pilot project approach therefore has many advantages, and as we introduce and describe this project, we will move through the following stages:

1. Identification of some of the major challenges and problems the DLP faces.
2. Review of baseline information gained from a survey of students living in the SADC region.
3. Description of in-country visits to gain direct insights from context.
4. Feedback from initial activities tested with a small group of students.
5. Overview of the design and development of learning materials and m-learning approaches for two course modules, including some preliminary student feedback.

1. CHALLENGES TO BE ADDRESSED

The growing emphasis on the use of e-learning tools worked well for a good proportion of the DLP's students, but created more of a divide across the student community as a whole than had previously been the case, and we have been keen to address this. The overall goal for the DLP has to be providing first class tutoring and support to all students, and making innovative use of pedagogy and technology appropriate to the context of the learners.

Neither e-learning nor m-learning are seen as panaceas or comprehensive solutions for achieving this goal, but they are part of a blend of approaches that are relevant if they help to solve identified problems and shortcomings of the existing approach. The context is also dynamic and, much as it might be desirable to design a programme from scratch that draws on latest technologies, the reality is that it will take significant time and resources to adapt existing course materials, and provide the students with learning resources that are designed in a consistent way that is easy to support from a distance.

Before looking further at the relevant literature and moving on to the activities piloted, we set out below some of the challenges that have influenced our thinking and encouraged us to explore the role of m-learning.

Challenge	Initial Status (at start of the pilot project)
Improving Communication	Whilst regular Internet access for many DLP students remains problematic, email is now regularly used by nearly 100 per cent of the students. Recognising this, the DLP has introduced email digests (e-digests) where tutors summarise online discussions, and encourage inputs from those not online so that they can participate.
Improving access and participation	Whilst e-learning has brought some students into closer contact with each other and with their tutors, this is not universal, and in some respects there is an uneven playing field. A goal of a global programme like the DLP is to ensure that all students irrespective of location have the opportunity to access and fully participate in the learning environment (however that is designed). Only when all students have reliable means of rapid communication with the programme, will we be able to implement educational developments such as continual assessment, and a more constructivist approach to learning that draws on the experience and context of the learning community.
Improving tutoring support to students in diverse locations	Over the last three years we have also explored the possibility of developing networks to provide in country support in countries where online access is limited. However, with students spread across many countries, this is a very expensive approach, and in practice the in-country tutorials piloted were poorly attended, as distance learning students typically work full time, and had difficulties taking time off and travelling to locations where tutors were visiting.
Improving the usability of leaning resources for students who are very mobile	DLP students are typically highly mobile, sometimes internationally, and often within their own country. Studying whilst on the move and away from the office and home presents its own problems and many students can get behind with their studies. Whilst books are portable, study guides and bound volumes are typically heavy and not that easy to have at hand whilst travelling. It is also difficult without a computer to work on assignments efficiently.

<p>Improving access to content and programme materials</p>	<p>The OLE offered a convenient repository for sharing learning resources and programme related documentation. Large files did not need to be sent as email attachments and were available for download wherever a student was able to access the Internet. However, the strategy of the DLP has not been to develop an entirely web based e-learning programme, but to use the OLE and learning materials on CD-ROM to support the DL approach. Resources such as sample exam papers that were initially only made available on the OLE are now also included on a study resources CD sent to students at the start of each academic year. These approaches illustrate how the DLP seeks to recognise access issues. Digital design and distribution of materials also offers scope for replacing a lot of the investment in printing and despatching materials with digital CD based versions, but this in itself presents a difficult issue as it transfers the task and cost of printing to students.</p>
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Given the nature of these challenges, the increasing availability and power of mobile technologies confirms that a pilot to explore the potential ways in which m-learning can enhance existing approaches would be very valuable. First, however, we need to consider whether suitable m-learning approaches would be feasible in the developing country context. We will do this by exploring the profile and needs of a group of students who provided the specific southern African focus for the m-learning project.

2. THE SADC BASELINE

The DLP currently supports 108 Commonwealth Scholarship students pursuing postgraduate master’s level distance learning courses, and in 2006 at the time of the survey there were 88 (see Table 1 below). These students are based in Commonwealth countries within the Southern African Development Community⁹ (SADC) region. In order to improve support to these students, the DLP has worked in collaboration with the University of Pretoria’s Department of Agricultural Economics and Department of Educational Innovation (EI) since 2002.

9. SADC comprises Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Tanzania, South Africa, Swaziland, Zambia (and formerly Zimbabwe).

TABLE 1 SADC student numbers in 2006

Country	SADC Student Nos	M.Sc. Programme	SADC Student Nos
Botswana	12	Agribusiness for Development	9
Lesotho	3	Agricultural Economics	5
Malawi	13	Applied Environmental Economics	1
Mauritius	9	Biodiversity Conservation and Management	10
Mozambique	2	Environmental Management	13
Namibia	7	Food Industry Management and Marketing	1
South Africa	7	Managing Rural Change/Development	18
Swaziland	4	Sustainable Agriculture and Rural Development	17
Tanzania	15	Sustainable Development	14
Zimbabwe	7		
Zambia	9		

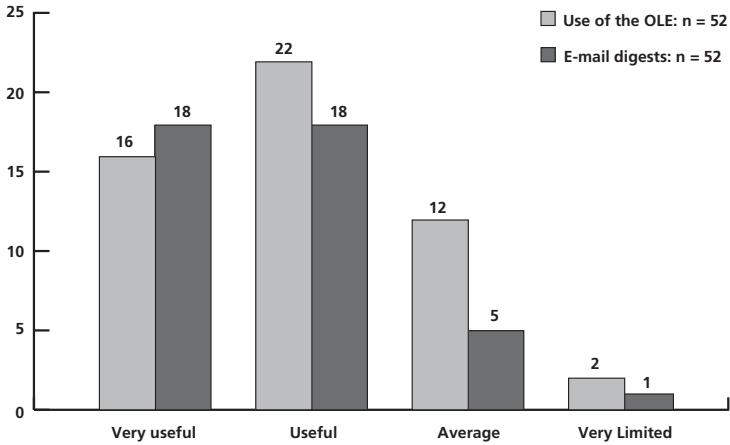
In March 2006 a baseline survey was conducted with the 88 SADC based students registered on the programme at that time. There were 43 responses and the table below shows the access that the respondents have to different types of technology and application:

TABLE 2 SADC student survey – ICT access

Computer	At Home	24	At Work	40	No Access	0	
CD ROM Drive	Yes	41	No	1	N/A	1	
Cell Phone	Personal	38	Provided by Employer	11	No Access	1	
Internet	At Home	8	At Work	38	Cyber café	18	No Access 1
Email access	Regular	37	Occasional	6	No	0	

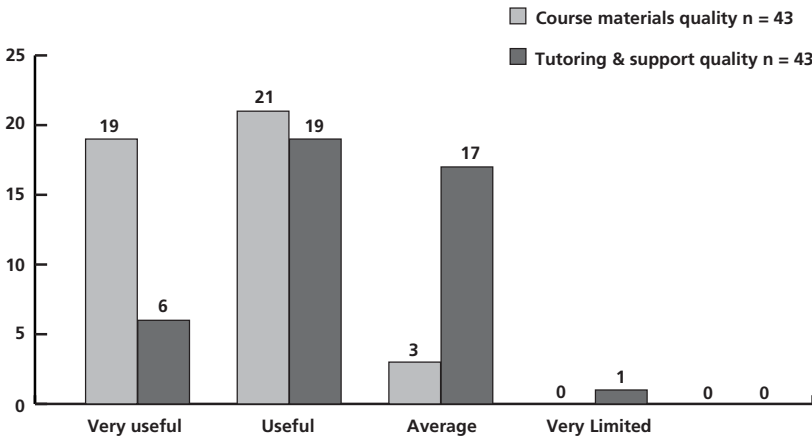
These responses are unlikely to be typical of the whole survey group, since survey responses were sent in by email. The respondents generally rated themselves highly in relation to their level of ICT literacy – “very good” (16), “good” (21) and “average” (6).

The graphs that follow illustrate the respondents’ ratings for the current e-learning approaches. Graph 1 shows that the majority of students who responded found the online learning environment and the recently introduced email digests written by tutors useful.



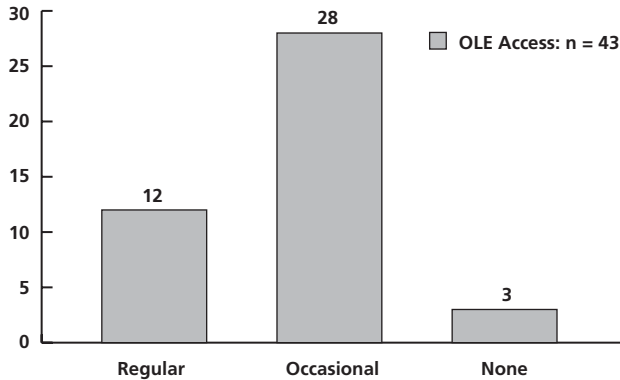
GRAPH 1 Usefulness of e-learning support

Graph 2 shows that course materials (including both printed and CD courseware) were also rated highly, but the tutoring support, whilst rated by many as of a very high standard, was not as highly regarded as the courseware.



GRAPH 2 Quality of support and materials

Whilst these responses are encouraging, the constraint on OLE access (illustrated below in Graph 3) was regarded as a problem, and several in-country tutorials were organized to overcome this limitation. These workshops were rated as useful, but many students found it difficult to get time off to attend, or too expensive to travel to a workshop location. This type of event is also very expensive to organize.



GRAPH 3 OLE access

Computer and Internet access are most likely to be via the workplace, and yet by contrast most indicated that they study mainly “at home,” followed by “in the office.”

Few students study when they are “away on field work,” but the amount of time spent out of the office was significant. Eighteen respondents indicated that they spend one to three months per annum in the field, and thirteen indicated that they spend more than three months.

All respondents indicated that they used their phones for receiving voice calls and almost all sent and received text messages. Interestingly a lower proportion (70 per cent) made voice calls. The amount of money spent was also revealing as it varied from US\$4 to US\$100 per month.

The survey details summarized so far suggest that there is a potential role for use of mobile phones to improve tutoring in terms of overall access and quality. Since almost all respondents have mobile phones that they keep with them all the time, they offer the only technology that offers the potential for contact with the tutors and use of course materials “anytime, anywhere.”

3. INSIGHTS FROM THE CONTEXT

The project focused initially on understanding the context and student profile, and determining which mobile technologies should be considered. The context of the distance learner is highly important, as is the need to understand how they work and study. In developing countries, for example, a student may study while travelling on a bus to the field or by candlelight when there is a power cut. Political disturbances may disrupt communications. Appropriateness of technology needs to be considered with an appreciation of such factors.

Four students were selected to be involved with the project in the first year, and this was deemed to be sufficient to enable us to obtain qualitative feedback. Students were selected based on location, mobile coverage availability, modules studied and progression within the MSc programme (in year two or beyond), and gender. One male and one female student were selected from Tanzania and two male students from Malawi. Three students are based in major towns (Dar es Salaam, Arusha, and Lilongwe) and one in a rural area, near Dwanga in Malawi. These locations are shown on the map illustrated in Figure 6. The modules that the students were studying were reviewed, and two modules were selected for the focus of the project. These modules are “Rural Development” and “ICT for Development.”



FIGURE 6 Map highlighting student locations in Tanzania and Malawi

During the project, new content and activities designed specifically to make use of the features of mobile technologies are being developed and tested, and since 2007 the tutors on these two modules have also become directly involved. Visits were made to Malawi and Tanzania in February

2006 to find out more about local ICT trends and explore the realities, constraints, and possibilities of the context where the students were based. The main cell phone operators offering services in the countries selected are shown in the Table 3 below:

TABLE 3 Cell phone operations

Malawi	Tanzania
CelTel	CelTel
Malawi Telekom	Tigo (formerly Mobitel)
	Vodacom
	Buzz

Mobile coverage maps were reviewed for all SADC countries and it was noted that there was reasonable coverage in most of them, particularly in major cities and towns, and on major routes. Significant demand for coverage in villages and rural areas was also noted, driven by people wanting to “call in” as well as “call out.”

Meetings were held with CelTel and Vodacom in Tanzania, and it became clear that plans to roll out 3G networks are moving ahead quickly. GPRS services are becoming widely available supporting data services, including multimedia and MMS applications. The price of GPRS services remains high: In Tanzania, for example, one kilobyte of data costs Tsh 50 (2006 rate), which was the same as the cost of sending a text message. Significant usage of GPRS services at this stage was therefore not realistic for students, and transfer of large files between students and the DLP is best done via transfer to a PC and email or Internet services. Operators did sell phones, but handsets tend to be sold separate from usage contracts, and are similar in price to SIM free handsets purchased in the UK.

The students were interviewed and videoed, and these interviews provided a rich picture of how students use their current phones, computers, and the Internet, and how they prefer to study. Personal factors such as wanting to keep on existing phone networks, or keep an existing phone number, were identified and initial suggestions about how a mobile device could support learning were explored. It became clear that in three out of four cases the students selected had reasonably good access to the Internet, and the fourth student could access e-mail on an occasional basis. It was also clear that the students travel a lot locally and sometimes internationally, and mobility is therefore an important factor to be considered during the pilot

project and in scaling up mobile learning to the wider student community. The selection of quotes that follow are drawn from interviews and provide some indicative impressions of the context, and initial ideas the students had in relation to the potential for m-learning.

Student Insights from Malawi and Tanzania – THE CONTEXT

Student 1 – Malawi: “In Dwanga there are more cell phones than computers.”

Student 2 – Tanzania: “Coverage is getting better and better. Three or four years back it was mainly available in the centre of town but now you can even go into the villages and there is very good coverage.”

Student 1 – Malawi: “We have the cell phones when we are out in the field so that we can be reached there and given information which we can pass on to the farmers.”

Student 3 – Tanzania: “With the call back services available I can call my mum in a village far away – she can just send me a message ‘call me’ and I can call her.”

Student 1 – Malawi: “Most people know how to charge their cell phone batteries. If they don’t have power they will go to their friends house or use a charger (which work on car batteries).”

Student 4 – Malawi: “I think the cell phone technology in Malawi has changed the way we live and the way we do things basically in terms of communication. Nowadays you don’t see many people posting letters; also in terms of the younger generation most of their money is been spent on cell phones because they call their friends. It has become easier to communicate and almost every young person has got a cell phone.”

Student 2 – Tanzania: “SMS banking is available – you can send credit through a mobile phone to somebody else.”

Student 4 – Malawi: “Right now people are advertising on the cell phone and it is used for public awareness. In election times you see messages coming in terms of voting.”

SUPPORTING LEARNING

Student 3 – Tanzania: “I think one of the changes that can happen to the distance learning programme is that somebody could use the cell phone to connect to the Internet or use an application in order to access the online learning environment.”

Student 2 – Tanzania: “I remember last year when I had to travel because we travel a lot, I had to take the printed material with me, which is heavy. Sometimes when you are doing a TMA you have to write it down on paper and you have to have your books with you so when you come back and you have access to computers you retype the thing. It makes life difficult but if you had a device where you can process some words or access some things even when you are away from your PC that would be the best option.”

Student 1 – Malawi: “Sometimes as a distance learning student I have some questions which I would like to have somebody answer for me immediately. If it then could be done through my cell phone it would be wonderful; with limited access to the Internet it means that I will receive that answer in two or three weeks time; it is frustrating.”

Student 2 – Tanzania: “If you are mobile and your learning is also mobile then it could make a lot of difference because if you spend two weeks without going through your materials then you may not be able to catch it up.”

Student 1 – Malawi: “If you can read information from your cell phone, add information to it, and transfer it to your PC, that will be easier to read because of the screen size... But I think storing material on the phone could be quite useful.”

Student 4 – Malawi: “If you hear the sound of somebody speaking something, and even see pictures or something which is audio visual, I think that will be very very interesting.”

Student 2 – Tanzania: “It would make a lot of difference if I could listen to some recordings of lecturers. Sometimes it is interesting to hear and see rather than to go through the books.”

Student 1 – Malawi: “It will be helpful to interact with other students using the cell phone.”

4. PRELIMINARY ACTIVITIES

The four students helping with the project were given an initial task of finding out about available phones, and recommending a model that they should test for future use by a larger group of students in the next phase of the project. The activity made use of their existing phone models, and a combination of e-mail and SMS, confirming our ability to communicate with the students in these ways.

Mobile phone services fall into three main groupings:

- Basic level services; voice call and text messaging.
- GPRS services; transfer of data and multimedia on an asynchronous basis.
- 3G services; real time video calls.

Handsets typically have features that are designed to operate well at one of these levels, and students surveyed currently make use of basic level services. From the exercise carried out by the four students involved in the initial pilot phase it became clear that, within the context of this project, we were going to be looking more to the future with the selection of a mobile phone with smartphone capabilities (that support GPRS and potentially 3G services). The model chosen by the students is shown in Figure 7.



FIGURE 7 Nokia N70 phone selected by DLP students for piloting m-learning

One of the major perceived benefits of this model to the students was that it avoids device proliferation, as it incorporates the capabilities of a phone, FM radio, video and still camera, music and video player, and audio recording in a single device. It also supports storage of files on a removable storage card.

The model selected can be purchased and maintained locally (2006 price: Tsh 570,000 = approximately USD 450), but transferring money and arranging contracts locally was problematic, so it was decided to supply phones from the UK, although this may not be practical in any future scaling-up of activities. The phones (with a monthly credit allowance transferred to the student to encourage usage) were supplied to the students in exchange for a commitment to support the project research activities. Through the provision of a specific model we established better control over the variables, and rather than getting varied feedback due to diverse equipment we could concentrate our own learning on the appropriate and effective educational use of the device.

The opportunity arose to deliver the phones personally to the two students in Tanzania and show them how to use different features. By contrast the phones were sent by DHL courier to students in Malawi. This has allowed us to contrast the two groups, and determine the extent to which training makes a difference. In practice, both groups progressed well and required no additional support or help from each other.

A wide range of practical issues were identified from the survey and country visits that highlighted important concerns to be considered further in any scaling-up of the project to a larger group of students. These include costs of handset and usage, coverage of access, theft of the device, reliability, damage, power supply, insurance, and import duty. There are also issues in determining the most affordable ways to offer mobile support to the learners, and whether to supply a specific handset to students, or support a wide range of models that students have, provided they meet minimum specifications.

When they received their phones the four students were asked to carry out the following preliminary activities aimed at testing their ability to use the technology, without significant levels of support, and communicate with the DLP:

- Texting messages to the project team.
- Recording of audio, video and images, making use of two different cameras included on the phone, and sending the files to the project team via their PCs.
- Communicating with other members of the team.

These tasks were all successfully completed without the need for substantial guidance given to the students on how to carry out the task. This confirmed to us that it was feasible to design activities that involved SMS, file transfer, and communication via email. Students also proved to be very

competent in making use of resources stored on their phone, and view or listen to audio resources made available on a removable storage card.

5. PILOTING M-LEARNING SUPPORT FOR TWO COURSE MODULES

Once these tests were completed work focused on designing learning activities that are being piloted with twenty students based in developing countries. These students have all been supplied with the Nokia N70 phone. Ten are based in SADC countries and studying the “Rural Development” module, and ten are based in a broader range of developing countries in Africa, Asia, the West Indies, and the Middle East, and are studying the course module in “ICT for Development.”

Drawing on the pedagogic approaches identified in the literature review, three major instructional design options are now being explored:

- The design of effective learning activities (that potentially involve collaboration and sharing among students) that make use of the multimedia and communication capabilities of the mobile phone.
- The redesign of course content so that it can be readily used on the mobile phone through greater emphasis on audio visual content, and interactive features such as quizzes.
- The enhancement of remote tutoring by considering the potential role of SMS, MMS, mobile blogging, pod- and video-casting.

The module tutors for each of the two modules have become involved in exploring how these options could best enhance the module that they are responsible for. This has resulted in different approaches being explored with each module, as highlighted in Table 4 below:

TABLE 4 Mobile learning design approaches for two course modules

Rural Development	ICT for Development
Contains a lot of narrative, and is not particularly technical.	Inherently more technical, with more tables and graphs and animations.
The context where the student is based is relevant to the study. Students travel on field visits providing the opportunity to relate learning to the practical challenges students face in their work.	Audio narrative versions of the content would not be very helpful, but there are lots of practical ways students could explore this subject and undertake small research tasks.

Rural Development	ICT for Development
<p>Materials designed and being tested include:</p> <ul style="list-style-type: none"> • Quick quizzes which students can use to test themselves on basic factual information, making use of learning moments – brief periods where they can study whilst on the move. • Mp3 audio files providing a narrative of the module unit content, that the student can listen to if they have their phone with them. • Videos compressed to 3GP file format, that the students can watch on the phone, giving short case examples. • Polls to solicit opinion on particular topics and feedback on course materials that can be sent to the tutor by text, and responded to in the tutoring process. • Activities that students can do to supplement their learning by making specific use of the phones audio recording and image/video capturing capabilities. 	<p>Materials designed and being tested include:</p> <ul style="list-style-type: none"> • Short video conversations with the course author/tutor introducing the unit, and highlighting some of the key learning points and topics for debate. • Provision of short videos supplementing the content of the study materials, or providing alternative study materials that can go further than the printed materials in illustrating a concept. • Development of major new types of assignments that are based on activities and replace the traditional TMA. The approach being developed involves using the mobile device to work through a series of activities that help students reflect on the learning materials, and engage where possible in short research or practical activities. There are two deliverables: a small multimedia portfolio and an assignment in more traditional essay form. Both are submitted to the tutor for assessment and feedback.
<p>In both cases the students are supported by tutors based in the UK and during 2007 the pilot is also exploring the scope for:</p> <ul style="list-style-type: none"> • Preparing multimedia digests supplied to students for viewing and listening to on their mobile phone. • Drawing on contributions submitted by students and encouraging sharing any interesting audio or video material with the wider group. Students may also be encouraged to develop and share their own audio narratives for module units. • Use of SMS by tutors to encourage completion of work and by students when they need to ask for help – perhaps when they are studying away from their office. 	

Significantly, resources that the students capture on their mobile device and share with the tutor may also contribute to the development of the modules in future. They may represent useful learning resources including case studies and examples from different contexts that can form part of a repository or be integrated with the course module. In this way the students may become both beneficiaries of and contributors to the educational process, which is an important element of the evolving distance learning pedagogy of the DLP. Given the rich diversity of the DLP's student community, this also represents a wonderful opportunity to build a student community with unique global access to a pool of current knowledge.

Discussion and Practical Application

In this section, we will reflect on the pedagogic model, and also on some of the technical design decisions that the project team made.

Reflections on Pedagogy

In our background discussions, we indicated that the DLP is seeking to develop a pedagogic model to encourage contextually situated constructivist activities that involve collaborative learning. Distance learning also links strongly to processes of informal and lifelong learning. A study by Bright et al. (2004) based on a survey of all the DLP students, and meetings with students in Hong Kong and Zimbabwe, revealed that the educational and pedagogic background of many DLP students lead to expectation of the educational process being primarily shaped around a process of knowledge transfer from expert teachers. By contrast those involved within the DLP designing the OLE had assumed a more constructivists model. Alongside the access barriers, this pedagogic factor probably contributed to participation in the asynchronous online discussions being lower than hoped.

The same study indicated that many DLP students pursue further study to support career progression through gaining qualifications. Interestingly, it also highlighted that DLP students work mainly in the development sector where participatory approaches to learning and professional development are increasingly common.

Preliminary feedback from students involved in the project has welcomed the audio and video content, and suggests that this more personal contact is encouraging, and can increase student commitment. The convenience of being able to learn by using the phone in different situations and in short study sessions is also being commented on.

Set against these insights, the authors make the following observations in relation to the design of learning materials and tutoring approaches for this project:

- Provision of audio visual content, and resources that replicate familiar experiences (such as lectures and quizzes), are quickly adopted, and these approaches suited the “Rural Development” module subject matter.
- Introducing ideas that encourage learning among peers, along with sharing and contributing to the educational process, represent more progressive and innovative approaches for the students to engage in. The more collaborative activities designed around production of new types of assignment deliverables and learning-by-doing (as reflected in the “ICT for Development” module) may take more time to get student “buy in” as they have to become contributors as well as beneficiaries. Interaction with the tutor and a well designed support environment for mobile learning are likely to be more critical.

In both cases mobile technologies certainly provide suitable tools. The immediacy of instant communication and the scope for student involvement in creating and sharing learning materials and sharing experiences is more apparent and accessible than in other technology mediated models. Experiential learning can provide feedback to the learning community at large, both in the present time and for the future. This creates the opportunity for designing a more successful constructivist model for supporting distance learning.

Technical Considerations

Important technical decisions had to be made about how to develop the learning materials and make them available on the mobile phone sets. This will not be covered in depth, but Table 5 below summarizes the choices made and provides the underlying rationale.

TABLE 5 Summary of major technical decisions

Choice	Rationale
To develop content initially using XHTML, and later on consider use of Java and/or Mobile Flash for more complex interactive content and advanced quiz features.	Decision to keep the technical approach as simple as possible, and enable students to access materials through a familiar mobile equivalent of a web browser. This encourages portability, interoperability, and independence from particular phone models.
To distribute content on CD, External Storage Card (SD, CompactFlash, etc.), and exchange files via synchronisation with a PC and email attachment.	GPRS and 3G services remain expensive and coverage for these services is patchy. Web based delivery of content could be considered at a later stage. This promotes broader access, though synchronising with a PC and emailing large files is a potential problem.
To supply all students with the same phone Nokia N70 model.	Enables the project to retain a focus on the educational components, without the distraction of diverse hardware.
Not to develop any special tools that assist students in storing files in the right location when they capture audio and video or exchange files with the programme.	We are impressed by the usability of the software supplied with the phones, and are of the view that if the students know the folder structure we have developed for the mobile content (which is consistent with the CD folder structures), then with adequate documentation they can successfully do their own file management.

Designing for the small screen was a challenge, and drawing on the ideas of Jones and Marsden (2005), careful thought is being given to how best to do this. Audio and video alternatives to text are being developed where possible, and the usability features of the phone model and browser software also facilitate the design of efficient navigation. In practice, a few unexpected technical challenges have been encountered relating to audio capture time limits and slow performance if audio or video files stored on the external card are launched via the phone browser. These problems are being investigated but should not be insurmountable as the handsets rapidly become more powerful.

Future Trends and Recommendations

Since we started planning this project in 2006, the price of the Nokia N70 handset and equivalent models, together with the price of removable storage cards, has halved. Coverage and roll out of data services in Africa is also gathering pace. The assumption we started with was that whilst we were making use of expensive relatively high end equipment at the outset, the picture would look very different by 2009. We should therefore be gearing up our programme for a context where powerful handsets will be widely available in Africa along with real time data services that would remove the need for our current file transfer model.

Alongside the technological advances, we are also seeing rapid developments in the following relevant areas:

- Emergence of social software on the Internet and mobile devices, providing a global platform where individuals publish audio visual content from remote locations (for example, via mobile blogging), and collaborate on the creation and development of ideas. This trend is likely to make more people familiar with constructivist approaches.
- Emergence of standards for sharing content (learning objects), and development of new licensing approaches such as creative commons that provide incentives to innovators alongside dissemination of knowledge. Repositories of open educational resources are being developed and becoming accessible to mobile users.

MOBILE LEARNING ENVIRONMENT

These trends point to the need for further research to be carried out on how best to provide a coherent environment for mobile learners that integrates the potential of the Web 2.0 services. Figure 8 provides an overview of the bigger picture, showing different application and system components that could eventually be integrated, and need to be considered from the perspective of the mobile distance learner.

The role of tutors within this environment is not illustrated, but will be critical in facilitating student understanding of the different tools and how they support individual and group. It is also likely that formal learning environments may also be superseded or at the very least complemented by personal spaces where lifelong learning is more effectively supported.

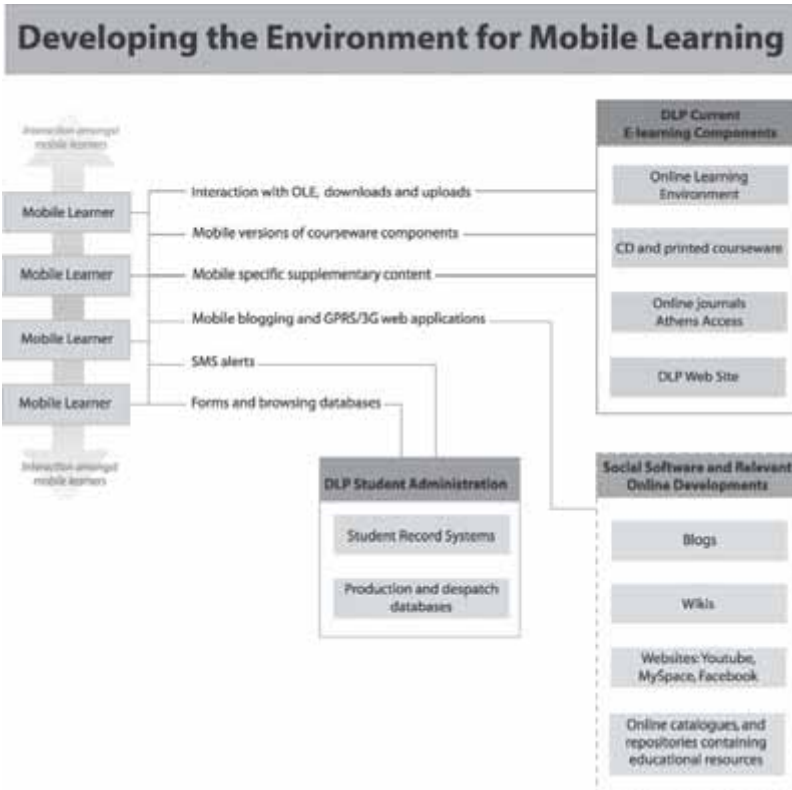


FIGURE 8 Big picture of applications and components that should be integrated for mobile learning

Conclusion

The outcomes and lessons being learned from this project should not be regarded as prescriptive, but some of the key learning points for the DLP in relation to the specific SADC context are as follows:

- The introduction of mobile learning is complex and multifaceted, and a range of pedagogic, practical, and technical issues need to be carefully understood.
- Mobile learning approaches need to be considered alongside traditional and e-learning models, and some of the emerging technical requirements for m-learning (for example, greater emphasis on audio-visual content) in turn influence the design and authoring approaches needed for the DLP's CD-based courseware and printed materials.

- Attention needs to be given to a coherent learning environment for mobile distance learners that takes account of future trends, and the emergence of social software.
- Keep it simple, personal, and avoid device proliferation.
- M-learning supports the development of new study skills:
 - learners can interact, create and share valuable learning resources such as audio versions of course materials they record themselves with appropriate regional accents, and share photos and videos providing insights into their context; and
 - make use of brief study sessions in unusual locations.

M-learning is certainly not an end in itself, so it is important to consider where it fits within a holistic learning model, and evaluation needs to identify added value in relation to clearly defined objectives. At the beginning of the DLP, we identified the needs we wanted the project to enhance:

1. Communication
2. Access and participation
3. Tutoring support to students in diverse locations
4. The usability of learning resources for students who are very mobile
5. Access to content and programme materials

In all five cases, the pilot project is providing insights into how mobile learning can help achieve these objectives, and we hope this case study has shed light that will be helpful to readers. We set out in this project to focus particularly on the needs of students based in developing countries. It is interesting to reflect that the possible solutions emerging provide the best hope for a learning environment that has global reach, and where common approaches can be developed and enjoyed equally by all students irrespective of their location. This has to be one of the major enhancements and attractions of a model incorporating m-learning.

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