Australian Flexible Learning Framework

Supporting Flexible Learning Opportunities

New Practices in Flexible Learning

Mobile learning: handheld innovations in flexible learning

Site induction: I need it now!

Sam Meredith, Daniel Dacey, Chris Richter

December 2004

ISBN 1 920906 97 5 web edition

Part of the Australian Flexible Learning Framework

Managed by the Flexible Learning Advisory Group on behalf of the Commonwealth, all States and Territories in conjunction with ANTA

AUSTRALIAN NATIONAL TRAINING AUTHORITY

Contents

Preface

This report contains references to various technology, software and hardware products and/or services. The inclusion of this material is provided under the following conditions (in addition to the general copyright statement provided at the beginning of this report):

- The material is provided for reference purposes only and reflects the views and opinions of the author(s) in relation to the technology, hardware and software products and/or services mentioned and not those of the Australian Flexible Learning Framework (Framework) or the Australian National Training Authority (ANTA).
- References to technology, hardware and software products and/or services do not indicate sponsorship, affiliation or endorsement of the product and/or services by the Framework or by ANTA.
- References to individual companies, technology and/or products mentioned in this report do not indicate sponsorship, affiliation or endorsement by the said companies for the report material or related products, or for the services of the Framework or ANTA.
- Details have been prepared based on information available at the time of publication. Any discrepancies or changes should not be interpreted as an attempt to provide false or misleading information but simply give due recognition for registered products and services.

The following is a summary of the registered technology referred to throughout the document. Each product or service has been listed using the full compound name of the registered product/service. Throughout the body of the report, the non-compound or shorter version may be used and users are directed to the following list for full details.

Note: Product or services names are listed alphabetically.

ASP/ASP .NET
Bluetooth®
CodeKeeper .NET™
ESRI® Corporation ArcPad
Microsoft®
Microsoft® .NET™
Microsoft® Excel
Microsoft® Outlook®
Microsoft® SQL Server™ 2000
Microsoft® SQL Server™ CE
Microsoft® SQL Server™ Enterprise Manager
Microsoft® Visual Studio®
Microsoft® Word
O2® Xda® II
OpenNET CF framework
Windows®

1 Acknowledgements

This report has been completed by TAFE NSW New England Institute for the project, *Mobile learning: handheld innovations in flexible learning.*

Project team members

Sam Meredith, Leader Teaching and Learning Support Unit and Flexilink, based at Armidale Campus

Chris Richter, Multimedia Developer and part-time teacher, Inverell Campus

Daniel Dacey, Multimedia Developer and part-time teacher, Armidale Campus

The project team report would like to thank:

- Telstra® for sponsoring the connect-time costs of the trials reported within this document.
- National Buildplan Group for providing building site induction material and access to a building site for the trial. See www.buildplan.com.au
- Our colleagues in TAFE Tasmania, Marcus Ragus and his team, for collaboration and support.
- Michael Leahy, Head Teacher Construction and Transport, Armidale Campus, TAFE NSW New England Institute, for advice and support.
- Bernard Ingle, A/Educational Developments Manager, TAFE NSW New England Institute, for sponsorship and support.
- Australian Flexible Learning Framework for financial support provided through the New Practices in Flexible Learning project 2004
- Support provided through the New Practices in Flexible Learning Program Management Team at WestOne Services.

2 Overview

2.1 Project trials

This report details the use of handheld device technology in relation to the development and trial of two concepts:

1. development and trial of a *Building-site self-induction resource*
2. undertaking a series of simple learning assessment tasks on the handheld device within the *Assessment tasks for younger learners* trial.

The following pages overview the concepts, challenges, development and impact of work undertaken throughout these two trials. In addition, a detailed explanation of the technical development has been included in section 6 showing one example of what can be achieved with this technology.

This material has been provided to assist those who are interested in the 'new practice' and ongoing implementation of handheld technology within Vocational Education and Training (VET) contexts and related workplace environments.

There are multiple audiences for this 'new practice' including:

- VET trainers and practitioners involved in a range of delivery areas, not limited to, but demonstrated in the training fields of Building and Construction and youth related areas.
- developers and information technology support staff
- organisations looking to implement handheld technology within their training programs
- industry and enterprise looking for example of how handheld technology can be applied in the workplace
- training related organisations and individuals who work with younger learners.

2.2 Technologies

The following technologies were used within this trial:

- O2® Xda® II personal digital assistant (PDA) with general packet radio service (GPRS) mobile access (code division multiple access [CDMA] version not available)
- *Snap*, a Windows®-based handheld device photo storage and retrieval application developed by a member of the project team
- Microsoft® Visual Studio® 2003 (VB.NET)
- OpenNET CF framework
- Microsoft® SQL Server™ Enterprise Manager
- CodeKeeper .NET™
- ASP/ASP .NET
- Microsoft® SQL Server™ CE

3 Trial 1: Building-site self-induction resource

3.1 Introduction

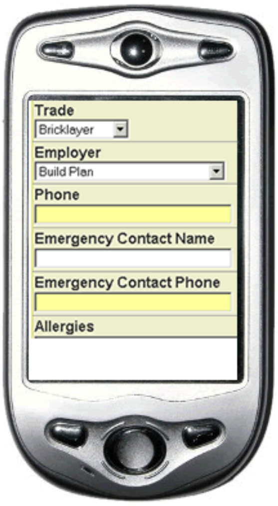
At TAFE NSW, New England Institute (NEI), the project team has been developing mobile phone enabled PDA (also known as a handheld) technology applications. In particular, they have developed the capability for a handheld device, equipped with a mobile phone and inbuilt camera, to record images and text at a mobile locations (for example, on a building-site) which can then be relayed back to a central server (for example, back at a company's head office). The application of this technology is ideally suited to the conducting of onsite/in situ assessments or for provision of onsite/in situ training (such as inductions).

The NEI project team became aware that the building industry was spending significant resources in order to keep abreast of the requirements of occupational health and safety (OH&S) legislation. This knowledge, coupled with the recognition that builders are typically very familiar with the use of mobile phones, led the project team to explore the potential for use of mobile phone-enabled handheld devices within the building industry as a means of providing OH&S site induction training that is specific to a particular building-site. OH&S requirements are similar, whether a builder is a large company with large building-sites, or is an owner builder.

Collaborating with TAFE Tasmania on the New Practices in Flexible Learning 2004 project, *Mobile learning: handheld innovations in flexible learning* has allowed NEI to trial their handheld device application technology and to share the outcomes with the Vocational Education and Training (VET) sector and wider education community.

Specifically, the handheld devices have been programmed to enable:

- Building-site managers to construct a site-specific induction process at a particular site and to update it as required. For example, the manager can photograph site specific situations through use of the in-built camera, add relevant textual information, and upload the resultant resource to a server.
- Builders (and other visitors to building-sites) to self-induct to the specific requirements of the site, with a final sign-off of the induction by the building-site manager or their appointed delegate. Additionally, due to the mobile phone-enabled capabilities of the handheld device, the technology enables a builder/visitor to self-induct before entering the building-site via remote downloading of the induction resource from the server to the handheld device.



3.2 The trial

The building-site induction trial was conducted between November and early December, 2004. Building group, *Buildplan* (based in Armidale Northern NSW), allowed the project team access to not only its site-induction process, but also to its building-site at Nazareth House in Tamworth.

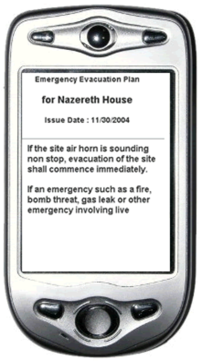
3.2.1 Handheld device resource

An overview of the handheld device resource and the steps involved in its use are illustrated and described below.

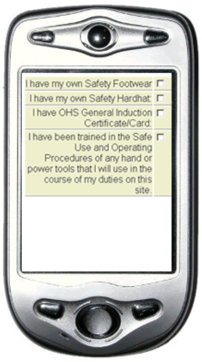
Users login to the site using their personal logon permissions

If a user is not registered then they will fill in their personal details.

A user then selects a site that that would like to be inducted in.



Induction information is then displayed. As many pages as are needed by the site to display relevant OH&S and other safety information.



A final form is displayed allowing the user to agree with the site induction conditions

Figure 1: Example of handheld device resource usage

3.2.2 Induction resource: administrator access

Administrator access to the self-induction resource enables site managers to modify, update, check and approve the resource data that is uploaded to the handheld device resource. The following screen shot displays some of the features of the self-induction resource that the administrator is responsible for including:

- adding new users, employees and trades
- setting user rights (that is, what the user can and cannot access and/or modify)
- adding new sites
- modification of induction content

Figure 2: Screen shot of administrator access options

3.3 Summary of trial evaluation comments

The site-induction process and its accompanying forms are the copyright of *Buildplan* and as such, cannot be reported as part of this report. However the generic process of the trial, including the issues faced and the key generic outcomes, can be reported as follows.

3.3.1 General comments by building-site trial personnel

General comments provided by building-site personnel were that the handheld technology:

- had great potential of allowing site managers to construct their site-inductions 'on-the-fly' through the ability to incorporate new hazards into the site induction resource as these hazards emerged on the building-site
- would save site manager's time through only having to sign-off a site visitor upon the visitor's successful completion of the induction, rather than having to personally conduct the induction process themselves during a face-to-face meeting with the site visitor.

Clearly, the building-site managers require a system in which they can have confidence that visitors to the building-site have been thoroughly inducted and that the induction process conforms to mandatory requirements and regulations.

Equally, the technology has demonstrated the potential to save subcontractors (and other visitors to the site) considerable onsite time by allowing them to download and undertake the induction themselves, at their convenience, and prior to arriving at the site. In such instances, upon arrival at the site office, the site manager would simply locate the site visitor's name on the system database, see that they had successfully completed the induction and then sign them off as having been inducted.

3.3.2 Sociocultural considerations

Conventions regarding the language that is appropriate for published reports, such as this one, prevent the reporting of the actual responses provided by one or two older 'subbies' when asked if they would like to participate in the handheld trial — except to say they clearly and directly indicated in which part of the human anatomy the proposed devices could be placed! In contrast, some of the younger contractors expressed a preference for use of an electronic system and were therefore keen to participate in the handheld trial.

This demonstrated difference in readiness to use a handheld device is related to the confidence, or lack of such, in using new technology. In general, an inverse relationship was observed within this trial between the age of the person approached and the apparent degree of confidence in use of the new technology. Consequently, older people appeared to be less confident in their ability to use new technology than younger people.

An important implication arising from this observation is that in order encourage use of handheld technology by a broad range of people, the technology must be easy to use and must require limited, if any, prior technical knowledge and/or skills. By way of example, if the induction process is only 'one click away' and the screen layout is clear, simple and easy to navigate, then acceptance by a wider variety of users will be more likely. In order to provide the novice user with a simplified presentation of the initial aspects of the handheld device resource, all other standard screen information can be minimised or 'hidden' behind the initial induction interface.

A further issue that was identified within this trial related to the question of responsibility for the induction process. One 'subbie' commented that he did not want to undertake the induction off-site, using the handheld, because doing so placed the responsibility onto him to provide the site induction, rather than the building-site manager. This person saw the provision of induction as the site manager's responsibility and so he wasn't going to spend his time self-inducting. An implication of this issue is the need to 'sell' the concept of self-induction as a time-saver for the site visitor, that is, to assist them to view the self-induction resource as something that provides them with the opportunity to self-induct at their convenience, whether this be at home, in transit to the site (provided they are not driving a vehicle at the same time!), whilst waiting at a supplier, or during other small periods of unproductive time.

3.3.3 Organisational environment

During the trial, several subcontractors visiting the building-site were reluctant to take the handhelds with them and to become more familiar with their use due to concerns related to the potential risk of loss or damage of the borrowed hardware.

An implication of this concern for the security of borrowed hardware is the need for the site-induction system to be reconfigured in order that it is able to run on all types of mobile phone-enabled handheld devices, or enhanced mobiles, that may already be owned by a site visitor.

An alternative option that may be considered, in the case of a large organisation such as a large building company, is to issue relevant staff and frequent visitors to their building-sites with a company-specific handheld that they could use during site inductions.

3.4 Suggestions for improvement

The following suggestions for improvement of the trialed resource have arisen in response to observations during, and outcomes of, the handheld device site-induction trial.

- The trial site was unfortunately situated within a general packet radio service (GPRS) blackspot, which made dial-up at the building-site difficult. Consequently the handhelds had to be taken off-site in order to dial-up to the website when an upload or download of information was needed. In this situation, availability of a handheld linked to CDMA mobile service provision would have been a more versatile option.
- It is suggested that a self-assessment activity be incorporated within the resource content following each key section of the induction. For example, after providing content that discusses the relevant emergency response plan for the building-site, insert self-assessment questions such as, ‘Where is the emergency exit?’ and, ‘Where are the fire extinguishers located?’. These questions/activities can require the inductee to check-a-box for a multiple choice or true/false answer etcetera. A further suggestion is that the user not be able to proceed with the next section of the induction until the inductee provides the correct answers to a preceding section.
- It is important to consider presentation of induction information in auditory as well visual text forms so as to take account of any literacy issues that the visitor may have. Through inclusion of such, the site visitor would have the option to listen to and view the site induction information, successfully answer the self-assessment questions (perhaps using voice recognition) and proceed through the induction.
- Consideration may also need to be given to the complexity of the language used to present the induction information (either verbally or in text form) in order to take into account the needs of any persons for whom English is not their fluent language.
- As a way of potentially increasing the integrity of the self-induction system, it is suggested that a protocol be established whereby each self-inductee is required to take a photo of themselves, via the handheld, as the first step in the induction process. This photo, together with their induction information, could then be uploaded to the website server. Then, when the visitor presents to the building-site and claims having undertaken the self-induction, the site manager can verify their identity (by examining their photo) in addition to verifying that they have successfully undertaken the induction.

4 Trial 2: Assessment tasks for younger learners

4.1 Introduction

At TAFE NSW, New England Institute (NEI), the project team has been developing mobile phone enabled PDA (also known as handheld) technology applications. These applications involved incorporation of capabilities to record images (via an inbuilt camera in the handheld device), write text and upload or download information to or from a central server or website.

The project team recognised an overlapping potential for their technology:

- its portability and versatility made it ideally suited to undertaking onsite/in situ workplace assessment recording
- the inherent attraction of younger aged learners to handheld device and mobile phone usage and therefore the potential of the technology to stimulate and motivate learning and assessment.

In response to this recognition, project team member, Chris Richter, arranged for a trial involving use of the handheld resource (for the purpose of undertaking a series of simple learning assessment tasks) by younger aged learners.

The participants for this trial consisted of 10 learners who were aged between 14 and 22 years of age, and who were located in Inverell, NSW.

The trial involved these participants undertaking some simple assessment tasks before completing an evaluation questionnaire.

4.2 Trial assessment tasks

4.2.1 Sequence

The following describes the sequence followed by the trial participants in order to undertake the relevant assessment tasks:

Step 1: click on **Start**

Step 2: click on the **Assessment** folder

Step 3: click on **Photo**

Step 4: click on ***Snap***

4.2.2 Tasks

The following describes the tasks that were undertaken by the participants during this trial.

1. Take a photo of yourself (click on ***Snap*** again, point the camera at yourself and press the camera capture button on the site).

   In **picture name**, type in your ID at the top of the page followed by the question number.

   In the **picture description** box, type in your full name, favourite food, favourite drink and favourite car.

2. Take a photo of a building and describe the basic materials used to build this structure.
3. Take a photo of a plant and explain photosynthesis.
4. Take a photo of a car and describe one safety feature of the vehicle.
5. Take a photo of an occupational health and safety (OH&S) issue in a building. Explain the issue.
6. Draw a quadrilateral on paper and take a photo of the drawing. Describe what a quadrilateral is.
7. Draw the Australian flag. Take a photo of your drawing and write 'Australian Flag' in the description.
8. Take a photo of a clock that has hands and write the correct time in the description. Then write down what time it was 45 minutes ago.
9. Orthopaedics – what do they deal with? Take a photo to answer the question.

   Thankyou for your participation.

4.2.3 Sample resource screen shots

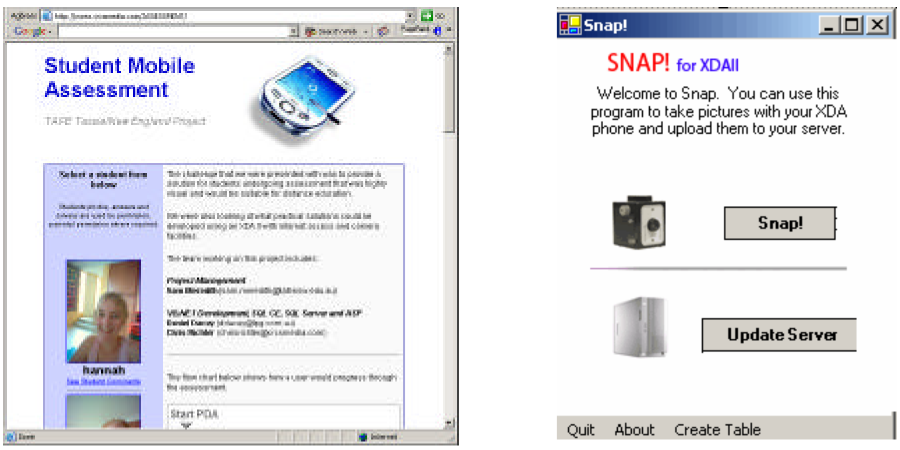


Figure 3: Sample screen shots from the assessment for younger learners' resource

4.3 Trial outcomes

The following represents a summary of the key outcomes from the assessment for younger learners trial.

- The trial produced some very promising results. For example, the participants provided a range of very positive comments related to:
  - the ease with which they were able to use the technology to undertake the required assessment tasks

  - their enjoyment of undertaking assessment in an alternative way when compared with more traditional forms of assessment.
- Learners also commented on how this particular form of assessment enabled them to develop and present their assessment responses in a more creative manner due to the resource's capacity to incorporate both visual and written text forms.

5 Participant evaluation questionnaire

Your name (optional)**:** ____

Age: ☐ 20yrs or less ☐ 21 – 30yrs ☐ 31-40yrs ☐ 41-50yrs ☐ 50+yrs

1. **Rate your initial impression of the handheld.** Rate from:

   1 – I hate technology, **5** – Interesting, **10** – Great, I want one

   1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 - 10

2. **After using the handheld what statement best reflects your opinion?**

   ☐ Unsure of its potential, I would like to trial its use for a longer period

   ☐ I hate technology, this would not be suitable for me

   ☐ I find this technology great, it would be useful to me, I want one now

   ☐ It would not suit my current requirements

   ☐ This might not be suitable for me but I can see its potential for others

3. **How easy was the handheld to use?** Rate from:

   1 - really difficult to use, I would not use it again]

   5 - straight forward with some experimentation]

   10 - easy, no problems]

   1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 - 10

4. **Was the activity useful to you?**

   Yes / No

   Briefly describe the reason for your answer:

5. Would you use the activity resource (the program, software) or something similar again if you had access to it?

Yes / No

Briefly describe the reason for your answer:

6. Did the handheld enhance your overall experience and improve your ability to complete your task/s?

Yes / No

Briefly describe the reason for your answer:

7. Would you like to see more activities made available using this technology?

Yes / No

Briefly describe the reason for your answer:

8. Did you encounter any difficulties or problems using the handheld? What were they?

9. What surprised you most about the handheld?

Why?

10. Do you have any other comments or suggestions?

Thank you for undertaking this evaluation.

6 *Snap* handheld device image and data capture application: a review of its development

6.1 Introduction

Section 6 of this document had been prepared by Daniel Dacey (Developer, *Snap*) and discusses some of the issues and outcomes of developing *Snap*; an image and data capture tool for the Microsoft® handheld device platform. *Snap* was part of a collection of tools developed as part of the New Practices in Flexible Learning 2004 project, *Mobile learning: handheld innovations in flexible learning*. Other tools used within the project included a Microsoft® SQL Server™ database and a web-based management tool.

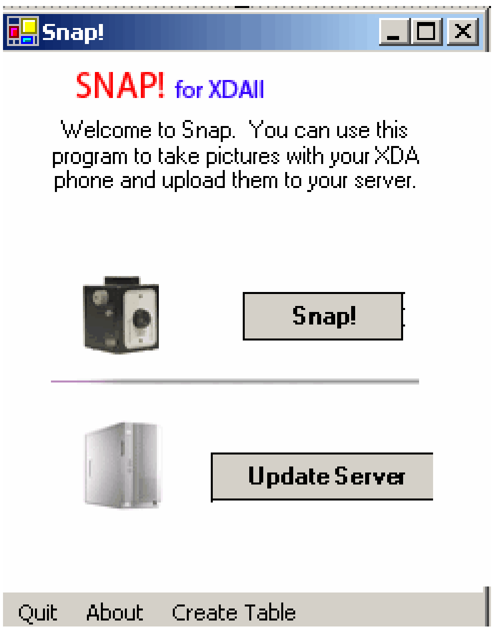


Figure 4: Screen shot from *Snap*

6.2 Interface design

A review of existing applications on the handheld device revealed that there were sharp contrasts in the design and feature sets of software applications for this platform. Microsoft® have adopted the approach of simplifying both the feature set and hardware demands of their popular desktop products such as Microsoft® Word and Microsoft ® Excel, while still offering core functionality and compatibility with their desktop equivalents. Other software developers have taken the approach of making the handheld device platform as feature-rich an environment as is practicable within the constraints of the hardware platform and operating system itself.

Perhaps the most striking example I could find of this feature-rich environment was the ESRI® Corporation ArcPad™ which attempts to put the functionality of a very powerful and complex Geographical Information System (GIS) that normally runs on an expensive and dedicated workstation, onto a handheld device.

My own experiences and observations of colleagues using software on a handheld device that crosses from the simplest interface to the most complex, is that adding functionality to an application (particularly when trying to get it to work within the fixed hardware and operating constraints that a handheld device represents) does not necessarily add value to the product. For example, if a feature requires navigation through numerous menus or various options on forms, many users will either ignore that feature or else use it only when absolutely necessary.

Drawing from these observations and from the project brief, I was able to identify what I felt would be core design and programming considerations for the application interface. Specifically, the application interface had to have:

- a simple navigation system that presented a consistent look and feel to the user throughout the application
- present the minimal number of options necessary to the user, while still allowing them to be effective at the task at hand
- a design that minimised the frustration that users can feel by having to deal with the constraints of the handheld device platform itself (this meant taking into consideration issues such as slow response times, use of a stylus, hand writing recognition issues, screen resolution and size, etcetera)
- make 'smart choices' through program design and coding so that the user had to step through less menus and buttons to complete a task
- use graphics to help represent the function (particularly important for those who may have limited literacy skills), and
- ensure screens had plenty of white space and large, clear, text and graphics (as it shouldn't become an exercise in trying to cram all the functionality onto one screen).

The result of these above considerations is a wizard-based interface that performs the core functions of the application and is supported by a simplified menu structure for less often used administrative tasks.

Feedback from users of the completed product showed that the decision to adopt a wizard-based approach to access the functionality of the application was well received and highly successful. Comments such as ‘fun‘ and ‘easy to use‘ were the overwhelming response from the trial participants.

It is important to note that trial participants were given little, or no, formal instruction in how to use the application and were simply asked to complete a series of tasks, using the application as the tool to assist them. That they should be able to satisfactorily complete those tasks without support, I believe, validates the design criteria that underpin the design and function of the interface.

6.3 Communication

The application was to be based on a handheld device, but also had to offer support for a 'back-to-base' function that could be used remotely. Ideally, this communication should be directly to a server and would allow the server to directly access and use the data captured in the handheld device application. This design feature proved to be the one that required the most time and thought in its development.

Handheld devices are generally intended to be 'docked' to a desktop PC through either a cradle or through the wireless capabilities of Bluetooth®. The underlying philosophy is that the desktop PC, rather than the handheld device, will then undertake any communication or updating required with a server. This project presented the challenge of trying to circumvent the desktop PC (treating it as nothing more then a simple communications pathway) and have the handheld device communicate and function directly with the server.

The main problem I identified in regard to this concept was that the design of the communication technologies available all expect the handheld device to work through a desktop PC and are thus are limited in their functionality. For example, the handheld device uses a subset of Transmission Control Protocol/Internet Protocol (TCP/IP) to communicate with the desktop. However TCP/IP standards are not fully implemented and some of the things that are possible are locked into proprietary dynamic link libraries (DLLs) for which Microsoft® has not made the specifications widely available. This means that the handheld device has a way to transfer files and updates to, and from, the handheld device when synchronising with Microsoft ® Outlook®, for example, but Microsoft® does not publish details of exactly how it does this for developers.

This meant that considerable time was invested in exploring what was possible through 'reverse engineering' some of the functionality that was evident. In the end, it was decided to use a database model where a copy of the handheld device's applications data was stored in Microsoft® SQL Server™ CE on the handheld device and then uploaded to a server running Microsoft® SQL Server™ 2000. This presented three ways of communicating with the server:

Remote Data Access (RDA)

RDA enables a Microsoft® SQL Server™ CE application to:

- retrieve data and schemas from a Microsoft® SQL Server™ database
- add, delete and modify data on the handheld device
- have Microsoft® SQL Server™ CE submit the changed data back to the server, and
- submit Microsoft® SQL Server™ statements from the handheld device back to the server-version of the database.

RDA is simpler model to understand then merge replication, but requires more coding on the part of the developer. RDA also requires that the handheld device be aware of the server's table-structure through having been connected (at least once) to the server and having downloaded the schema before the handheld device's copy of the database is put to use.

Merge replication

Merge replication means that a user can pull down all the tables and records that they need in order to merge their data with the server. One of the limitations of this model is that it needs to use what is called 'enforced relationships'. This means that even if only one field is required from a table, the user effectively has to pull down the whole table or, alternatively, write complex filters that can pull down only the data the user requires.

Custom application

Given the limitations outlined in the previous two methods, a custom solution seems attractive. However, there are very definite limitations in regard to how and which way communication with the server can occur. This means that it is possible for a developer to write their own tools to enable communication with the database on the server, but the development time would be substantial. Consequently, only a large project (and budget) could justify and support the effort involved.

For the purposes of this trial, the RDA method of synchronising data between the handheld device and the server was thought to be the closest match to the original design brief. Since the tables were relatively simple in design for this project, the underlying code that was developed for the handheld device was kept to a minimum.

Three key issues became apparent during the trial when using this technology:

1. The synchronisation worked fine during the development of the handheld device application, but problems later became apparent when trying to synchronise multiple handheld devices to the one table. A solution has subsequently been identified through use of a composite key that consists of a unique number and the device identity of the handheld device.
2. Testing revealed that the communication between the handheld device and the server is slower than the USB2 standard used by the docking cradle would suggest it should be. It is not clear what causes the delay, but initial investigation seems to show this is a limitation of the Microsoft® .NET™ Compact Framework itself. Although this did not adversely affect the trial, given the limited scope of the data used, it did become apparent during the testing I undertook when developing the application and moving large quantities of ‘dummy’ data between the handheld device and desktop.
3. The setting up of the communication tools between the server and the handheld device (including Microsoft® SQL Server™ CE transportation tools, configuration of Microsoft® Internet Information Services [IIS]™, shared folders and user permissions) is complicated and prone to unexpected problems. For example, while I was able to get all these elements working successfully on my test network, problems emerged when a project colleague placed the tables on the production server. Unfortunately, these problems were unable to be satisfactorily rectified within the available project timeframe (although I have no doubt that they would have been overcome if more time had been available). As a consequence, the handheld device could only take partial advantage of the web-based tools that had been developed by another project team member.

6.4 Hardware

Early in the project, it was decided to develop the present application for the Windows® handheld device platform as it was identified that this platform had the best range of tools and readily available hardware.

For the trial, the O2® XDa® II PDA/phone was chosen, as this device had the right combination of hardware features required for the trial, including a built-in camera. One thing that was later identified during the software development phase was that items such as cameras, global positioning systems (GPS) and some other specialised hardware functions are outside of the handheld device standard developed by Microsoft®, and are thus not directly supported by Microsoft® development tools. This means that it is absolutely critical that a developer also consider what development tools and support are available when selecting hardware purchases from a particular vendor.

Figure 5: Image of the O2® XDa® II PDA used within this trial

Ideally, a developer should ensure any hardware they develop has a software development kit (SDK) and published specifications available. Within this project, the project team was fortunate enough to find an unsupported third-party DLL that allowed some access to the O2® XDa® II camera functions. This was used as a starting point to build the functionality the project team needed from the camera for this project.

6.5 Development tools

For the development of the handheld device application, Microsoft® Visual Studio® 2003 was utilised as it supports the Microsoft® .NET™ Compact Framework that is part of the handheld device operating system. One additional (and very valuable) tool was the OpenNET CF framework, a collection of open-source development tools that have been collated by developers and made freely available. The OpenNET CF framework adds extra functionality to (rather than replacing) the Microsoft® .NET™ Compact Framework.

Other development tools that were used included Microsoft® SQL Server™ Enterprise Manager and CodeKeeper .NET (a code repository).

6.6 Conclusion

This project has facilitated an invaluable and very enjoyable investigation into the issues surrounding the development of handheld device applications for mobile learning. One thing that has become evident from this investigation is that the handheld device platform is still maturing and, as a consequence of this, the developer of handheld device applications is presented with a different set of challenges to those of a typical Windows® application or web-developer. Furthermore, it is also clear that handheld device developers need more time to investigate and trial ideas and to document their findings.

However, these points represent considerations rather then any real limitations to the handheld platform. It is the belief of this developer that these considerations can be overcome, provided that an appreciation of the time and effort needed for developers and educators to learn, and leverage, the most from the mobile platform is made available.

One particular learning gained in the course of this project that is worthy of mention, was that care must be taken in the choice of hardware selected as not all vendors offer the same feature-sets, or the same level of technical support for their products.

At a macro level, this project trial has demonstrated that mobile technology can be packaged in a way that will be well received by students and will deliver real benefits for learning. The challenge before the VET system is to ensure that there is a continued exploration of this, and other, mobile technology applications in order to take full advantage their potential as an effective learning tool. The opportunities for this platform are just opening up.

For more information contact:

Framework Communications Team

Phone: (07) 3234 1852

Fax: (07) 3237 0419

Email: enquiries@flexiblelearning.net.au