



Using Wireless Technologies for Context Sensitive Education and Training

WP5 Art Gallery and Museum Education

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Dun Laoghaire, Co. Dublin

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Summary

The main focus of this document is to outline the work conducted in Work Package 5, Art Gallery and Museum Education, at Ericsson Education Ireland. A description of the training package produced is outlined, followed by the evaluation of this package with users and the conclusions that can be drawn from it.

Introduction

The profile of the typical mobile device, and also user, has changed dramatically since 3G was first introduced commercially 10 years ago. Wideband Code Division Multiple Access (WCDMA) was the first 3G standard introduced commercially and was envisaged as the first step towards commercially available mobile broadband networks. This allowed network operators to offer data rich services to their customers, similar to what they were used to on a home or office PC.

The next phase step for 3G networks was the addition of High Speed Packet Access (HSPA), along the first evolution of WCDMA in terms of capacity and user speeds. The introduction of HSPA has caused “mobile broadband” to explode over recent years and opened up a whole new world of opportunities where consumers can now experience mobile broadband at data rates and prices comparable with fixed broadband.

At present there are over 400 Million WCDMA subscribers globally, which includes over 140 Million HSPA subscribers. At the time of writing, there are 290 commercial WCDMA networks in 120 countries and 274 HSPA networks in 115 countries, over 94.4% of networks are mobile broadband capable. (Source: <http://www.gsacom.com>)

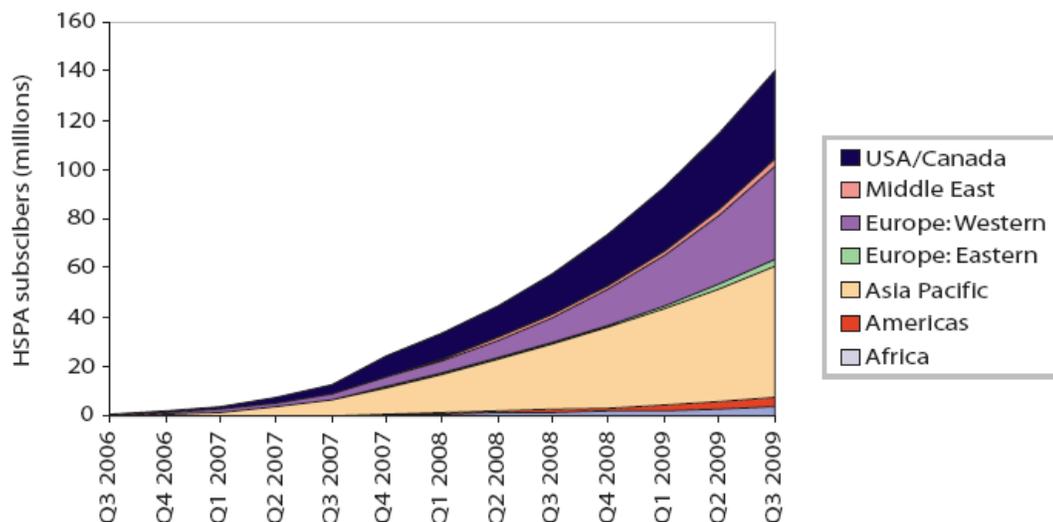


Figure 1: HSPA subscriber numbers July 2009

Mobile broadband access is being made on all types of mobile devices. Originally devices were pure mobile phones or pure PDA (mobile computers). Today, there exists a

wide range of devices within this continuum, that mix traditional telephony with computing services, such as mail, calendar, but also with FM radio, MP3 players etc. PC and cell phone vendors are crossing into each others territory as phone and computer functionality converges, which can be clearly seen with the recent introduction of 3G wireless-enabled laptops. As well as Device Convergence, two types of convergence which should be considered are as follows:

- **User service convergence;** implies that there are common user service delivery capabilities with access and device awareness. This means that a multitude of services (person to person, person to content and content to person) can be provided to the same user over different access networks and to different devices.
- **Network convergence;** implies the consolidation of the network to provide different user services, with telecom-grade quality of service to several access types with an emphasis on operator cost efficiency.

All this means that it is now possible to envisage an audience for mobile learning content which is media rich, collaborative and always available to the user. Using established location detection technologies, training content can be developed for both context sensitive and location based delivery. Context sensitive education and training refers to training material which is directly relevant to the training situation that the learner finds themselves in. Location based education and training refers to material which is directly relevant to the location in which the participants find themselves. Seeing as mobile devices can be used almost anywhere, they are perfect platforms for situated learning activities where real life is used to provide stimuli and activity for learning.

As the convergence of networks, media and end-users continues at great speed it will encourage the development of learning based around existing and emerging technologies. This should lead to huge advances and greater opportunities for a lifelong learner to choose how, when and where they learn, based on their personal preference. Already there are 31 network operators committed to the next step in the mobile technology roadmap, namely Long Term Evolution in Radio Access Networks (LTE), which will be introduced commercially in 2010 and allow users to avail of much higher mobile broadband speeds; matching fixed line broadband networks. The introduction of LTE and the move towards all IP mobile networks will further strengthen the ongoing convergence and lead to the development of a lifelong learning environment based on mobile technologies. Also as the number of broadband-capable mobile subscribers begins to grow rapidly (Figure 2 below), the demand for such learning environments is bound to increase.

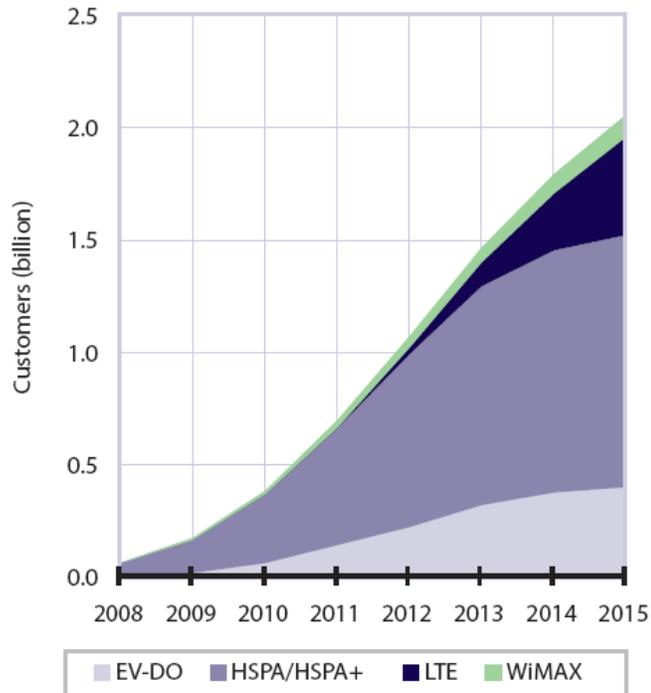


Figure 2: Wireless broadband customer forecasts worldwide, by technology.

Development of Training Material

The training package has been developed with three locations in mind, all of which are well known tourist destinations:

- Dun Laoghaire Harbor
- Peoples Park, Dun Laoghaire
- 40 Foot, Sandycove

These three locations are within the same 5KM radius. Information on each location consists of text and graphics explaining the history of that area and features which are of interest to tourists and the general public.

The development software used for this project, *eXact Mobile* developed by Giunti Labs, enables access to a Learning Management System (LMS) with mobile 3G, Wi-Fi and GPRS devices. This allows the engineer to access Learning Objects (LOs) and learning paths specifically customized for the available peripherals and for the location of access. *eXact Mobile* is the first commercial mobile Learning Content Management Solution (LCMS). It is a module of learn eXact, that enables context-aware learning content delivery when the learner needs to access it.

eXact Mobile can be integrated with the learn eXact LCMS suite or interfaced with any 3rd party eLearning (LMS/VLE) solution. eXact Mobile provides access to the LMS

through mobile 3G, Wi-Fi and GPRS devices providing a high level of flexibility in learning programmes planning. eXact Mobile also feeds tracking information back to the LMS allowing the learner or mobile worker to follow learning programmes using the most convenient device available.

The following outlines the steps to be taken to install eXact GEO on a mobile device

- Connect the mobile device to the computer.
- On the computer access a folder on the mobile device and copy over the two required application files (.jad and .jar).
- On the mobile device access the folder where the two files have been copied
- Select the .jad file and start the installation
- Select eXact GEO to start the application.

Once you have started the application, the following steps are required to retrieve the information from the database:

1. **Set GPS** – by using either a built in GPS device or one connected to the device, the users position can be calculated and used by the phone to inform the database of its location
2. **Set Server** – the participant can set the web address of the server where Learn eXact is installed. This will allow the participant to pull the relevant course from the database
3. **Set Distance** - The participant can set the distance (in meters) used to retrieve eXact GEO LO list located around this distance from the GPS point. Default value is 10000 meters.
4. **Get GEO LOs** - The participant can start eXact GEO to retrieve the relevant Learning Objects and he/she has to login to Learn eXact with a username/password. Once the participant has logged in, eXact GEO sends the geo coordinates using the default GPS device. If there are Learning Objects between the participant position and the distance, eXact GEO will display the titles of the Learning Objects, otherwise an empty list will appear. When the participant is logged in, eXact GEO permits them to set up a new distance every time by command selection on the bottom of the display. If a title of the Learning Object is selected, the Learning Object is downloaded. At the end of the download, a player is going to display the Learning Object. eXact GEO downloads the Learning Object selected, only if the Learning Object has never been downloaded.

All the above was installed, run and tested on a Sony Ericsson Xperia X1 which has a 800 x 480 pixels, 3.0 inch screen and runs on Microsoft Windows Mobile 6.1 Professional Operating System.

Location 1 – Dun Laoghaire Harbor

In this scenario it is assumed that the user is on or near the Dun Laoghaire Harbor. The learning material discusses the main structural features of the pier and explains some of the history of the area.



Figure 1: Dun Laoghaire Harbor Tour

Location 2 – Peoples Park, Dun Laoghaire

In this scenario it is assumed that the user is in or near the Peoples Park, in Dun Laoghaire. The learning material explains some of the history of the area.

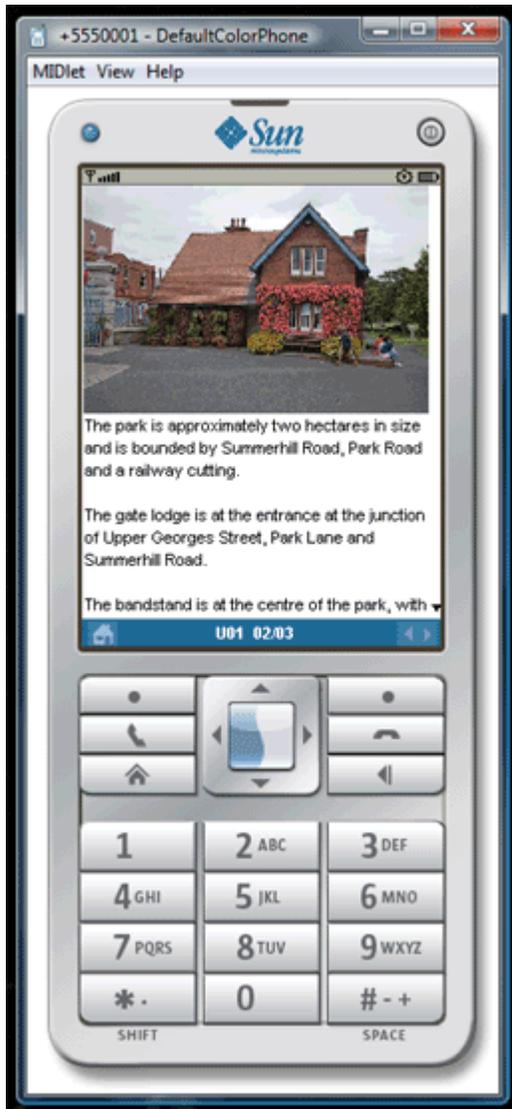


Figure 2: People's Park Tour

Location 2 – 40 Foot, Sandycove

In this scenario it is assumed that the user is near the 40 Foot, in Sandycove. The learning material explains some of the history of the area.



Figure 3: 40 Foot Tour

Testing of Location and Context Sensitive Package

The testing phase took place in Dublin during November/December 2009. The participants were:

- Telecommunication engineers, consultants and project managers working for Ericsson in Ireland
- Members of the public working in various fields such as media, IT, Finance

All of the Ericsson staff are involved in Life Long Learning as the technical environment within the telecommunications environment is continually changing. It is also the philosophy of Ericsson to support Life Long Learning, as a well educated staff is vital to the success of the company worldwide. Ericsson Education in Ireland has 100 experienced learning consultants and instructors.

Ericsson Education in Ireland has always been to the forefront in researching innovative ways of deploying training material to Ericsson staff and customers. It has the global competence within Ericsson for eLearning, Synchronous eLearning and mLearning. It is also one of the leading centers globally for Learning Solutions, which focuses on Business Analysis and Training Analysis to optimize customers learning experience and competence development. Ericsson Education Ireland's aim is to help Ericsson and its customers to succeed in today's technology-driven telecom world through employee performance improvement.

The members of the public were randomly chosen as a cross-section of society. This was necessary as the content to be tested in this work package is not specific to any industry or product training; rather it is intended to be used by tourists and the general public.

The test phase took place in Dun Laoghaire, Dublin and Blanchardstown, Dublin.

Evaluation and Analysis

Evaluation Methodology

In total, a group of 12 participants in total took these courses. Each individual was given a short introduction regarding the purposes of the project and the reasoning for developing such a mobile based application for individual learning. Two GPS-enabled mobile phones were used for testing purposes:

- SonyEricsson Xperia X1
- SonyEricsson W960

Each participant completed the tasks in approximately 10-20 minutes.

The following data has been gathered from the testing phase:

- Questionnaires completed by each participant

Evaluation results

Participant questionnaire results

12 questionnaires were completed using the questionnaire in Appendix 1. The questionnaire aims to gauge the user experience of a variety of users of different age, gender and technical experience.

Gender

	Frequency	Percentage
Female	5	42%
Male	7	58%
Total	12	100%

The sample comprised 42% females and 58% males.

Age

Age	Frequency	Percentage
18-20	0	0.00%
21-25	0	0.00%
26-30	0	0.00%
31-35	4	33.33%
36-45	4	33.33%
Over 40	4	33.33%
Total	12	100.00%

The age range of the participants spans from 31 to over 40.

1 Which mobile phone do you own?

All the participants used the SonyEricsson Xperia X1 or SonyEricsson W960 to test the content. However they indicated that they personally owned a number of different handsets, including Nokia, Samsung and iPhone handsets.

2 Does your phone have GPS?

The Sony Ericsson Xperia X1 has built-in GPS capability. The SonyEricsson W960 has GPS capability through a Bluetooth connection to an external TomTom Wireless GPS Receiver.

3 How would you rate your experience in using mobile phones?

Rating	Frequency	Percentage
Very experienced	2	16.67%
Experienced	7	58.33%
Not experienced	3	25.00%
Total	12	100.00%

4 What did you think of the mobile learning course you have just experienced?

- Nice course. Good information
- Very useful and Interesting
- Very useful
- Very good, too much text though
- Very good idea
- Course very good. Could do with more flashy images. Very static.
- Very positive. A good tourist guide
- Good
- Excellent content, small and informative
- Good concept, well executed
- Excellent, good idea but needs more content
- Very good

5 How would you rate its usefulness in learning the subject?

Rating	Frequency	Percentage
Extremely Useful	1	8.33%
Useful	11	91.67%
Uncertain	0	0.00%
Not Useful	0	0.00%
Extremely Un-useful	0	0.00%
Total	12	100.00%

No negative ratings were given concerning the usefulness of the course in learning the subject. 8.33% thought it was ‘extremely useful’ and 91.67% ‘useful’.

6 It was easy to use the equipment.

Rating	Frequency	Percentage
Strongly Agree	0	0.00%
Agree	10	83.33%
Uncertain	0	0.00%
Disagree	2	16.67%
Strongly Disagree	0	0.00%
Total	12	100.00%

The majority said it was easy to use the equipment, 83.33% answered ‘agree’. Two people disagreed as they found the content difficult to navigate.

7 It was easy to navigate through content.

Rating	Frequency	Percentage
Strongly Agree	1	8.33%
Agree	8	66.67%
Uncertain	0	0.00%
Disagree	3	25.00%
Strongly Disagree	0	0.00%
Total	12	100.00%

The majority also found it easy to navigate through the content, with only 3 (25%) rating ‘disagree’.

8 The mobile learning experience was fun

Rating	Frequency	Percentage
Strongly Agree	2	16.67%
Agree	10	83.33%
Uncertain	0	0.00%
Disagree	0	0.00%
Strongly Disagree	0	0.00%
Total	12	100.00%

All participants either agreed or strongly agreed that the mobile learning experience was fun.

9 I would take another mobile learning course if it was relevant to my learning needs.

Rating	Frequency	Percentage
Strongly Agree	5	41.67%
Agree	7	58.33%
Uncertain	0	0.00%
Disagree	0	0.00%
Strongly Disagree	0	0.00%
Total	12	100.00%

A good indication that the participants had a positive experience is that none disagreed with taking another mobile course. 41.67% answered 'strongly agree' and 58.33% answered 'agree'.

10 I would recommend mobile learning as a method of study to others.

Rating	Frequency	Percentage
Strongly Agree	4	33.33%
Agree	8	66.67%
Uncertain	0	0.00%
Disagree	0	0.00%
Strongly Disagree	0	0.00%
Total	12	100.00%

All of the participants would recommend mobile learning as a method of study to others. Of those that agreed, 33.33% 'strongly agreed' and 66.67% 'agreed'.

11 The mobile device enhanced the learning experience.

Rating	Frequency	Percentage
Strongly Agree	3	25.00%
Agree	8	66.67%
Uncertain	1	0.00%
Disagree	0	0.00%
Strongly Disagree	0	0.00%
Total	12	100.00%

All but one participant felt that the mobile device enhanced the learning experience; 25% strongly agreed with this statement, and one participant was uncertain.

12 In what ways did it (or did not) enhance the learning experience?

1. It was great to have all the information presented in one course
2. Navigation was difficult
3. Good to have in your pocket when out in the open. Portable.
4. Quick hit of information
5. Provided clear information in a logical manner
6. There was a good balance between text and graphics
7. Made it more enjoyable/realistic
8. It is a useful "quick hit" of information about the subject
9. Very useful for a quick hit of information
10. Good idea to have the information in a portable format
11. Not sure how useful it is but maybe I am not experienced with the phone. Found it difficult to navigate.

13 Which functions of the device did you use most?

1. Stylus
2. Stylus
3. Stylus, touch pad
4. GPS
5. GPS
6. Centre touch pad
7. next page
8. Screen, stylus
9. touchpad
10. screen
11. stylus, screen
12. next button, options

14 What did you think about the look and visual design of the course?

1. I liked it. Large screen and clear images were good
2. Very good, needs more graphics
3. Very nice
4. OK. Needs more graphics
5. Very nice. Hard to read small text

6. OK. Could have been more flashy and interactive
7. Good balance between text and graphics
8. I thought it was good
9. It was perfect. For faster connections we could use video or audio
10. Was OK, needs more graphics
11. It was ok, a little too much text
12. Very good, clear text

15 The course used location-based technologies to provide relevant learning materials to your phone. How did you find this?

1. Very useful
2. It was fine but could be more integrated with Google Maps like on an iPhone
3. Did not use this
4. No problems experienced
5. Yes – it worked well
6. N/A – not used
7. Information was excellent and well thought-out
8. Worked well. GPS was slow to connect
9. Good to see the location on Google Maps, never used this before
10. Worked well

16 Did you encounter any technical problems? If so, what problems did you have?

1. No
2. Navigation was difficult sometimes. Text was too small
3. None
4. No
5. No
6. No
7. No problems
8. No
9. Menu was initially confusing
10. None
11. Navigation was difficult

17 What did you like most about the mobile learning course?

1. Short, interesting content

2. Easy to use, good idea
3. Easy to use, fast to load, informative
4. It was compact and relevant
5. The novelty of it
6. Ease of use and relevant content
7. Information in the course and pictures
8. Interesting content
9. Interesting information
10. It was fast. Interesting content
11. Compact, fast, good graphics
12. concise information presented with relevant graphics

18 What did you like least about the mobile learning course?

1. Nothing
2. Larger font might be preferable for me. Maybe show image in between text instead o always at end
3. Navigation
4. Too much text, more graphics needed
5. Small text
6. The fact that it was not interactive
7. None really!
8. Would have been nice to have richer content
9. For faster phones, use video, audio
10. Navigation was confusing at the start
11. Too text heavy
12. Navigation is hard, not used to using a stylus

19 Do you have any suggestions for how we could improve the mobile learning course?

1. Make it easier to navigate. More content
2. Add video and audio
3. Have video or links to web pages
4. Some video content would be nice
5. Add sound, in this case background music (relevant to the situation) would have enhanced the experience
6. More interactive, better graphics
7. Make the text easier to read
8. Add video or voice over

- | |
|--|
| <ol style="list-style-type: none">9. Allow user to make the text bigger. Add more content like video10. Specific pages might benefit from paragraphs or line breaks. Can pages be renamed in menu? And on display?11. Use video or audio |
|--|

Synthesis of the evaluation results

12 participants completed the training course. Each participant completed a paper-based questionnaire after complete the course

The responses to questions in the participant questionnaire are synthesized below.

Learners

42% of the participants were female and 58% were male. The age range of the participants spanned from 31 to over 40. All participants owned a mobile phone and the majority considered themselves to be experienced or very experienced users.

Participant feedback

Q4 What did you think of the mobile learning course you have just experienced?

Of the learners who responded to this question all were positive about the course. Multiple learners commented that the course was ‘useful’ or ‘very useful’. Three learners were impressed with the course but felt that it needed more content, or “flashier” content such as video or audio.

As an overall majority of the group viewed the experience as useful, interesting or better, it can be stated that the concept is acceptable to the learners albeit with some reservations which will be discussed in more detail below.

Q5 How would you rate its usefulness in learning the subject?

100% of learners rated the course ‘extremely useful’ or ‘useful’.

Q6 It was easy to use the equipment.

The majority said it was easy to use the equipment, 83.33% answered ‘agree’. Two people disagreed as they found the content difficult to navigate.

Q7 It was easy to navigate through content.

The majority also found it easy to navigate through the content, with only 3 (25%) rating 'disagree'.

Q8 The mobile learning experience was fun

100% of learners either agreed or strongly agreed that the mobile learning experience was fun.

Q9 I would take another mobile learning course if it was relevant to my learning needs.

A good indication that the participants had a positive experience is that none disagreed with taking another mobile course. 41.67% answered 'strongly agree' and 58.33% answered 'agree'.

Q10 I would recommend mobile learning as a method of study to others.

All of the participants would recommend mobile learning as a method of study to others. Of those that agreed, 33.33% 'strongly agreed' and 66.67% 'agreed'.

Q11 The mobile device enhanced the learning experience.

All but one participant felt that the mobile device enhanced the learning experience; 25% strongly agreed with this statement, and one participant was uncertain.

Q12 In what ways did it (or did not) enhance the learning experience?

On the positive side, quick access to information, clarity of the information and portability were cited as enhancements of the learning experience. On the negative side, problems with navigation, was the only aspect mentioned which did not enhance the experience. The majority of the negatives could be addressed through course design.

Q13 Which functions of the device did you use most?

Most participants mentioned the stylus or the centre touch pad as the device functions they used the most. This is not surprising as these are the primary methods of navigating the content. However some negatives were observed in other answers related to the navigation.

Q14 What did you think about the look and visual design of the course?

In general the reaction was good. However two main issues were identified by the participants:

1. Text size was too small for some users
2. Some users felt that there could be more images in the course
- 3.

Q15 The course used location-based technologies to provide relevant learning materials to your phone. How did you find this?

The reaction to this question was positive. One iPhone user suggested that greater integration with mapping software should be researched.

Q16 Did you encounter any technical problems? If so, what problems did you have?

The issues mentioned fell into two categories: course design and technical issues with the phone. On the course design side, problems with navigation, and an initially confusing menu were cited as problems. Technical issues on the phone such as the small text size were commented on. Whereas the course design aspects can be addressed in future courses, the technical issues on the phone are not so easy to resolve, but different handsets will have different characteristics.

Q17 What did you like most about the mobile learning course?

Among the 12 responses, 3 words appeared frequently in the feedback; easy, fast and interesting. The comments which best sum up all the feedback were:

- *“Short, interesting content”*
- *“Easy to use, fast to load, informative”*
- *“It was fast. Interesting content.”*

Q18 What did you like least about the mobile learning course?

Text was mentioned regularly as being too small *“Too text heavy”*, *“Small text”*. Confusing navigation was also cited as a barrier to learners’ enjoyment of the course. A comment was also made that more images or audio would enhance the experience.

By and large the elements least liked by the participants could be addressed by designing the courseware differently.

Q19 Do you have any suggestions for how we could improve the mobile learning course?

The majority of suggestions received concentrated on the design of the course and how it could be enhanced. Learners would like to see more audio and video; background music; links to web pages and the option to resize the text.

Conclusions

Location based, context sensitive training material was successfully developed for three locations, all of which are well known tourist destinations:

- Dun Laoghaire Harbor
- Peoples Park, Dun Laoghaire
- 40 Foot, Sandycove

These three locations are within the same 5KM radius. Information on each location consists of text and graphics explaining the history of that area and features which are of interest to tourists and the general public.

The location based aspect was obvious to the learner and all those that participated saw how location based was addressed.

The ability to download the appropriate material in the right location was achieved. This was achieved with no issues relating to the download procedure or launching the course.

The survey dealt with a mix of genders and age groups which would have been ideally suited to trial this course. In addition, the skill and knowledge of the group dealing with handsets was high. This meant that training was not required and the course developed was intuitive to the needs of the learner. Learners came from a diverse range of industries, including media, IT, Telecoms and Finance.

The learner's reaction to the courses was very positive, with the only negatives relating to course design issues, rather than to the training concept. Learners found the experience useful and indicated they would take other courses in this format.

However, issues such as course design and technical aspects of the mobile device were highlighted and will be addressed in future course development. These issues relate to areas such as text size and phone functionality. These issues are common across most research in this area. Issues such as screen size have been addressed somewhat by handset manufacturers and will continue to be addressed as handset development increasing to suit the changing needs of the end users. Through future research, we will see this become less of an issue.

Overall, the concept of context and location sensitive learning was seen as extremely useful and one that would be very beneficial to learning in a personal manner. The majority of participants alluded to the fact that the clarity and simplicity of such applications which could greatly enhance learning,

One of the main advantages of such positive feedback is that one can see there is a huge interest in technologies like this as it allows end-users to choose when/where/how they learn and takes away the link, which is sometimes negative, to education being perceived classroom based.

Another positive is that the majority of people found the experience to be fun with the majority of participants saying they would do a similar course again. The fun aspect of learning will encourage people to engage in lifelong learning as they will be more engaged and active in the learning experience, and will feel they have a greater control in their own development. Also, the majority of participants highlighted the fact they found that the experience enhanced their learning.

In general, the context and location sensitive course was well received by all participants and the vast majority can see the benefits that such technologies will have for end users. The main negative aspects were largely related to limitations with the course design but these did not detract from the learning experience and the overall satisfaction of those who participated.

Appendix 1: The Questionnaire

CONTSENS Mobile Learning Evaluation Questionnaire

Please complete this questionnaire. Your views are very important to us, so please do give your honest opinion. All your answers are confidential, and you will not be identified in any resulting work.

Name: Male: Female:

Course or module:

Age: 18-20 21-25 26-30 31-35 36-45 Over 40

1. Which mobile phone do you own?

2. Does your mobile have GPS (Global Positioning System)? Yes No Don't know

3. How would you rate your experience in using mobile phones?

Very experienced

Experienced

Not experienced

4. What did you think of the mobile learning course you have just experienced?

5. How would you rate its usefulness in learning the subject?

Extremely useful

Useful

Uncertain

Not useful

Extremely un-useful

6. It was easy to use the equipment.

Strongly agree

Agree

Uncertain

Disagree

Strongly disagree

7. It was easy to navigate through the content.

Strongly agree

Agree

Uncertain

Disagree

Strongly disagree

8. The mobile learning experience was fun.

Strongly agree

Agree

Uncertain

Disagree

Strongly disagree

9. I would take another mobile learning course if it was relevant to my learning needs.

Strongly agree

Agree

Uncertain

Disagree

Strongly disagree

10. I would recommend mobile learning as a method of study to others.

Strongly agree

Agree

Uncertain

Disagree

Strongly disagree

11. Using the mobile device enhanced the learning experience.

Strongly agree

Agree

Uncertain

Disagree

Strongly disagree

12. In what ways did it (or did not) enhance the learning experience?

13. Which functions of the device did you use most?

14. What did you think about the look and visual design of the course?

15. The course used location-based technologies to provide relevant learning material to your phone. How did you find this (e.g. was the course material always relevant, did this work well, etc.)?

16. Did you encounter any technical problems, e.g. in using the device and/or location-based technologies? If so, what problems did you have?

17. What did you like most about the mobile learning course?

18. What did you like least about the mobile learning course?

19. Do you have any suggestions for how we could improve the mobile learning course?

If you would be interested in being involved in further research with us into using mobile phones for learning, please give your details below:

Name:

Email address:

Thank you for your help