SMILE: The Creation Of Space For Interaction Through Blended Digital Technology

Rose Luckin, Diane Brewster, Darren Pearce, Richard Siddons-Corby, Benedict du Boulay
IDEAS Lab, School of Cognitive and Computer Science (COGS) University of Sussex
Falmer, Brighton BN1 9QH

Email:
rosel@cogs.susx.ac.uk
dianeb@cogs.susx.ac.uk
darrenp@cogs.susx.ac.uk
rsc@cogs.susx.ac.uk
bend@cogs.susx.ac.uk

Abstract

Interactive Learning Environments at Sussex University is a course in which students are given mobile devices (XDAs) with PDA functionality and full Internet access for the duration of the term. They are challenged to design and evaluate learning experiences, both running and evaluating learning sessions that involve a blend of technologies. Data on technology usage was collected via backups, e-mail and web-site logging as well as video and still photography of student-led sessions. Initial analysis indicates that large amounts of technical support, solid pedagogical underpinning and a flexible approach to both delivery context and medium are essential. The project operated under the acronym SMILE – Sussex Mobile Interactive Learning Environment.

Keywords: XDA, Pedagogy, conversational framework

1. Structure of the course

Interactive Learning Environments is the latest incarnation of a long running course, at the School of Cognitive and Computer Sciences (COGS), that explores the use of technology in education. The course is offered to third year undergraduate students as well as to postgraduates from a variety of Master's courses. Because of the speed at which educational technology develops, the course has to be regularly rewritten and updated. In planning the latest version of the course, for spring term 2003, it was decided that we should be exploring the learning possibilities offered by new mobile technologies.

Eighteen mobile devices, XDAs[1], with PDA functionality and full Internet access, were used as part of the course. Students were allocated devices for the term and were expected to use them 'as their own'. Postgraduate students had a device each, whilst the undergraduates had to share them in small groups of 3-4 students. The course itself has a wider remit than mobile technology alone, covering everything from the early development of Intelligent Tutoring Systems, through to the experimental tangible and pervasive systems currently being developed in COGS[2]. One of the core issues for the course team was to ground the student's understanding of educational technology within an appropriate pedagogical context. Consequently, the students were introduced to different pedagogical models that might underpin different kinds of "learning systems" and encouraged to use whatever technology best fitted their purpose. The course team also provided a web site for information along with access to lecture slides. The web site was

[1] Details of the device can be found at: *http://www.mmo2.com/docs/services/xda_details.html*

[2] For example the projects associated with the Equator project.
http://www.cogs.susx.ac.uk/projects/equator/equator.htm

particularly well used during a lecture on "online learning" which was delivered via the site (details below).

Two one hour lectures a week were used to cover the syllabus content, whilst the seminar time, 2 hrs for postgraduates, 1 hr for undergraduates, was given over to an exploration of the issues surrounding the use of mobile technology for learning. Seminars for both groups of students consisted of practical activities using the mobile device, as well as workshops on topics such as personalisation, collaboration, design and evaluation. At the start of the term all of the students took part in a data gathering exercise, either on campus or in central Brighton. The exercise was designed as a familiarisation exercise and to illustrate the potential use of mobile devices within the context of key stage 2 of the UK national curriculum, the students acting as designers for technology to support 10 - 11 yr old pupils. Having gathered the required data they then had to send it back to "base" where it was collated into a spreadsheet and displayed on the course web site for viewing with the device.

In reflecting upon the exercise, students were expected to consider practical and safety issues in this kind of learning experience, as well as issues of pedagogy and appropriate use of the technology.

Towards the end of the term the emphasis for postgraduates and undergraduates shifted, in that the postgraduates had to design and run a "learning experience" for the undergraduates using the devices – the undergraduates then had to evaluate this session. Formally assessed work at this point in the course was similarly focussed, with the postgraduates required to concentrate upon producing their own design guidelines for developing Interactive Learning Environments using mobile devices, whilst the undergraduates used multiple data sources, including video and still photography, for their evaluation of the session run by the postgraduates.

2. Pedagogical Grounding for the course

The pedagogical grounding for the course itself derives from Diana Laurillard's Conversational Framework (Laurillard, 2002). This approach aims to clarify the mediated nature of academic learning and to define its essential components. It identifies the component activities of an effective learning experience, describes them as discursive, adaptive, interactive or reflective and stresses that learning is an iterative dialogue within the learner and between the learner and others. This dialogue must operate both at the level of operations and at the level of conceptions. Both these levels must be interlinked so that learners engage with the concepts of the domain to be learnt not just with the medium of their communication. When using digital technology to support learning, the artefacts in use (XDA, networked PC, paper) and the operations they provide (PowerPoint, WWW, email, word processing etc.) are merely dialogue enablers not the focus of attention. In order to maintain a coherent narrative about the domain to be learnt — in this case the design of interactive learning experiences — the course material was structured in episodes that were specific to a particular learning goal and not tied to the technology through which they might be experienced.

An example will clarify. In week 8 of the 10-week course the topic for attention was on-line and distance learning environments. The goal for the session was for students "to gain a greater understanding about the challenges facing the designers of on-line and/or distance learning environments." This section of the course consisted of multiple linked elements: a PowerPoint presentation, an interactive web-based poll and a discussion forum. On-line and paper based resources were also identified. Students were encouraged to log on to the course website at the normal lecture time (9.15 am on Wednesday morning) and to follow the PowerPoint presentation. Within the presentation students were then asked to consider the key features that were required for effective face-to-face learning and likewise for effective on-line learning. They were asked to follow a link to the interactive polls on the website and vote for the three features they felt were the most important in each of these learning contexts. On returning to the PowerPoint presentation they were encouraged to reflect on their views and move on to the on-line discussion group to share and discuss their reasoning with the group. The learning context was, to an extent, within the control of the individual learner: students could choose to log on via a computer on campus or at home. Alternatively all the course elements could be accessed via the XDA, in which case students may be in bed, on the bus or in a coffee bar in town. The material within the course was designed in accordance with the session goal. The material was developed in a manner that

allowed it to be accessed across multiple platforms. The PowerPoint slides were simple with audio annotations and no images in order to ensure that, if students chose to use their XDA, the file could be downloaded with minimal delay and viewed easily on the small screen. During the one-hour lecture session learners were required to be discursive, adaptive, interactive and reflective with the support of multiple media and a choice of technology platform and location. The online group forum remained as a repository of the discussion, as well as providing storage and exchange facilities for other student generated data.

3. Data Collection

Throughout the course a great deal of time and attention were paid to the issue of data collection and evaluation. This was extensively discussed with the students as part of the process of developing their understanding of data collection issues. We covered the benefits and problems associated with different kinds of data, as well as attendant issues such as privacy and consent. The following data was collected:-

- University E-mail traffic between course participants was logged from week 4 onwards. When an email was sent between two or more people involved in the course we know whether it was sent via the XDA or not.
- Email checks on the COGS server were logged as coming from either the XDA or another device.
- Access to the course web site was similarly logged as being with the device or not.
- Backups of the devices allowed use of other functions, such as the calendar, to be logged.
- Complete record of the e-mail exchanges via the online group.
- Data on student attitudes and learning preferences from a poll taken during the online session.
- Video and still photography from the postgraduate student led session.
- SMS data showing the patterns of collaboration during the student led session.
- An end-of-course questionnaire produced data about student study habits, external access to technology and their attitudes to the XDA. It also covered their preferred input methods and feelings about the usefulness of the software/functionality provided.
- Qualitative data from notes taken during an end of course evaluation session with the postgraduate students.

4. Preliminary Data Analysis

4.1. What did the students think of the device?

Attitudes ranged from enthusiastic to antagonistic, with most students recognising the potential of the technology but making statements such as "*the device isn't quite there yet".* Others felt that they had not really had the opportunity to engage properly with the device, either because they had to share one "*… little incentive to use calendar etc when you only have it for 3 non consecutive weeks"*, or because handing it back at the end of the course limited how much data they were willing to put onto it *"It wasn't **my** device so I didn't bother putting stuff on it"*. Interestingly, very few students took the opportunity to synchronise the device with a home PC (the third party software we purchased for Mac sychronisation has proved to be problematic).

The large number of different functions available were also considered off-putting by some *"you can do too much stuff on it, who needs all that?"* and *"our lives are not complicated enough to require the use of these devices"* A major issue, which engendered much discussion, was the size of the device in relation to the large number of functions it tries to provide. As one postgraduate student put it *"It's too small and too big – carrying it around is a major issue".* This seemed to be the case particularly for male students who were used to being able to carry a small mobile phone around in a pocket. When used as a phone the device was generally considered clumsy and too large, on the other hand the screen was too small to be used comfortably for the integrated Office functions (Word and Excel) or for web browsing *"a small laptop would make more sense".* The reliability / trustworthiness of the device was another issue often raised, some of the devices were particularly prone to freezing / crashing, others had problems with GPRS (web) access and a number of students lost all data when the battery was not recharged in time. Other students underused the device because of concerns about inadvertently exceeding the data download allowance on the tariff. We purchased 3rd party software to monitor data traffic, but this too proved unreliable. As we were unable to get figures for use from the air time service provider this

created a climate of nervousness among the students, they were concerned about incurring debt if they used data above the agreed tariff. Most students tried at least half of the functions offered by the device (figure 1), although e-mail came out a clear winner as its most useful feature (figure 2).

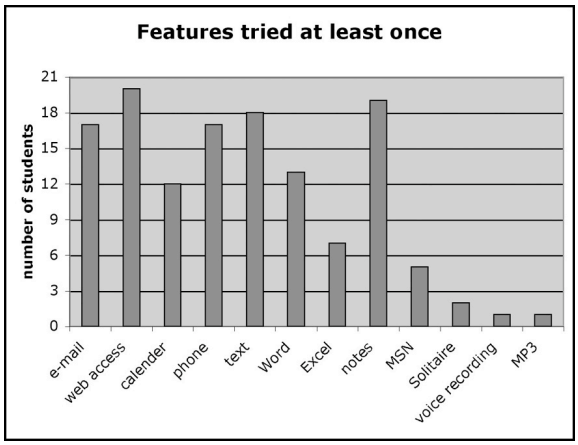

Figure 1 Features of the XDA tried by students

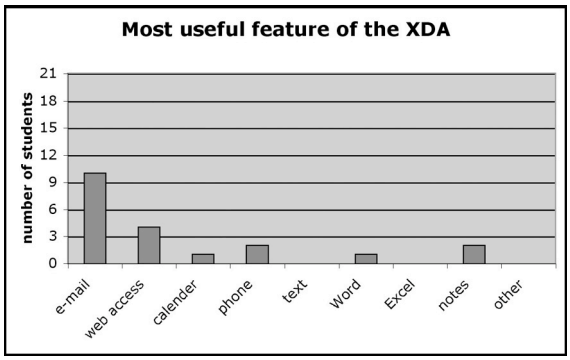

Figure 2 The feature considered most useful

Having used the XDA, and explored how it might be used within an educational context, the students were asked whether they saw a clear educational use for the device (figure 3)

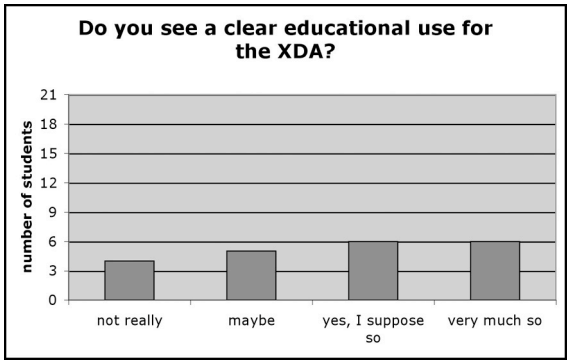

Figure 3 Student views on educational use of the XDA

4.2. What kind of Learning Resources do Students Value?

4.2.1 The on-line learning experience in week 8

Students were enthusiastic about this session (described earlier) and joined in during the normal lecture time (9.15am on a Wednesday). They accessed the PowerPoint slides from the website and voted in the polls. The most popular selections for the three key features vital to the success of a normal lecture and seminar based face-to-face teaching experience were:

- Approachable, knowledgeable & enthusiastic tutors: 25% of the votes cast.
- Fully resourced course website: 13% of the votes cast.
- Opportunity to take part in group work: 12% of the votes cast.
- No students felt that interactive media in lectures or State-of-the-art technology resources were key features here.

Similarly, the most popular selections for the three key features vital to the success of a distance and on-line course experience were:

- Tutor support on-line: 24% of the votes cast.
- Web resources: 17% of the votes cast.
- Conference environment and email: 14% of the votes cast.

In both cases the tutor's role was seen as the key feature and tools to support or opportunities to take part in, collaborative group work were seen as important along with web based resources. 82% of the students thought it was harder to design resources for an on-line learning experience than for a face-to-face one. In addition to this, Internet access was viewed as the most important technology for both on-line and face-to-face teaching situations. Students want to be connected and this is one of the key features devices such as the XDA can offer.

Students were engaged and willing to continue on to the discussion forum where 52 messages were posted. Several students also took advantage of the chat room too, though there is no record of this discussion. A content analysis of the messages posted to the discussion forum reveals that the largest category of talk was about the technology and its operation. However, there were also large

amounts of discussion about the key features for learning in distance and face-to-face contexts. Examples from the different types of talk included:

- Context/process

  Mmmm.... waking up almost an hour later than usual, looking at the slides whiles still in bed and listening to the audio over breakfast. Am now planning on taking the bus and continuing the lecture with my xda... how nice :o)

- Operational/Technology

  I'm battling with a UNIX terminal, not good for media, to (sic.) slow.

- Key features of a VLE/F2F the "Asker" polling system.

  Well, I have answered the first set of questions and here are what I said and why:
  Enthusiastic tutors, interesting and accessible books, and up-to date content. I think these are the most important characteristics for a face-to-face course.

Figure 4 illustrates the content breakdown within the discussion forum.

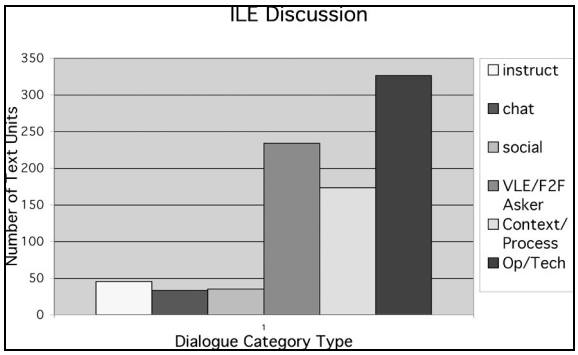

Figure 4 Discussion Forum Messages (repeated text and header information excluded)

4.3. E-mail and Web Logging Data

This data is still in the process of being analysed, but the preliminary findings show some interesting usage patterns. The e-mail logging only began in week 4 of the course. This was due to extensive discussions held with the students about issues of privacy regarding their use of e-mail and who they were mailing. The decision was made to only log e-mail *traffic* between course participants, not content, nor e-mails sent to individuals outside of the course. Not surprisingly the course admin team come out ahead in the average number of e-mails sent to course members, both using the device and not using it. The postgraduates were more frequent users of the device overall for e-mail, but the undergraduates were at the severe disadvantage of sharing devices so not being able to use it to access their *personal* e-mail. E-mail traffic from the undergraduate device came from a group alias set up for the course, therefore we need to consider carefully how this data might be used for comparative purposes. Access to the course web site, on the other hand, did not have the same kind of restrictions (Figures 5 and 6). The overall ratio[3] of postgraduate to undergraduate use of the XDA for accessing the course Web site is 1:0.7, whereas for access to the web site using other devices it is 1:1.5. Overall the undergraduates used the course web site more when not using the XDA.

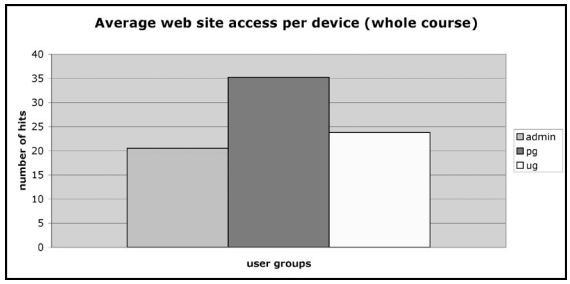

Figure 5 Average web site access per XDA device

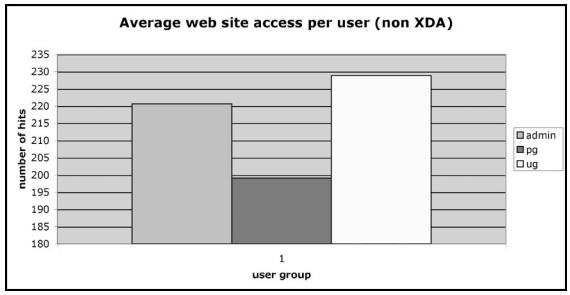

Figure 6 Average web site access per user (not using the XDA)

There are interesting weekly fluctuations in all of the data, these will be examined in the light of different course requirements for the undergraduate and postgraduate groups during those periods. Hourly patterns of use are also interesting showing that students are active and online even in the early hours of the morning (figure 7)

[3] Normalised data from 9 postgraduates and 19 undergraduates

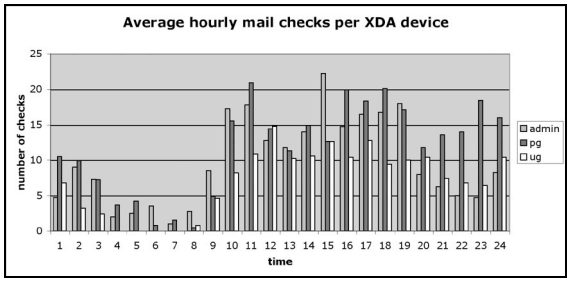

Figure 7 Hourly patterns of use with the XDA device

Data gathered from backing up the device is, unfortunately, patchy. Students did not always bring in the device at the required time, others forgot to recharge the battery resulting in data loss for that period.

5. Preliminary conclusions

The overall feeling from both the course team and the students was that this was a worthwhile exercise to have undertaken, allowing an investigation of the use of such devices within an educational context. In particular, it allowed students who were interested in becoming developers of such technology the opportunity to explore not only design and usability issues, but also the pitfalls encountered in the "real life" use of them. From the perspective of the course team a number of valuable lessons were learnt, the most important being that once you add the feature of "online connectivity" to a device the administrative burden increases dramatically. Particularly onerous was the task of dealing with the company responsible for airtime billing, trying to negotiate sensible tariffs at the start of the project, finding out usage information during it (not possible!) and then renegotiating tariffs when we found we would have been better off on a different scheme.

An enormous amount of time was spent maintaining the devices in full working order. As was mentioned above there were numerous problems with the devices – in particular GPRS access, installing third party software, resolving problems with *that* software when it turned out to be buggy and, finally, negotiating the thorny issue of tariffs and billing. As the devices had been given to the students to use "as their own" there was the issue of who paid the bills. The project paid the basic tariff for a limited number of phone calls and a 20 Mb download limit, students were then to pay any excess usage. While this turned out to be a generous limit overall, the lack of adequate software for logging data use made some students overcautious, in that they did not use the device very much in case they incurred charges. This over caution represented the extreme end of a pleasingly responsible use of the devices by the students, none of the devices were damaged or lost, although one SIM card went missing when a student removed it in a shop to try it in another device.

Initial results on the use of mobile technology, such as those reported in Mlearn 2001, 2002 and in the 2002 IEEE workshop (Milrad, Hopper and Kinshuk, 2002) have been encouraging. Researchers have suggested, for example, that mobile learning enhances autonomous and collaborative learning (Cereijo Roibás and Sánchez, 2002), and that it can be applied to a wide age range of students (Inkpen, 2000; Perlin and Fox, 1993; Sharples, Corlett and Westmancott, 2002 and Soloway, Norris, Blumenfield, Fishman, Krajcik and Marx, 2001).

The evaluation of *this* learning experience, in particular the contribution of the technology is ongoing. However, the initial analysis discussed here would suggest that the provision of coherent learning opportunities and episodes mediated by technology and accessible through multiple devices is possible. Students engaged well with the week 8 session on distance learning. They used the XDA and/or a desktop machine to interact with the PowerPoint presentation, they voted using the website "asker" and could watch as their peers did likewise and the representation of this data adapted accordingly. They joined in the discussion and reflected upon their differing views. Indeed the discussion continued long after the allocated session had finished. The success of this particular session is captured in the previously cited comment from a student who took part:

Mmmm.... waking up almost an hour later than usual, looking at the slides whiles still in bed and listening to the audio over breakfast. Am now planning on taking the bus and continuing the lecture with my xda... how nice :o)

Other emerging positive findings are illustrated by the use of the device for accessing and interacting with information: the course website, and for course based email exchanges. The students who had sole use of an XDA used it for both types of activity, throughout the day and most of the night. The device enabling them to experience the promise of anywhere, anytime connectivity with learning resources both human and electronic. The technology certainly can support the iterative

dialogue we know must take place for learning to be effective. However, this is not universally the case, with students reticent about using the device and failing to engage with much of its functionality. To be successful, designers of Interactive Learning Experiences that involve this type of mobile connectivity need to provide:

- a strong focus for the activity to engage learners with the concepts of the domain to be learnt, with regular reminders throughout the interaction.
- activities that require a clear and simple use of a very limited set of the functions available through the technology.
- regular support from peers and teachers both face to face and on-line

They also need to be able to access a vast amount of technical support both before and during the course being offered.

6. References

Inkpen, K. M. (2000). Designing Handheld Technologies for Kids. Personal Technologies, 3(1&2), 81-89.

Laurillard, D. (2001) Rethinking University Teaching, Routledge

Milrad, M. Hopper, H.U. & Kinshuk (eds) (2002) Proceedings IEEE International Workshop on Wireless and Mobile Technologies in Education, August 29-30, 2002, Växjö, Sweden. IEEE Computer Society 2002

Perlin, K., & Fox, D. (1993). Pad: An Alternative Approach to the Computer Interface, Proceedings of SIGGRAPH '93 (Vol. 93, pp. 57-64). New York, NY.

Cereijo Roibás, A. & Arnedillo Sánchez, I. (2002) Pathways to m-learning. Proceedings of the First European Workshop on Mobile and Contextual Learning, Birmingham, UK, June 2002 pp 53-56

Sharples, M. (2003) Disruptive Devices: Mobile Technology for Conversational Learning. International Journal of Continuing Engineering Education and Lifelong Learning, 12, 5/6, pp. 504-520..

Sharples, M., Corlett, D. and Westmancott, O. (2002) The Design and Implementation of a Mobile Learning Resource. Personal and Ubiquitous Computing, 6, pp. 220-234.

Soloway, E., Norris, C., Blumenfield, P., Fishman, B., Krajcik, J., & Marx, R. (2001). Handheld Devices are Ready at Hand. Communications of the ACM, 44(6), 15-20.