

Interactive Logbook: The Development of an Application to Enhance and Facilitate Collaborative Working within Groups in Higher Education

Paul Kiddie, Tom Marianczak, Neil Sandle, Larry Bridgefoot,
Chet Mistry, Dan Williams, Daniel Corlett, Mike Sharples, Susan Bull
{PDK140; TMM139; NNS122, LMB148; CXM129; DPW146; corlettdj; m.sharples;
s.bull} @bham.ac.uk

*Department of Electronic, Electrical and Computer Engineering
The University of Birmingham
Birmingham
UK
B15 2TT*

www.interactivelogbook.tk

Abstract

This paper describes the development of Interactive Logbook, an application designed primarily for University students, to facilitate and enhance individual and collaborative learning in higher education. Interactive Logbook exploits the Tablet PC architecture to incorporate wireless communication, natural handwriting input, context awareness and provides a seamless integration of tools for learning, collaboration, and time management. The development follows closely the socio-cognitive engineering methodology (Sharples et al., 2002) for the human-centred design of educational learning technology. In addition, usability evaluation techniques such as card-sorting, heuristic evaluations and field studies have been used to ensure the system interface is intuitive, uncluttered and easy to use.

Keywords: Tablet PC, Collaborative, Computer Supported Collaborative Work, Higher Education, Context Awareness, Groupware

1. Introduction

A recent development within education, particularly higher education, is support for group and collaborative learning. Previous research has shown that peer collaboration is an effective means of learning (Johnson, Johnson & Smith, 1991; Collier, 1980). Although the results of this research have been available for over 20 years, it has only recently had a widespread influence within higher education. It is now accepted that a significant part of a degree should include working within small groups to the successful completion of a project. To benefit from groupwork, the students need to communicate and share ideas quickly and efficiently. New communications technology can offer tools for distributed teamworking, but these have mostly been designed for work in business teams rather than student learning.

The aim of Interactive Logbook is to *provide an integrated suite of tools to facilitate and enhance small group collaborative learning within higher education*. In conjunction with this aim, the emergence of tablet PCs as a viable alternative to desktops, laptops and PDAs was recognised and the increased mobility and accessibility of this form was harnessed to improve distributed group working.

A collaborative tool is not a new idea, nor is the ability to work wirelessly while mobile. Wireless and mobile technology for use within education has been available for some 10 years or more (Wayne, 1993), but only recently have the barriers to implementation such as cost and technology limitations been overcome.

A similar system is the CoVis Collaboratory Notebook (Edelson & O'Neill, 1994) which provided a knowledgebase to enable remote collaboration between students,

academic staff and professionals. However, this is now very similar to an internet message board and therefore somewhat limited and outdated. There has also been development of software tools that aids students to organise their studies more effectively. These are not necessarily collaborative applications, but they indirectly increase peer collaboration through greater organisation and local access to resources. A recent example of such an application is the Student Learner Organiser (SLO) (Holme & Sharples, 2002). This was designed for the Pocket PC and provided a mobile platform for students to organise their studies, including tools for time and resource management. Several key points were taken from this project, including the necessity for such organisational tools, and the need for a mobile device to provide anywhere, anytime access.

2. Development Procedure

To complete the complex task of building such an application, a Socio-cognitive Engineering methodology (Sharples et al., 2002) was adopted. This allowed an analytic approach to the design of human centred technology. Through consideration and combination of several different viewpoints, it facilitated the development of system but ensured the main focus throughout the development was on the user.

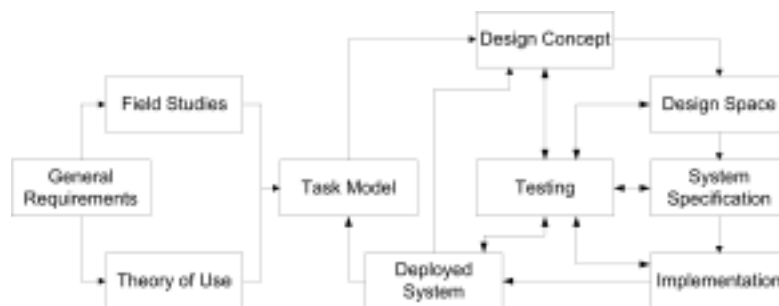


Figure 1: Socio-cognitive Engineering Methodology (Sharples et al., 2002)

Socio-cognitive Engineering breaks system design into building blocks, each of which is necessary to deliver a successful application, as outlined in Figure 1 above. The left hand side, including General Requirements, Field Studies and Theory of Use, provides a user-orientated approach to the analysis of activity and theory, related to small group collaborative learning. The Task Model integrates these into a coherent depiction of how students learn together with their current technologies. The Task Model also indicates limitations of current learning and teamwork practices that can inform the design of new technology. It enables an iterative process of system design and evaluation, which is represented by the right hand side.

3. Aims and General Requirements

Interactive Logbook is intended to assist students in coordination and collaborative problem solving, through previously gained knowledge. Its prime purpose is not to support basic learning or knowledge gathering.

The initial general requirements were identified by undertaking brainstorming sessions with potential users from different academic backgrounds. The requirements include the ability to effectively communicate, to share resources and information, and to create collaborative documents. In addition the brainstorming sessions showed the necessity for personal and group organisational tools including a possibility of contextually aware devices were highlighted.

The Theory of Use was constructed through research into cognitive processes and social interactions surrounding the collaboration of students to reach a common goal. The findings of this research showed that advantages of collaborative learning over independent study lie in the processes of articulation, conflict and co-construction of ideas between

collaborating peers (Crook, 1996). Dillenbourg et al. (1996) suggest that when considering such processes it is necessary to differentiate between learning and problem solving and, in addition, between collaboration and cooperation.

Consideration of the differences between collaboration and cooperation suggests that Interactive Logbook should be designed to ensure a high level of mutual contributions towards attaining a common goal. This is in contrast to simply dividing work between group members. Facilities should be provided to ensure that coordination is simple and effective amongst group members, and that contributing to a task while interacting with group members is feasible and simple.

The concept of an electronic workspace was proposed by Smith et al. (1991). This can provide a shared visual space for co-construction of ideas. In addition, a common factor of both socio-constructivist and cognitive theories of learning is the importance of rich communication for building and sharing knowledge. A key requirement, therefore, is the provision of tools to enhance communication and knowledge sharing.

In combination with the Theory of Use, the field studies attempted to discover the requirements of potential users. The field studies were questionnaires, scenarios and focus groups, which pointed to a core set of requirements. These included natural handwriting input, peer messaging and time management facilities and would be provided in the final application.

4. Ensuring Usability

Usability issues were highlighted during design and development, through the use of field studies undertaken with several groups of potential users and experienced usability experts.

Possible interface designs were drafted and these were shown to groups of students, for them to select and modify. In addition, fifteen students from a cross section of courses took part in a card sort. Students grouped related functions, such as Calendar, To Do's and Appointments into a common group which was named appropriately, Diary in this case. This ensures ease of use, as the target users are consulted throughout the design process.

The results attained gave the identification of four groups; Programs, Modules, Meetings and Diary.

5. Development Tools and Functionality

Interactive Logbook v1.1 is the first usable release compiled by the authors. The application employs the .NET architecture and utilises the Tablet PC SDK. Several UI components were provided by Divil. Figure 2 on the next page gives a typical overview of Interactive Logbook's interface.

The main source of user interaction is 'Launch Panel' to the right hand side of the interface, from which four separate sections exist.

- 'Programs' provides easy access to 'mini applications' from within Interactive Logbook, such as the Internet, text messaging to other peers, and freehand notes entry.
- 'Modules' provides access to teaching material on the users request by the selection of a module. It also provides related lecture material if a particular lecture is about to begin.
- 'Meeting' provides collaborative tools such as access to previous group minutes and initiating of a peer to peer whiteboard session.

- 'Diary' provides time management features. These include to-do's and appointments, represented in a Calendar view.

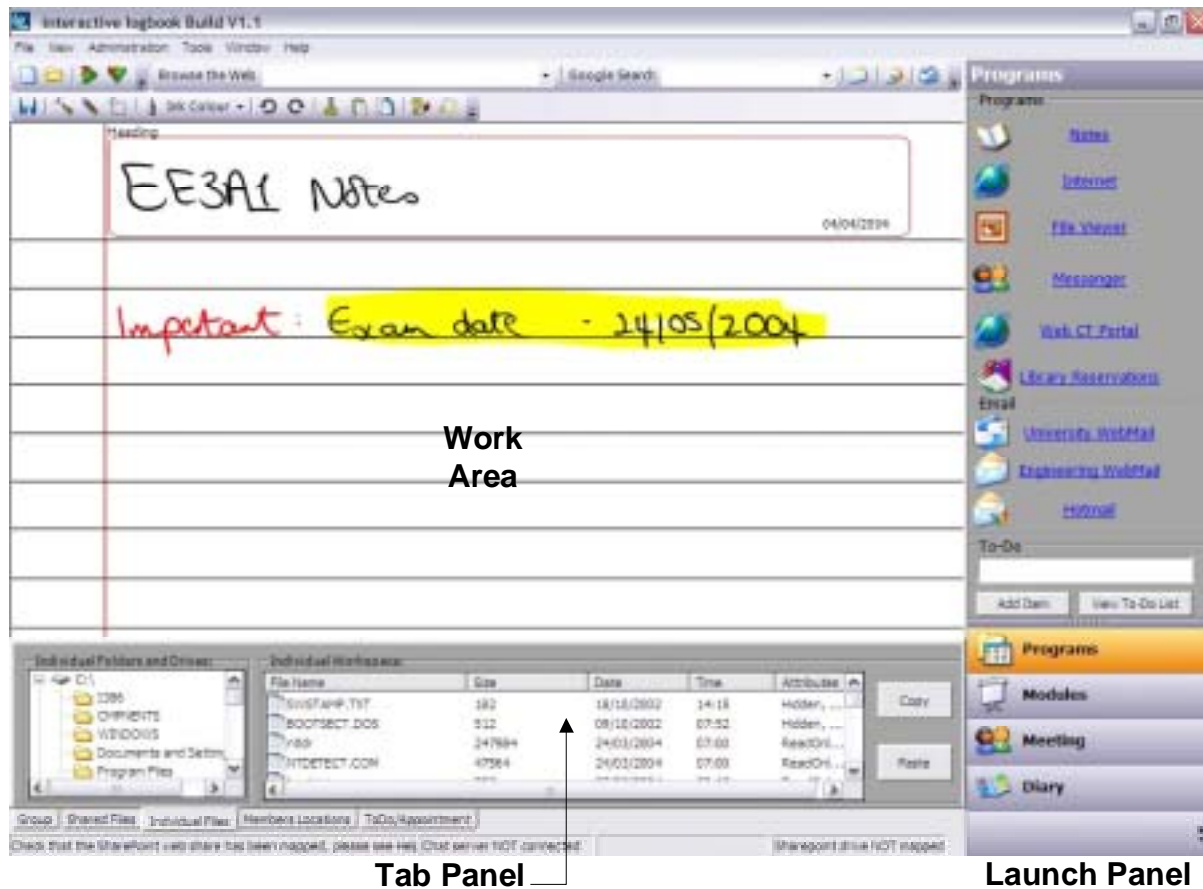


Figure 2: The Interactive Logbook User Interface

Furthermore, a 'Tab Panel' located towards the bottom of the interface provides the student with access to shared group resources and private resources. It also allows simple file manipulation. Location sensing of other group members is provided by the Ekahau positioning engine (<http://www.ekahau.com>). Some functionality is provided for users who belong to a number of project groups. The swapping of the present group environment is permitted to access related files to that group.

Finally, administration, though in its infancy, is present in this release of Interactive Logbook. The features provided allow the use of Interactive Logbook on any shared network space and the use by lecturers to add material thus allow the time based provision of correct teaching material. Lastly, administrators may create year timetables that can be offered to students providing reminders and related teaching material from the Interactive Logbook system.

6. Further Developments

Interactive Logbook is still in its infancy. The authors are committed to utilising feedback gained from the initial release to further improve usefulness of the system.

Developments will be made on the collaborative features to develop its usefulness in group working scenarios; team whiteboard sessions, ink messaging and administration of teams by the Interactive Logbook server. In addition, the authors will ensure existing features are as comprehensive as possible, such as adaptability of the software depending on the environment of the student, the addition of multimedia elements to notes and administrative tools. Finally the reliability of Interactive Logbook will be evaluated and improvements made to ensure more sophisticated data handling in shared environments.

The authors intend to continue development with an aim to establish Interactive Logbook as an indispensable tool for students using Tablet PC's.

References

- Collier, K. G. (1980) Peer-Group Learning in Higher Education: The Development of Higher-order Skills. *Studies in Higher Education*, 5,1 pp. 55-62.
- Crook, C. (1996) *Computers and the Collaborative Experience of Learning*, Routledge International of Psychology, London.
- Dillenbourg, P., Baker, M., Blaye, A. & O'Malley (1996) The evolution of research on collaborative learning. In Spada & Reimann (Eds.) *Learning in Humans and Machines*, Pergamon Press.
- Edelson, D. C., & O'Neill, D.K. (1994) The CoVis Collaboratory Notebook: Supporting Collaborative Scientific Enquiry. In A. Best (Ed.), *Proceedings of the 1994 National Educational Computing Conference*, pp. 146 – 152.
- Holme, O. & Sharples, M. (2002) Implementing a Student Learner Organiser on the Pocket PC Platform. *Proceedings of the European Workshop on Mobile and Contextual Learning*, Birmingham UK, pp. 41- 44
- Johnson, D. W., Johnson, R. T., & Smith, K. A. (1991) Cooperative Learning: Increasing College Faculty Instructional Productivity. *ASHE-FRIC Higher Education Report No.4*, Washington, D.C.: The George Washington University, School of Education and Human Development. (ERIC Document Reproduction Service No. ED 343465)
- Smith, R., O'Shea, T., O'Malley, C., Scanlon, E. & Taylor, J. (1991) Preliminary experiments with a distributed multi-media problem solving environment. In Bowers & Benford (Eds.) *Studies in Computer Supported Cooperative Work: Theory, Practice and Design*, pp. 31-48
- Wayne, C. (1993) Wireless Coyote: A Computer-Supported Field Trip, *Communications of the ACM*, 36, 5, pp. 57-59