Collaborative Learning in Virtual Learning Environments:
An Interim Report
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Collaborative Learning in Virtual Learning Environments


The context of this work, Chapelstown and Harehills Assisted Learning Computer School (CHALCS), is well documented (Barker, 1998 and Ravenscroft & Hartley, 1998). The original (CASE) ESRC proposal for this research highlights the CHALCS context and, as the provisional thesis title (above) suggests, emphasises the collaborative capability afforded by New Technologies such as the Internet. It also declares a need to evaluate the impact of these Technologies on student’s learning. Such evaluation has informed the current intention of supporting student’s acquisition of the Key Skills of Communication and Information Technology (Department for Education and Employment, 1999) as well as the acquisition of discipline-specific Physics course notes delivered over the Internet.

2. Research Aims.

Table 1 shows the Research Aims which were formulated on the basis of the Research Questions which in turn were based on the original proposal. They have been subsequently specialised to the present context.

<table>
<thead>
<tr>
<th>Research Aims</th>
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<tr>
<td>1. To review educational benefits of collaboration between Agents (human and/or artificial)</td>
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<td>2. To review the educational benefits of ICT in the classroom</td>
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<td>3. To evaluate pedagogical models of effective ICT within a collaborative framework</td>
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<td>4. To adopt and test one pedagogical model for working collaboratively with ICT through the development of appropriate example materials in the Physics context at CHALCS</td>
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<td>5. To adopt a formative evaluation framework to test this pedagogical model by collecting data that will enable an investigation of emergent factors affecting learning in the context</td>
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<td>6. To draw conclusions concerning those factors affecting learning both in the pedagogical model and in developing key skills</td>
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<td>7. To draw conclusions concerning those characteristics of WebCT which are effective for learning</td>
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<tr>
<td>8. To specify mechanisms for the inclusion of relevant characteristics within WebCT to improve its support facilities - these mechanisms being to adopt an Agent-based approach to a user-centred design of a (limited) Learning Companion.</td>
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Table 1. Research Aims.

Note. WebCT is a commercially available, off-the-shelf Learning Environment providing an infrastructure for the delivery of lessons over the World Wide Web. (See http://www.ult.net)

Research Aims 1 to 3 are ongoing and will be presented in the final thesis. A three-phase pedagogical model has been developed and is being continually evaluated at CHALCS and, as discussed below, in the nearby future in other schools. It consists of Acquisition, Argumentation and Application (Barker 1999). Acquisition is concerned with the students obtaining the requisite knowledge from the course material and/or the tutor/peer interaction. The next stage, Argumentation, is concerned with the students corroborating internalised knowledge by seeking evidence, comparing or explaining, possibly in a social context. Finally, Application
emphasises skills, of both quantitative and qualitative problem-solving in an attempt to reinforce student’s newly acquired knowledge.

Aim 5 has partially been carried out at CHALCS in the form of a Case Study reported in detail elsewhere (Barker 1999) and mentioned below. This has led to some conclusions which satisfy Aims 6 and 7 most notably that WebCT requires additional functionality (Aim 8). The proposed solution is to design an artificial Learning Companion, in-keeping with the notion of Social Learning Systems (Chan, 1996) with which students collaborate to produce a summary document. This was derived from the inadequacies of the WebCT ‘my-notes’ facility in terms of scaffolding the summarisation process as well as consideration of Chan’s wider social computing vision with it’s particular relevance to the National Grid for Learning (DfEE, 1999).

3. WebCT Overview.

WebCT was chosen as a delivery mechanism for an on-line Physics module in Astronomy and Optics. This decision was made on the basis of a survey of web-based learning environments and component solutions made in the early stages of the research together with such pragmatic concerns as favourable licensing arrangements, platform independence and support (Barker, 1999). Figure 1 shows a typical WebCT session in the Lenses module.

![WebCT Interface](image)

**Figure 1. WebCT Lens Module.**

From the figure we can see the various tools offered by WebCT along the top frame (i.e. glossary, search, chat, bulletin board, email, ‘my notes’ and links to external URLs). The menu to the left of these tools allows navigation through the course notes. The frame along the left side of the figure headed ‘Lenses’ shows the
path through the notes thus giving students an overview, the red marker indicating their current position. The main notes screen here shows the lenses diagrams. The red underlined text indicates a hyperlink to the glossary. When these are selected a separate window is opened containing definitions, etc. as can be seen in the upper right area of the figure.

Preliminary evaluation (relating to Research Aims five and six) indicated that there was a need to supplement the functionality provided by WebCT so further studies were designed to elaborate upon this requirement thus leading to answers to the final two Research Aims. The ‘my-notes’ facility provided by WebCT was considered to be most in need of improvement. It is shown in Figure 2.

![Figure 2. WebCT ‘my notes’ facility.](image)

There are four options available, as indicated in the figure, consisting of:

1. **Edit** – a window pops up allowing the user to enter text for their annotation of the current page of course notes (N.B. There are no wordprocessing type facilities e.g. spellcheck, formatting, etc. and hyperlinks are not active)
2. **Delete** – this operation simply removes all annotations from the current page, i.e. individual notes cannot be selected
3. **View All** – this produces a list of all annotations across all modules
4. **Page List** – this produces a list of hyperlinks consisting of course page titles, selecting one of these produces a list of all the annotations for that page (i.e. this is a simple indexing capability)

It can be seen that this ‘my-notes’ facility does nothing to support the process of summary construction. Furthermore, as the above list indicates the facility is lacking certain essential word processing features as well as intuitive and complete editing capabilities. Also, URL’s pasted into the annotations are not active so that links, for example, to glossary definitions appear as a meaningless URL. Therefore the aim of the study detailed here was specifically to identify student’s needs in terms
of ICT support when creating their own summary documents which were poorly supported by the current version of WebCT. They were, however, exceedingly important in creating a solid foundation in the initial Acquisition stage.

4. An Investigation of Summarisation.

The subsequent Case Study involved two CHALCS Physics students who were asked to summarise a portion of the WebCT ‘Lenses’ module. Microsoft Word was used for the purposes of constructing the summary. One of the subject’s screens was filmed and WebCT on-line data captured for later analysis. First, we demonstrated the use of Word which was followed by a tutor-led discussion on student’s beliefs of summarisation. Next, students produced their summary documents by cutting and pasting from WebCT to Word and making any necessary amendments. After about 45 minutes the students were asked to stop summarising and another tutor-led discussion took place on summarisation experiences. Next, the students swapped documents and used the Word annotation facility to comment on each other’s work. Finally, this was followed by another class discussion.

Analysis of the Case Study data (i.e. tutor-class transcripts, video, WebCT data and summary documents) at CHALCS has recommended a number of features of student’s current summarisation skills and areas in which additional support would prove useful. These include the following suggestions to aid students’ decision-making, transfer and reflective review phases:

1. A scratch-pad for jotting ideas and diagrams.
2. A decision-aid to selecting pertinent text.
3. A database of equations, diagrams and definitions.
5. A flexible underlying process model
6. A complimentary ‘personality’.

Two distinct processes of summarisation were identified in the students, notably that the more able student used a straight-forward three stage decision-transfer-review strategy in constructing their document whereas the less able student employed the notion of a ‘scratch-pad’ and a re-draft strategy. Hence the need for the further support to be flexible.

Future studies are being designed to incorporate users into the design process of the Learning Companion. This will involve students and teachers in the evaluation of all aspects of the Companion including the User Interface/Personality and the behaviour as evident in, for example, the collaboration strategies and the actual summary document produced. These studies will aim to strengthen the applicability of the companion to a number of different situations as encountered in various combinations of summary document to be produced (e.g. abstract, revision notes, overview), student variations (e.g. strong and less able) and course note types (e.g. entity/concept - Properties of Light and instrument/process - Lenses).
5. Future Work.

Future research will concentrate on the formative evaluation phase of the work by repeating the currently small case study with a larger number of students. It is also intended to train the CHALCS Physics tutor as a course designer thus enabling home-grown WebCT courses. The study will be followed up with a more informed design phase of the Learning Companion in keeping with further emerging factors. However, this line of approach excludes the necessity of implementing the full Learning Companion system as computer software. Instead, it is proposed to evaluate the design using a Wizard of Oz (WoZ) technique (see Kemp, 1997) with a small sample of students so that an intelligent systems component can be simulated and subsequently validated at the design stage leading to a complete design specification and partial implementation. Currently, the precise mechanisms required to undertake this study might include the development of software such as a collaborative text-editor and a virtual animated ‘puppet’ together with a chat applet which could all be controlled by the simulated companion or ‘Wizard’. Figure 2 illustrates these ideas with the Hanabero collaborative environment open with three windows: a text editor, a whiteboard and a chat tool. The Text Editor is used for collaborative construction of the summary document, the Whiteboard is used for dynamic display of the appropriate icon (which can be an animated Gif loaded by the collaborator) and the chat is used to simulate the dialogue between student and Companion.

![Figure 2: Hanabero Tools: Text Editor, Whiteboard and Chat Used in Conjunction with WebCT (showing Physics Course Notes)](image)

6. Conclusions.
This document has presented an argument for the implementation of a Learning Companion as part of the remit for a wider research project at CHALCS. Some of the Research Aims are beginning to be met whilst others are continuing and will be reported in the final thesis. The rationale for the Learning Companion is stated herein including a brief report on a pilot study leading to thoughts on the Companion’s design. It is currently intended to re-run the summarisation experiment at CHALCS with current students leading to an appropriately more detailed design conceptualisation which will utilise a Wizard of Oz approach in conjunction with local schools. Subsequent work will involve implementing a proof-of-concept of the Learning Companion which is intended to benefit CHALCS students by providing assistance in making their own notes and in collaborating with peers.


