An Investigation and Design of Networked Learning in Inner-City Leeds

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Abstract

A pedagogical framework for the implementation of a World Wide Web based course at an inner city Leeds school is described together with a detailed study of students own summarisation of course notes contained therein. Results of this study lead to some recommendations, principally that an artificial Learning Companion would help with the summarisation *process*, a feature which is lacking with the present support tool. Finally, an overview of a preliminary design for such a Learning Companion is presented as future work.

Introduction

Chapeltown and Harehills Assisted Learning Computer School (CHALCS) is an inner city Leeds school providing tuition and a supporting environment for pupils out of their normal school hours (Barker, 1998). The Computer Based Learning Unit at the University of Leeds has a long-standing research relationship with CHALCS and has in the past provided help in Science topics (Mohammed, 1996) and in evaluating CHALCS' effectiveness (Ravenscroft & Hartley, 1998). The work reported here is based upon the development of a novel Physics course in Astronomy and Optics utilising WebCT, a commercially available Virtual Learning Environment (Barker, 1999). This work aims to introduce Information Communications Technologies (ICT) to the CHALCS context together with an appropriate pedagogical framework then evaluate the utility of the approach.

This paper begins with an introduction to the pedagogical framework adopted for this work. An investigation which aims to highlight the difficulties students have with one key area of ICT use, i.e. creating their own notes, is then described together with the results analyses. The following section outlines the recommendations resulting from this investigation then finally conclusions are reached about the work so far and possible directions for future work are proposed.

Pedagogy of Networked Learning

A three-phase pedagogical model has been iteratively developed for the introduction of ICT-based learning at CHALCS. It consists of Acquisition, Argumentation and Application (Barker 1999). **Acquisition** is concerned with obtaining knowledge from the course material and can be likened to the processes of *accommodation* and *assimilation* (Ausubel, 1985). The next stage, **Argumentation**, is concerned with reinforcing internalised knowledge by seeking evidence, comparing or (self) explaining and is best carried out in a challenging social context. At a scientific level argumentation would involve the formal process of *deduction* (Johnson-Laird, 1988) particularly relevant in Physical experimentation. Taking a broader view, argumentation can be taught in terms of linguistic techniques, by exploring the connection between narrative and argumentative composition in both speaking and writing, examining planning strategies and providing argumentative resources (Andrews, 1995).

Finally, **Application** emphasises skills, of both quantitative and qualitative problem-solving (Ploetzner, 1998) in an attempt to further reinforce student's newly acquired skills and knowledge. Furthermore, collaborative problem-solving (Teasley 1993) exposes students to alternative viewpoints and corresponding explanations thereby challenging their own ideas and forcing them to adopt new problem-solving protocols.

These three pedagogical stages were considered in terms of the facilities provided by WebCT resulting in a suite of tools with an associated function for each of the stages. It was then possible to design tasks based on the available tools (plus Microsoft Word and face-to-face sessions) for each stage of the initial pilot work. **Table 1** illustrates this for a lesson on "Reflection and Refraction".

Stage	Tool	Function	Task
Acquisition	Compile & Word	Annotating own notes	Start to compile the Physics course notes then cut and paste them into word, adding your own thoughts as you see fit. These are your own notes. Complete this as homework.
Argumentation	Bulletin Board	Group based explanations & judgements	Discuss solutions to the following two problems using the bulletin board : a)... b) Ideally, how thick and how smooth should a glass window in a house be ?
Application	Whiteboard & chat	Group based model answer	Use the whiteboard and chat to solve the following problem as a group: "A person stands at the end of a swimming pool 8 metres in length ...What is the depth of the pool ?..."

Table 1. Mapping Lesson Tasks onto the Pedagogical Framework.

Although it appears from this overview that the three stages naturally progress linearly in practice this does not have to be the case. For example, it may be that students in the argumentation stage uncover deficiencies in their knowledge which requires backtracking to the acquisition stage.

An Investigation of Student's Summarisation Skills

Introduction

As shown above we are following a pedagogic framework based upon the literature and our evolving experiences in the field. These, together with the prescribed needs of the collaborating partner, i.e. CHALCS, led to the Research Aims (Barker, 2000).

Pilot work carried out at CHALCS led to the conclusion that WebCT required additional functionality in the form of an artificial Learning Companion to aid summarisation so a small study was designed.

Rationale.

From the Pilot work mentioned above it was found that the current WebCT 'my-notes' facility as shown in **Figure 1** does nothing to support the *process* of summary construction (Barker, 2000). The facility also contains only basic editing and no word processing capabilities. Furthermore, URL's are not active so that links, for example to glossary definitions, appear as a meaningless URL. Summaries are seen as essential in the Acquisition stage of the pedagogical model as they not only highlight key points of the course notes but also involve students in an active constructive process. Summarisation is in fact a Key Skill in the 'Communication' Unit, Level 2. (Qualifications and Curriculum Authority, 1999).
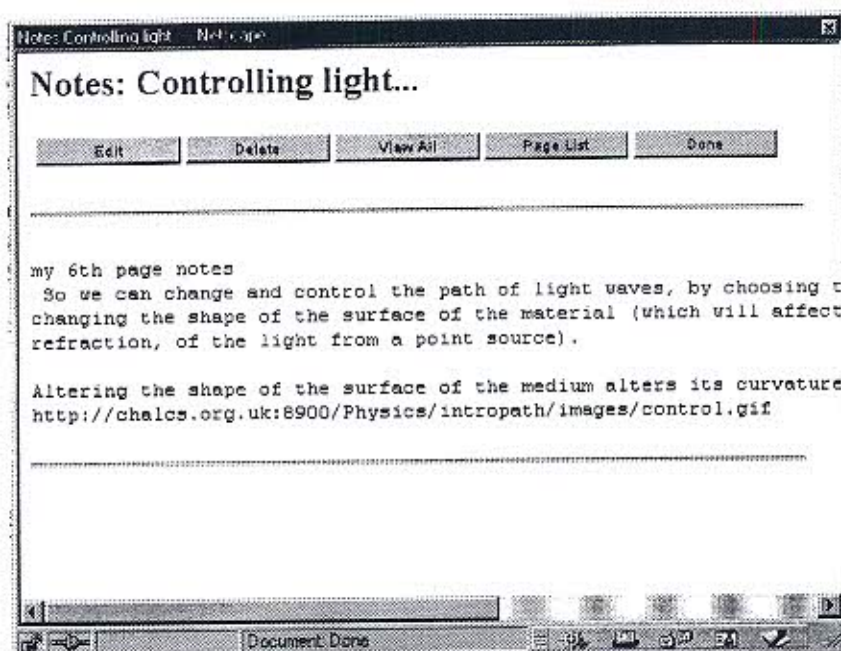
Figure 1. WebCT 'My Notes' Tool.

Therefore the aim of the study detailed below was to *identify student's needs in terms of ICT support when creating their own summary.*

Design.

Two subjects (females, age 17) were asked to collaborate in performing a summarisation task of a portion of the WebCT 'Lenses' module within the Astronomy and Optics course. They both study A Level Physics at the same school and have been attending CHALCS for a number of years. In answers to a question about "searching for the right information or taking the right sort of notes" S2 reported "I would benefit from note taking and note making to make appropriate notes" and S1 reported "I always get confused. I often have to do things several times because I don't have the right notes."

After a short demonstration, both subjects were asked to cut and paste from the WebCT notes into Microsoft Word then swap documents and comment on each other's work finally emailing their summaries to the Instructor. Artefacts collected for the purpose of analysis include video/audio tapes (later transcribed), Word 'summary' documents including the collaborators annotations (later annotated by the instructor) and WebCT data (e.g. page tracking logs).

Procedure

The video camera and microphone were first set up in the room pointing at S1's computer screen, having already secured her permission. Aside from being aware of the video data, the subjects were also aware that the WebCT on-line data was also being gathered.

We began by demonstrating how to have two windows open, one containing WebCT, the other containing MS Word then how to cut and paste text from the former to the latter. The 'compile' tool within WebCT was also demonstrated. Next it was necessary to demonstrate how to copy images from WebCT to Word. Subsequently, we demonstrated the use of Word's annotation facility by inserting a comment in an example document.

At this point we held a discussion with the students concerning their thoughts on effective summarisation techniques. The teaching style employed here and in subsequent

sessions was for the tutor to facilitate rather than dominate the discussion by eliciting students knowledge then encouraging them to expand their notions collaboratively.

The students were asked to summarise section 1 "Introduction to Lenses" which comprises of 6 sub-sections including a summary. They were reminded of the navigation facilities within WebCT then proceeded to cut and paste from WebCT to Word. In addition to capturing video and audio data classroom based observations were also recorded.

Towards the end of the summarisation session the subjects were warned that they would have to soon end then after 43 minutes they were told to stop summarising. At this point the summary documents were saved and swapped. The subjects were then asked to comment on each other's work by adding annotations. First though the tutor intervened to initiate a discussion of subject's impressions of their own and their collaborators summary document including eliciting strategies and decisions. The annotation activity was given just 11 minutes.

Following the annotation phase the tutor initiated another discussion concerning the differences between the two subject's documents leading to a discussion of summarisation method.

Results Analysis

Analysis

Both subjects responded well to the initial 'training' session with just the annotation demonstration requiring repetition. At this point they were quite proficient in WebCT, Windows and Word and cutting and pasting between the two packages presented no real problems. However, it did later become apparent that pasting WebCT hyperlinks into the Word document was ineffective as this resulted in an error and ultimately missing words ,e.g. ."Outer rays have a larger angle of incidence and hence a greater **Error! Bookmark not defined.**". This lead to confusion as picked up by S2's annotation : "the error has replaced many important words and therefore nearly all of the text doesn't make sense". It is worth pointing out that S2 avoided this possible error by making less use of cut and paste and actually typing her own notes or even writing and drawing diagrams on a separate piece of paper.

The initial tutor-led discussion elicited the subjects preconceived notions of the content and process required to produce a good summary. These included :

- *Shorter than the original text*: "Like a shortened version of what you've picked up from what you've…" (S1)
- *Recap of main points:* "it's easier to get information from if its like…if you recap the bits you need." (S2)
- *Need to decide what to keep* : "You keep what you thinks important and relevant…" (S2), S1 saying "that's the hardest bit actually"
- In Physics *equations, diagrams and definitions are important*
- Sometimes *diagrams are clearer than written descriptions* : "…some things, they're not obvious if you write out, like, a description you need to draw the diagram to show what you mean… (S2)
- Use *note form*, in particular "trigger points" (S2)

It was observed during the actual summarisation phase that both subjects read the course notes first before commencing construction of the summary. However, S1 employed traditional sequential reading techniques reminiscent of static texts whereas S2 employed techniques which take advantage of hypertext structure. Subsequent page tracking indicated

that during the actual summary construction both subjects navigated the course notes in exactly the same sequence, i.e. the pre-defined path.

A similar number of page hits were registered by WebCT in the study for both subjects (S1=32, S2=38). It is clear from the WebCT Hits Distribution, however, that S2 made greater use of the glossary facility whilst negotiating the summary process (see **Figure 2**). In addition S2 also read an article on the Bulletin Board.
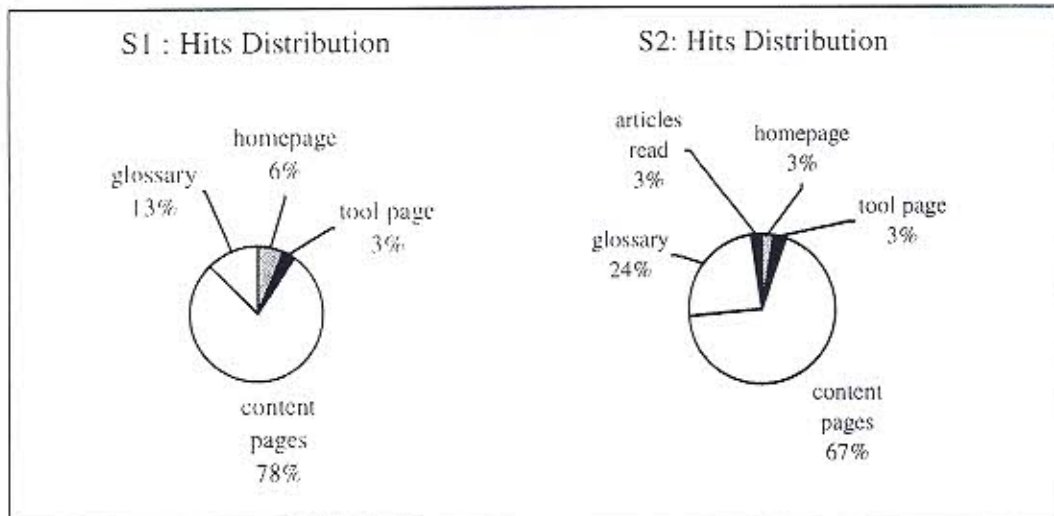

Figure 2. Comparison of Hits Distribution During Pilot

From the video it was noted that S1 employed a 'paste and complete' technique, that is sections of text are cut from the WebCT course notes, pasted then formed into complete sentences by typing. This technique was used extensively together with a separate 'editing' technique which was used more as completion approached. Upon a first draft S1 viewed the whole document, particularly looking at overall layout. As mentioned, the glossary hyperlinks did not work when copied and pasted into Word leaving error messages in the summary document. This resulted in S1 having to go through the entire document at the end and replace the errors with the actual word. Images were cut and pasted effortlessly to great effect. The Expert commented that both summaries were "very good" and that S1's was similar to their own.

Upon completion of the summary documents the ensuing tutor-led dialog revealed that S1 not only selected and edited on a sentence level but also maintained a contextual consistency between sentences by moving them around : "I've rearranged the sentences a bit because like you know like you read things in a different order". On the other hand S2 maintained the original sequence of notes : "I kept to the order it was in…". Interestingly S1 also stated that she added definitions from the glossary next to the appropriate diagram then consequently edited the text : "I've rearranged the writing to go with them". As already mentioned, S2 did not use cut and paste to copy glossary definitions but actually wrote them by hand then incorporated them into her summary.

S2 only made four comments on S1's summary commenting on S1's brevity ("This is quite good as it's very brief") and the hyperlink error already mentioned. S1 made nine comments on S2's summary, making quite detailed criticisms of her document. In particular she is concerned with S2's repetition ("this is the third time you've said this"), straight copying of text without explanation ("just straight copied out, no own notes made") and the general contextual consistency of the document ("this sentence has just been stuck in the middle of nowhere").

After completing annotating each other's documents the tutor-led dialog revealed that S2 had in fact repeated some information in her summary as pointed out by S1. It later became apparent that this was due to S2 thinking that this was just a first draft and would be subsequently refined, a method which she employs in her normal note-taking : "I didn't actually...edit that document". At the other end of the scale S1 relates "I just read it off, I never make notes" and is keen to point out the fact that she utilises "trigger points" forcing S2 to concede that "I don't pick up stuff that quickly".

Results

The need for S2 to have to write and draw on supplementary pieces of paper is indicative of the inadequacies of the cutting and pasting methodology and subsequently would be an ideal area for further support, for example a '*scratch pad*' for jotting down sections of notes. Editing of the pasted text is obviously an important part of summary writing, the subjects taking care to add appropriate words to form complete sentences and indeed carefully selecting the text in the first instance although less rigorously in S2's case. Further support could serve to scaffold this process in three stages :

1. in the initial selection **decision-making** (e.g. aiding selection of pertinent information)
2. during the **transfer** from one document to another (e.g. a *database* of equations, diagrams and definitions)
3. the subsequent **reflective review** process (e.g. employing notions of syntactic and semantic correctness both at the level of sentences and complete documents, especially checking cohesion)

This support would have to be **flexible** enough to allow subjects to utilise differing strategies in navigating the source material as evidenced above and shown in **Figure 3**. As shown S1 reads the course note sequentially whereas S2 utilised hypertext navigation more fully. Also shown is S2's use of the 'scratch-pad' and their tendency to produce a first draft then edit this. This is in contrast to S1's method of one draft only. Apart from the two extremes of summarisation techniques espoused by the subjects an interesting emergent factor of the dialogues is the dominating personality of S1 and almost submissive concessions of S2. Also, in terms of personality traits colloquialisms such as "like", "gonna", "sort of thing", "'cause" and "yeah" are much in evidence in the dialogues. Incorporation of these personifications in a summary support may prove advantageous (Lester, 1997) but require formative evaluation.

Conclusions

Further support is undoubtedly much needed to aid students when taking their own notes within WebCT due to the inadequacies of the 'my-notes' facility. From the study it has emerged that this support should include the following:

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.
4. A cohesion aid.
5. A flexible underlying process model.
6. Appropriate personifications e.g. colloquial dialogue (Barker, 1999)
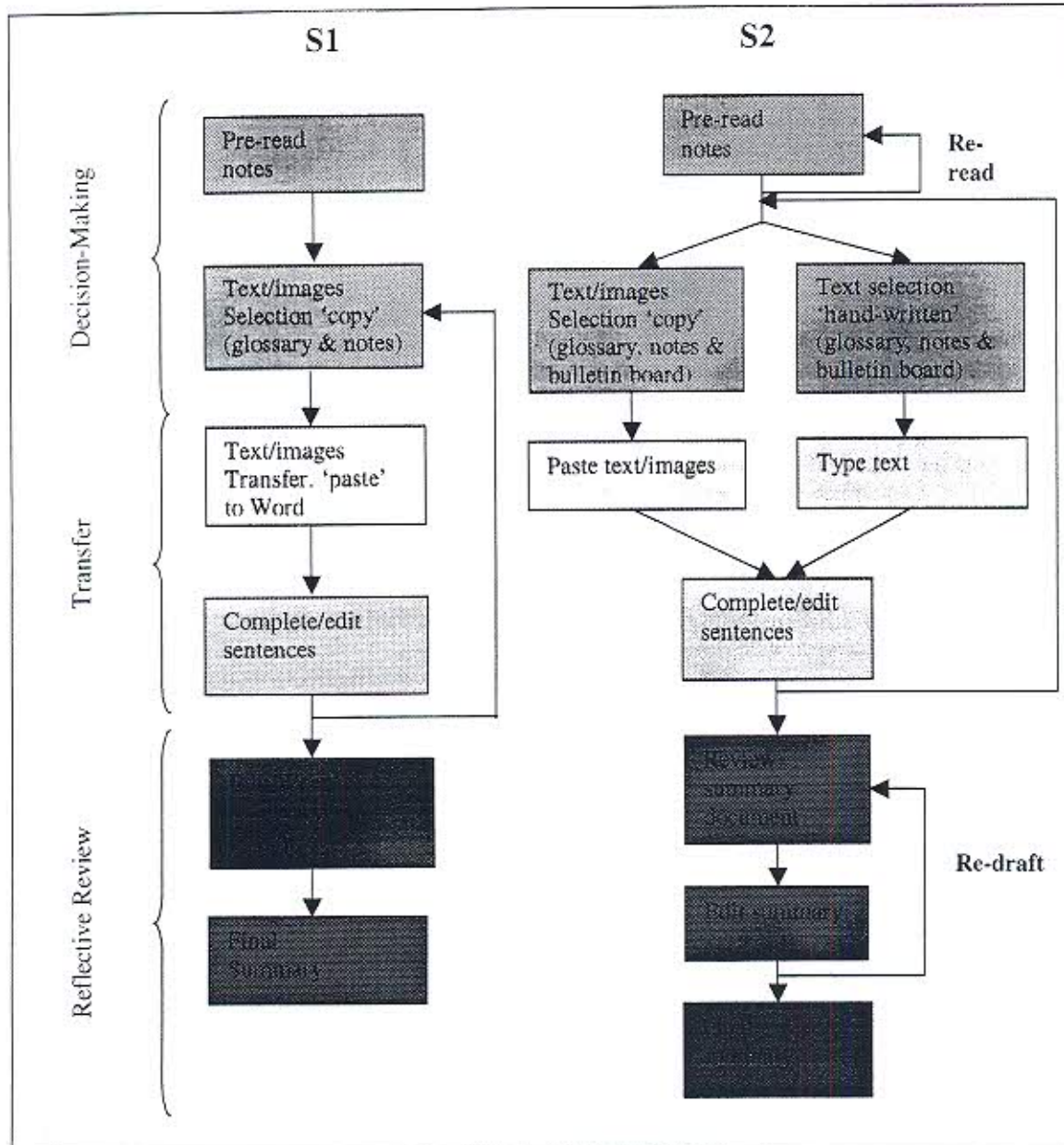
Figure 3. Summarisation Process Models.

One possibility is to expand upon this work by synthesising a number of relevant interventionist strategies as further support mechanisms. The proposal outlined below is to use a Wizard of Oz technique (Maulsby et al., 1993) to prototype additional support designs before they are coded in software summarisation support aids. However, this study has proved invaluable in highlighting some of the issues to consider in the design of the necessary additional note-taking and summary writing support which are currently not met by the WebCT 'my-notes' facility.

Recommendations

The proposal is to introduce an artificial Learning Companion to the WebCT environment. It is proposed to adopt an Agent-based approach (Woolridge, 1999) to the design of the Companion. A suitable model of collaboration between student and companion was proposed by Chan (1988) : " *while one is working on a problem, the other is watching and ready to give suggestions if asked. If they both run out of ideas, then the teacher may*