A Software Tool for Supporting the Acquisition of Metacognitive Skills for WebSearching

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INTRODUCTION

Some people enjoy searching the World Wide Web, do it frequently, and find it relatively easy to locate useful sites; but others find it more difficult, do it less often, and dislike the experience. This is evident both from everyday social contacts and from an earlier study (Lloyd, 2000)

This paper describes a study for the design of a software tool that aims to support the acquisition of metacognitive skills that are useful in web searching. It is intended to encourage novice users to reflect on their own cognitive role in the information-retrieval exercise, to improve their skills, and to achieve a more productive and enjoyable experience using the current generation of search engines and web browsers.

THE USER GROUP

Sixteen-year-old students at a college in East Sussex, UK, were targeted. 35 of them, studying Information and Communication Technology (ICT), were relatively experienced and confident web searchers; 20 of them, studying for a certificate in Child Care and Education (CCE), were relatively inexperienced and uncertain web searchers.

INITIAL QUESTIONNAIRE

While they were in a computer lab for a normal lesson, the students completed a questionnaire in which they were asked to imagine that they were searching the web for information for a group project. The questionnaire explored how they would carry out the search, what they liked and disliked about various aspects of web searching, and what improvements they would like to see that might make web searching easier and more enjoyable.

The main findings from the questionnaire were that

- All students showed a basic knowledge of how to start the search, in terms of what to type and/or click (e.g. type some keywords and click on the 'Search' button).

- The ICT students reported more frequent web searching than the CCE students, and they demonstrated more extensive and sophisticated knowledge of the facilities, techniques, and terminology involved.

- The ICT students showed a wider range of satisfaction level - they gave more replies along the lines of 'it's fine as it is', when asked if they could think of any improvements, yet they also made more, and more useful, suggestions for improvements to specific examples of search engine or browser functionality, such as the 'no results found' message or the way the 'Favourites' ('Bookmarks') and 'Back' buttons worked. The CCE students gave more 'don't know' replies.

- The ICT and CCE students tended to complain about different things. When they were asked what they disliked about their usual search engine, the quality of the information found was the most important factor for the ICT students, while for the CCE students it was the format and layout of the search engine screens. In reply to a more general question about desirable improvements to web searching, CCE students made more requests for better speed and connectivity, presentation, and ease of use, while ICT students made more requests for multimedia, better search engine functionality, and better quality/quantity of the information found.

Metacognition and web searching

Searching the web for information is a complex cognitive activity and it is proposed that the involvement of metacognition - or 'cognitive monitoring' (Flavell, 1979) - in the task may improve people's performance, as it has been shown to do in studies on, for example, reading, memory, and language acquisition (Yzerbyt, Dardenne & Lories, 1998; Forrest-Pressley et al, 1985). Besides the person, task and strategy knowledge proposed by Flavell (1979), planning ahead, monitoring, self-questioning, and self-correcting (Day, French & Hall, 1985) could all be relevant.

An example of 'person knowledge' might be a recognition that different people can, at different times, find it more or less easy to be distracted by things that are irrelevant or secondary to the main task; but that one can monitor whether or not one has become distracted, and control the direction of one's attention. An example of 'task knowledge' might be an awareness of the web as a vast collection of largely unorganised (yet inter-connected) objects of variable quality; an awareness of a browser as a tool that both interprets and displays web objects and has other useful functions such as 'Bookmarks' and 'History'; and an awareness of the useful role of search engines in indexing and/or cataloguing a proportion of it. Learning how to carry out other types of information access (e.g. in a library) often involves discovering the underlying structure of a collection - so when there is no obvious structure, searching may seem, to some, much more difficult. Similarly, inclusion of an item in a collection such as a library often implies some assessment of its quality and relevance, whereas anything can be put on the web. An example of 'strategy knowledge' might be knowing that 'searching' for any kind of information usually involves an iterative progression through different stages - specification and presentation of requirements, review of results, refinement of specification (see, for example, Sheiderman, Byrd & Bruce Croft (1997), Spence (1999), and Belew (2000) for different descriptions of this cycle). It might help if people are reminded of the cyclical nature of searching, so that they do not expect the computer to find what they want immediately.

Table 1 breaks down the task of web searching into various sub-components and links each with corresponding questions that might be asked by a searcher's 'inner voice' (Vygotsky, 1962) while they are working, or provided as prompts by a human or software assistant.

Table 1 Metacognitive questions for web-searching

Sub-Component of web searching	Metacognitive questions
identifying key characteristics of the overall task	What is the question that I want to answer? Am I going to try not to be distracted by other interesting but irrelevant things? How will I know when I've found what I want?
selecting a start point	Shall I use my usual search engine, or are there others that might give better results? Do I know a useful web site that might lead me to something useful more quickly?
deciding between a keyword search and a category search	Is my query fairly specific, or very general? Do I trust the categories of this search engine?
choosing appropriate keywords	What are the best few words for expressing what I am looking for, that are clear and unambiguous, and are not too general and not too specific?
choosing appropriate search categories and sub-categories	Which category/ies would be most useful? Will I be able to keep track of where I am?
using an efficient search syntax appropriate for the search engine being used	Do I have to type 'AND' or 'OR'? what happens if I do, or don't? what other options are available? Does the search engine provide information?
selecting likely-looking websites to visit	How can I tell from the summary information about a web site (description, title, address, etc) whether or not it is worth visiting?
deciding whether or not a particular website is useful for the current task	Has this website got the information I want? Do I trust what it says? Why? Shall I ignore this page, or follow links from it, or shall I come back to it later?
creating & using personal website directories	Shall I file this site's address? Where?
re-visiting sites	How can I quickly and reliably go back to where I was a few minutes ago?
assessing the success of a search	Did I find what I wanted? Could I repeat the search if necessary? what could I have done differently to get better or quicker results?
remembering and reapplying previous successful search strategies	How did I find something like this before?
overcoming problems	Why didn't it find any websites for me? why did it give me these irrelevant pages? why is it taking so long? shall I try something else, or wait, or give up, or ask someone else?

FUTURE WORK

The planned software will draw on some of the metacognitive questions listed in Table 1, and on the answers of the students to the initial questionnaire, possibly displaying context-sensitive hints and tips according to which search sub-component the user is currently engaged on.   It will be used in conjunction with a standard web browser (Netscape or Internet Explorer). Low-tech prototyping, involving screen mock-ups and walk-throughs of different scenarios, will be carried out with both groups of students, to see what features of the software they would find most useful. This will be followed by iterative cycles of development and evaluation. The possibility of generalising beyond this user group will then be examined.

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