INFORMATION RETRIEVAL WITH INTERACTIVE MULTIMEDIA: A STUDY OF SECONDARY PUPILS' SEARCHING STRATEGIES USING "MICROSOFT® ENCARTA™"

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Abstract

This paper reports on a study of the information retrieval strategies of secondary school children using Microsoft® Encarta™, multimedia encyclopaedia. Data were collected by systematic observation and interviewing procedures. Analysis of the data revealed that the children predominantly used the alphabetic index to find the required information. Keyword searching was rarely used and search tactics were in general unplanned, with browsing being a common tactic. The children themselves reported they were unaware of the existence of searching strategies other than using the Index. The paper concludes by discussing the implications of these findings for teaching and learning.

Περίληψη

Στόχος της έρευνας που περιγράφεται στη δημοσίευση αυτή, ήταν η αναγνώριση και η περιγραφή των στρατηγικών εύρεσης πληροφοριών που χρησιμοποιούν μαθητές δευτεροβάθμιας εκπαίδευσης, όταν αλληλεπιδρούν με μία ηλεκτρονική εγκυκλοπαίδεια (Microsoft Encarta). Η συλλογή των στοιχείων πραγματοποιήθηκε μέσω ατομικών ημιδιαρθρωμένων συνεντεύξεων και συστηματικών παρατηρήσεων των αλληλεπιδράσεων των παιδιών (Ν=88) με την εγκυκλοπαίδεια. Τα αποτελέσματα της έρευνας έδειξαν ότι οι στρατηγικές εύρεσης των μαθητών ήταν γενικά απερίσκεπτες και περιορίζονταν στην επίμονη χρήση του αλφαβητικού ευρετηρίου. Άλλες περισσότερο σύνθετες στρατηγικές εύρεσης αποφεύχθηκαν συστηματικά. Όπως μάλιστα ισχυρίστηκαν οι ίδιοι οι μαθητές, δεν γνώριζαν ότι υπήρχε η δυνατότητα χρήσης άλλων στρατηγικών εύρεσης πέρα από το ευρετήριο γιατί κανείς δεν τους έδειξε ποτέ τις λειτουργίες της εγκυκλοπαίδειας. Η δημοσίευση καταλήγει με μία κριτική θεώρηση των προαναφερθέντων αποτελεσμάτων και των επιπτώσεών τους σε επίπεδο μάθησης και διδασκαλίας.

Background

Advances in technology and particularly the development of Information Technology (IT), have made it possible for information to be easily accessed and transmitted. This has, in turn, contributed to an exponential growth of the amount of information available, which has not left the field of education uninfluenced.

"Information Technology (IT) has become part of our society: the so-called information society of the late twentieth century. The aim of many policy-makers......around the world is to encourage evolution into a learning society for the next century: one in which all people are responsible for their own learning throughout their lives." (Somekh and Davis 1997, p3).

In a world in which the amount of information accessible within any discipline radically progresses far beyond what can be covered by a mass education system, the memorisation of facts stops being a meritorious or rational educational objective. As early as 1985, a shift in emphasis from information receiving to the processes of information retrieval and information handling was judiciously predicted. Such a shift was seen as altering the form and content of what is to be learned by emphasising the development of domain-independent skills, such as problem solving and information browsing, as well as metacognitive skills, such as learning how to learn and how to become a strategic learner (Brown, 1985; Sanger, 1985).

Professionals in education, who recognised the increasing need to prepare pupils for an era demanding autonomous information handlers, flexible decision makers and reflective problem solvers, have given considerable thought to the processes of retrieving and interpreting information in the classroom environment. As an inevitable consequence, the fundamental and vital issue of offering learners opportunities to acquire information retrieval and information

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processing skills has been specifically and explicitly stated in a range of publications in the UK. (NCET, 1990; NCET, 1991; NCET, 1993a &b ; NCET, 1994e; NCET, 1995a; NCET, 1995b; NCET, 1994a; DFE, 1995; NCET, 1996). In particular, in relation to the Communicating and Handling Information strand of the IT Curriculum for England, Wales and Northern Ireland:

"Pupils should be given opportunities to:

2c Be systematic in their use of appropriate search methods to obtain accurate and relevant information from a range of sources

2e Interpret, analyse and display information, checking its accuracy and questioning its plausibility" (NCET, 1995a:21)

It has been frequently suggested and there is general consensus that the use of CD-ROM databases, such as interactive multimedia encyclopaedias may actually and potentially provide such opportunities, in the sense that they can develop a spirit of inquiry and may involve most of the cognitive skills encompassed in the information handling procedure (Collins et al, 1997; Knight and Knight, 1995; NCET, 1994e; Langhorne et al, 1989; Sharp, 1995; NCET, 1996).

Interactive multimedia applications combine the processing capabilities of the microcomputer with the power and capacity of audio-visual media to present information and motivate and enable users to interact with a vast amount of reactive electronic information. Usually, a branching kind of structure is employed, whereby pieces of information are not connected and presented in a linear manner but through *'associations of words or ideas'* (Northwood, 1991). Access to all these information sources is often achieved through multiple, powerful and sophisticated retrieval routes and tools. Essentially then the sequential stages through which children may pass, when browsing through an interactive multimedia application for a defined purpose, are apparently quite similar to those involved in the problem solving procedure. Children, for example, seeking specific information in a CD-ROM encyclopaedia have firstly to define and understand clearly what they are being asked to find. Secondly, they need to devise a plan, think what information to retrieve, and which searching strategy would best serve their purposes. Thirdly, execution of the plan devised will probably take place together with an examination of the results and, if necessary, further action planned.

Due to these characteristics, CD-ROM encyclopaedias open up new ways of searching for, retrieving, processing, manipulating, interpreting and presenting information but they leave the cognitive skills of analysis, synthesis, comprehension and interrogation to the user (Atkins, 1993). Often complex reasoning is required for effective information retrieval and children may not use such systems to their full potential but treat them as conventional information sources i.e. use them in a similar manner to printed materials. Furthermore, children may come to like these applications for the attractive powers of their multimedia special effects rather than the learning opportunities they bring about. Thus, interaction with a hypermedia environment does not necessarily equate with active and meaningful engagement in a problem solving procedure.

The study' s objectives

The concerns, apprehensions and speculations noted above served as stimuli in focusing this project on what may actually be happening with interactive multimedia use and the ways in which the immense educational opportunities they offer, are actually conceptualised and put into practice. In particular, it was decided to focus on the procedures which pupils of secondary age would adopt when using an interactive multimedia application, in order to offer answers to a set of differentiated activities. Due to their popularity and regular utilisation in educational settings (Laurillard et al, 1994; Plowman and Chambers, 1994; NCET, 1994b; Sparrowhawk, 1995), encyclopaedic CD-ROMs and specifically the best selling one, (Microsoft® Encarta™,) became the target multimedia application of this study, which attempted to:

1. Identify and describe pupils' information retrieval strategies while using "Encarta" on a range of given tasks and
2. Identify and describe pupils' views and attitudes towards information retrieval with "Encarta".

Methods-Procedure

Following the perspective that the problem under investigation determines the choice of methods for the research undertaken, it was thought that descriptive information concerning children's views and attitudes towards information retrieval could be ascertained by asking the children themselves. However, identification and description of the children's information retrieval strategies would require observation of the children when searching for information. Setting up an experimental situation in which children could be systematically observed using "Encarta" on a standard set of tasks would provide detailed information regarding the children's searching strategies. With such speculations in mind the study's design was formulated, and this involved systematic observation and interviewing techniques.

A structured schedule/instrument was devised for the systematic observations. This would provide a running record of the children's actions during their interactions with "Encarta". Furthermore, a set of 7 discrete and differentiated, in terms of searching demands, activities were devised which acted as stimuli for engaging the children in different information handling procedures. Moreover, a list of discussion topics and questions to be asked in the course of interviewing the children was constructed.

As regards the study's procedure it should be noted that initially each child/participant was observed individually for about an hour interacting with "Encarta" in a quite classroom of the school in which s(he) was being educated. At the start of these sessions each participant was given the set of the questions and asked to answer them using the information provided by the encyclopaedia. By the end of the observational session, each child was asked whether s(he) felt like talking about the encyclopaedia. If a positive answer was obtained then interviewing would take place immediately or shortly after.

The Sample

The population participating in the observational phase of the research consisted of 88 secondary school children of which 36 were also interviewed. All of the children were of above average ability and of similar age (Year 9: 13-14 year olds), and all had prior experience of using "Encarta". However, in order to make sure that the children's level and quality of experience in using the encyclopaedia would not differ widely, a training session was offered in the use and the features of "Encarta". These training sessions took place approximately 2 weeks before actual testing started.

The Results

This section will concentrate on the demonstration, analysis and discussion of across-activities findings with respect to the children's information retrieval strategies by placing emphasis on: (1) the types of searches the children used in order to retrieve the information required (2) the searching box used and, (3) the success of their searching decisions. Interviewing data are also used and play the supporting and valuable role of clarifying and emphasising observational data. Yet, in order that this description is meaningful to the reader, a description of "Encarta' s" searching system is essential.

Encarta' s searching system: Searching for specific information in "Encarta", which contains a vast amount of information of various types, can be executed through the use of two different searching boxes: An Article searching box, which can be used for finding text based articles and a Media searching box, which can be used for finding pictures, sounds, videos, animations, maps, etc. Apart from this major difference between them, both boxes are almost identical in appearance and function. Each searching box gives the user the opportunity to search for information using the same 7 types of searches. Whatever one wants to find -an article or a picture-, s(he) has to use one of the following types of searches or a combination of them (a synthesised search):

- **Index/Title Search** : The user types in a title to find whether this precise title exists in the alphabetical list of articles or media titles of the encyclopaedia.
- **Word Search** : Searches for one or more keywords or whole phrases contained in the sources of the encyclopaedia using Boolean logic.
- **Category Search** : Searches for information sources related to a particular topic/area of interest.
- **Media Search** : Depending on which searching box you use, searches either for articles with media in it or searches directly for information in the form of media.
- **Time Search** : Searches for information referring to a particular date.
- **Place Search** : Searches for information referring to a particular country, region, political subdivision or city.
- **Wizard Search** : Walks the user through the process of searching in a step by step fashion, using all the above mentioned types of search.

A written description of the searching system of "Encarta" may make the system appear complex, in practice it is not difficult to conceptualise and use, or at least this was the impression given by the children during the one-hour training sessions. This was also demonstrated by the children's achievements on the practice questions given in the training sessions. In fact, with few exceptions almost all the children managed to complete them with success and this degree of success was also evident in the testing phase of the study.

Across - activities findings: It would appear from figure 1 that the rate of success in answering the set questions was very high. Indeed, as figure 1 graphically illustrates, with rare exceptions almost all the children managed to retrieve the specified information in each of the given tasks.However, this claim could be consider crude and superficial, due to its concentration on the outcome and not the process of information retrieval. It would appear from this finding that in general the children found it easy to retrieve information; or, if not easy, at least they did not find the tasks too difficult or complex. In fact, this is what the children themselves pointed out
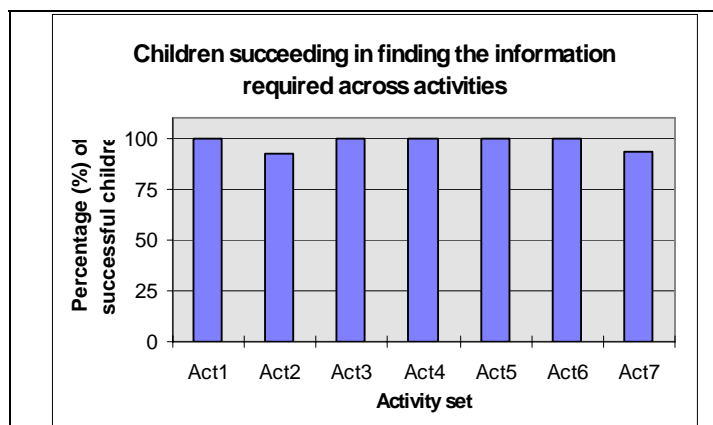

Figure 1: Frequencies of successful children across activities

when interviewed, even though with some reservations. About half said that in general it was easy to search for and find information in "Encarta".

Earlier research on information retrieval, supports this finding by referring to students' enthusiasm regarding the sheer speed and ease of accessing information through CD-ROM databases (NCET, 1994b; Underwood, 1994). However, and more specifically, a range of software reviews, agree that "Encarta" appears to be the 'helmsman' in terms of ease of navigation and accessibility, but some point out that one needs to know how to operate the search engines in order to get the best from it (NCET, 1994b; Drage, 1996; Mooney, 1996; Pettengale, 1996; Sharp, 1995).
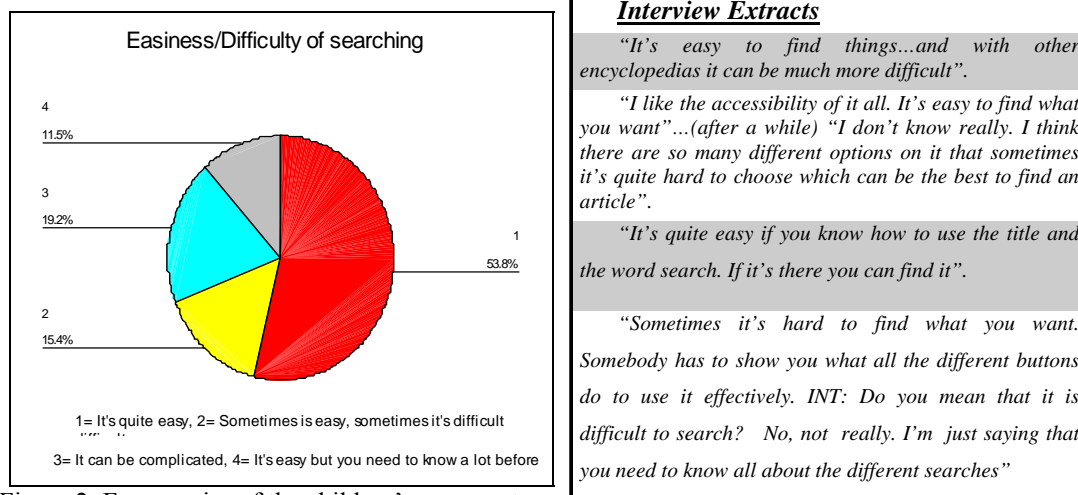

Figure 2: Frequencies of the children's comments regarding the ease of searching

Interview Extracts

"It's easy to find things...and with other encyclopedias it can be much more difficult".

"I like the accessibility of it all. It's easy to find what you want"...(after a while) "I don't know really. I think there are so many different options on it that sometimes it's quite hard to choose which can be the best to find an article".

"It's quite easy if you know how to use the title and the word search. If it's there you can find it".

"Sometimes it's hard to find what you want. Somebody has to show you what all the different buttons do to use it effectively. INT: Do you mean that it is difficult to search? No, not really. I'm just saying that you need to know all about the different searches"

Indeed, the other half of the children who commented on searching expressed their reservations regarding the ease of information finding. Evident in some of the interview extracts (above) and widespread among other children's comments were concerns pertaining to the multiplicity of searching methods available, and to the task specific aspect of the ease of searching. Perhaps many children judged the searching procedure from the success of its outcome and thus professed its ease, but their allusions or direct referrals to such concerns seem to point to difficulties faced during the actual process of inquiring. It is this process together with the accomplishments, difficulties and pitfalls experienced, that provided a more accurate picture of what was easy and what was difficult about searching and enabled interpretation of the children's controversial comments.

The observational data collected shows that on average each child made about 2 searches (Mean Total number of searches=13.5 searches) and searched for approximately 1 minute in each of the 7 activities set (Mean Total searching time = 8.7 minutes). However, these figures, whilst legitimate, do not reflect a realistic view of the quantity of searching performed because they isolate it from its context. In fact, as the following figures illustrate, there were activities in which the children made less than 2 searches each and there were others where they made many more.
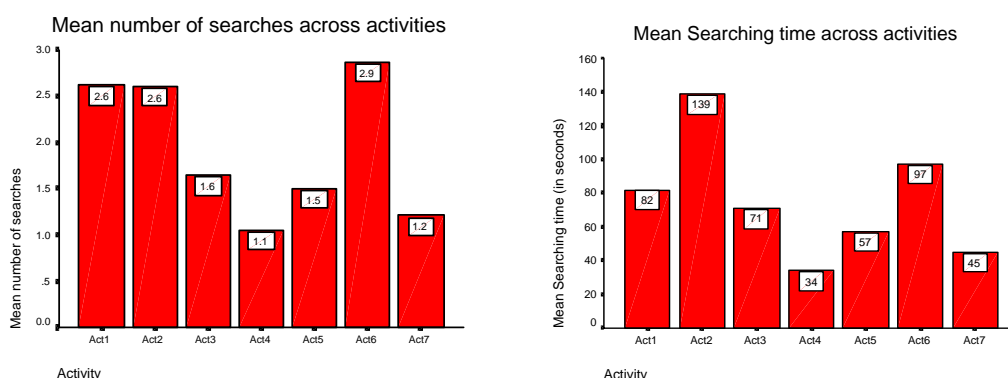
Figures 3 & 4: Average number of searches and mean searching time performed across activities

Comparing the graphs above, there appears to be some contradictions. The children made most searches in activity 6, closely followed by activities 1 and 2, and the least searches were made on activity 4. Although the time spent on searching supports the ease of activity 4, it appears that the most time-consuming and consequently the hardest activity was neither activity 6, nor activity 1, but activity 2. This was supported by the data collected during the interviews, with 55.6% of interviewees reporting that activity 2 was the most difficult.

The nature of the tasks and the way in which the children perceived them may offer an explanation (Appendix I illustrates the differences between the searching demands of each activity). In activities 1, 2 and 6, the children needed to retrieve information from more than source. However, for activities 1 and 6 the items required were explicitly specified by the question itself and the children had the choice of either applying one well-thought out search to find all the sources at once or search separately for each source by applying several similar searches. Since most children chose to do the latter and the same type of search was used repeatedly with slight alterations, the children appear to have made several searches, most of which were successful in finding a piece of information, but this was time-consuming.

Furthermore, in activity 2, as figure 5 illustrates, the children's unsuccessful attempts outnumbered their successful. Figure 5 also illustrates that in activity 4 the children made the least futile searches and at the same time as many successful searches as were necessary. Furthermore, it shows that in activities 1 and 6 children made many more searches than were essential, and also illustrates the ease of question 4 and the difficulty of question 2.

Figure 5: Sums of successful searches across activities

What is, however, particularly significant about the findings of this research are the possible reasons underlying the results found. Inspection of the types of searches the children chose to utilise across activities in comparison with what was required in each activity or with the most optimal searching choice, offers a reasonable interpretation of the above findings.
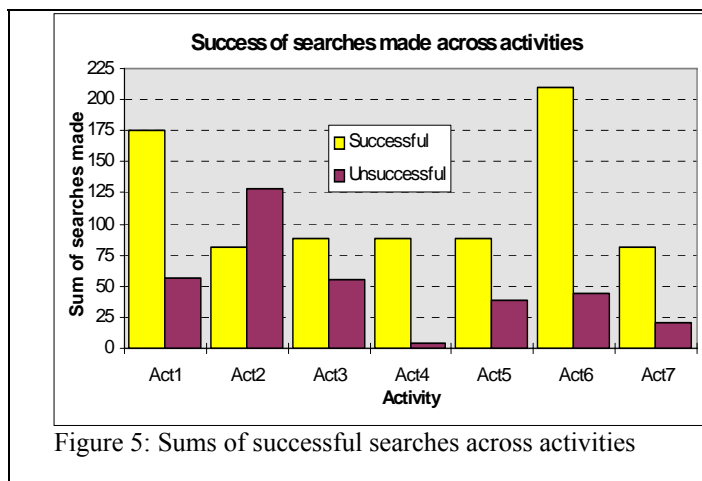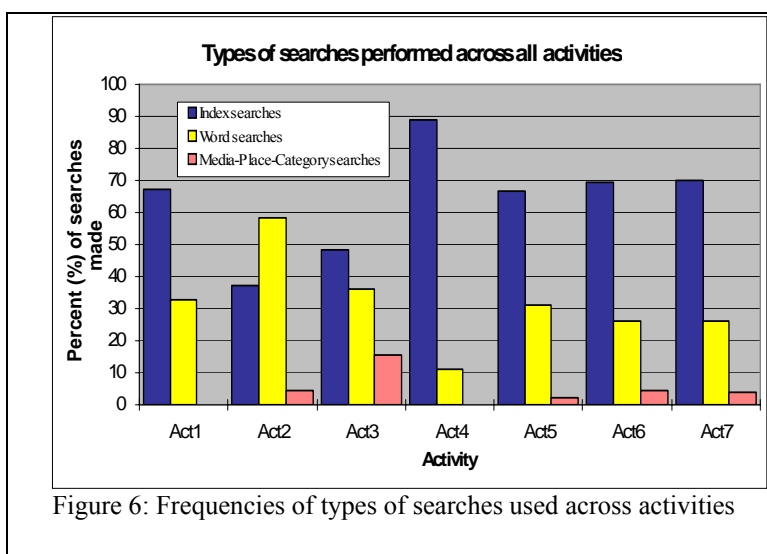

Figure 6: Frequencies of types of searches used across activities

The information shown in figure 6, highlights the children's most preferred and most used searching strategy as the Index/Title search. Yet, the decision to use the Index/Title search was not always appropriate. In questions 1 and 6, the use of the Index/Title search was as successful as other search methods, but necessitated the appliance of more than one search for successful retrieval of the information required. Moreover, in question 2 there was no way that the children could find the sources needed by applying an Index/Title search. Adversely, in activity 4 the most optimal searching strategy was the Index/Title search. Whereas, in the remaining activities (3, 5, & 7) the sources requested could be found using any of a number of different search methods.

In practice, however, and regardless of its appropriateness, wherever and whenever possible the children utilised the encyclopaedic Index for retrieving information. Hence, what the children found easy and what they found difficult was dependent on the following principle: If the Index/Title search worked then the search was easy, if not then the search was hard. Hence, the activities they reported as easiest and hardest represented the extremes regarding this axiom. Question 2 was thought to be most difficult, because they made a lot of fruitless Index/Title searches before realising that the information could not be found this way. Conversely, question 4 was the easiest, since the use of Index/Title search would return the information needed immediately. The predominance of the Index search over any other kind of search suggests that in general this is the strategy that children habitually utilise for retrieving information in school or at home. This was endorsed by the interview data collected, concerning the manner in which the children usually search for information in "Encarta":

Children's usual way of searching for information

Other search combinations 14%

Index/Title search 45%

Word search 22%

Mainly Title, someitmes Word 19%

Interview Extracts

"I just put a title and it goes through the whole list to find it"

"I just go to find and type in a word, a title (shows me Index). INT: And if you couldn't find it this way, then what you would do? I'd probably got to...I don't know. I'd do it this way...and then I'm not sure about what I would do"

"I just go to Find. In general I just go for a summarising word. I don't really use the other searches in the Find section. Sometimes I might go to Word search but in general I do this".

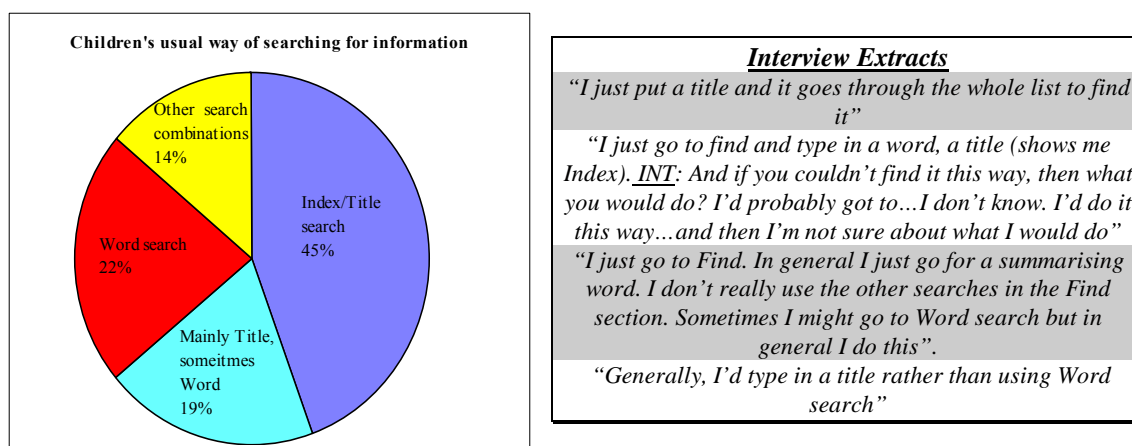*"Generally, I'd type in a title rather than using Word search"*

Figure 7: Frequencies of the children's comments regarding the search strategy they use

The children's persistence in the use of simple searches, such as the alphabetical index was a finding common among other research projects concerned with information retrieval from CD-ROM databases. Morgan's investigation (1996) into the search strategies of pupils using "Information Finder" and the "Times" CD-ROMs showed that 66% of the students who used the former application and 50% of the children who used the latter did not use keyword searching, as a search strategy, in the first instance but utilised the system default settings for finding the information required. Some of these students progressed to more complex strategies but evidently not in the first instance, and only when it was absolutely necessary (Morgan, 1996). Similarly, Marchionini's exploratory study of elementary school children searching a full-text electronic encyclopaedia in USA (1989) and Oliver and Oliver's (1996) inquiry were 12 year old Australian students used the New Grolier Multimedia Encyclopaedia seem to agree, that although the systems used provided powerful search options, most users accepted the system defaults and tended to employ inefficient strategies when searching.

The children's perseverance in the use of the system default settings was not only demonstrated in the excessive use of Index/Title search but also in the overwhelming and in most cases inappropriate utilisation of the Article searching box of "Encarta". Even though in 5 out of the 7 activities the information the children needed to find was not textual (article) but pictorial (pictures, videos, animations), many children persisted in using the searching options in the Article searching box instead of using the Media box or Media Gallery.

In became apparent during the observations that, even though the item required might be a picture and the obvious

Article and Media Box searches across activities

Number of searches

Article Searching Box
Media Searching Box

Act1 Act2 Act3 Act4 Act5 Act6 Act7
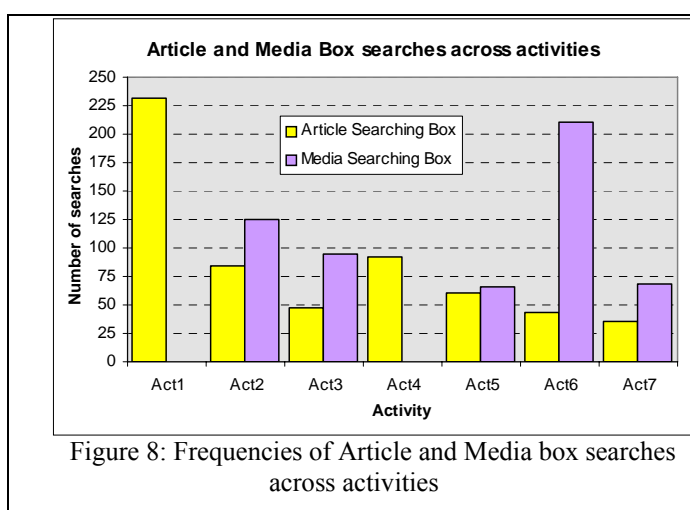
Activity

Figure 8: Frequencies of Article and Media box searches across activities

and logical way to find it would be to look at the media list of the encyclopaedia, many children attempted to search for it in the articles' list of "Encarta" and guess which article might include the picture required. Whenever the item needed was included in an article that its title was linked with and could be directly assumed by the information given in the question itself, this searching strategy proved to be successful. Yet, it was due to serendipity that these children found the information and not because of a well thought out or planned searching strategy. This finding apart from illustrating the children's inclination to search at the basic entry level, also brings about another important aspect of the searching strategies the children exercised: their heuristic character. In many cases the children formulated scrutinising and inquisitive queries, in the sense that these were not planned, not reasoned through logic and not seriously considered before being applied.

Earlier evidence supports such findings by pointing out that children appear to use highly interactive, inefficient and ineffective searching strategies, which do not enable them to take full advantage of complex information delivery systems (Marchionini, 1989; Sparrowhawk, 1995; Morgan, 1996; Oliver and Oliver, 1996; Heller, 1990; NCET, 1996; NCET, 1994c; NCET, 1994b). Attempting to offer an explanation to this, many advocated the idea that students seem to have developed an ill-defined mental model of the ways in which information is structured, organised and stored (Oliver and Oliver, 1996; Sparrowhawk, 1995; Marchionini, 1989).

As regards this research, the children's inaccurate mental conception of the information web was demonstrated by its subsequent effects on the children's understanding of the different searching mechanisms existing in the CD-ROM database used. Specifically, there were children who actually used Word search as if they were using Index/Title search. By setting the titles of the items needed in some of the questions given as the searching descriptors or the keywords in a Word search, they demonstrated that they did not quite understand what the Word search was and how it functions. Moreover, it was not only the inappropriate use of the Word search that revealed a faulty conceptualisation of the search system of "Encarta", but also the unsuitable use of their most preferred searching strategy. In all of the activities set, many of the children, in order to reduce the list of articles or media items of the encyclopaedia, combined the Index/Title search with a Media or Category search or both. Clearly, the alphabetical Index can be used for finding whether a particular title exists in the contents' list of any reference tool and therefore combining it with any other kind of search would not make any serious difference to the outcome of the search attempted.

It has been proposed that children's inadequate use of information retrieval strategies is associated with difficulties in converting plain English into the query language recognised by the database and that children's mental categorisation system is actually quite different from the one supported by the database (Underwood and Underwood, 1990; Spavold, 1989; Sparrowhawk, 1996; Morgan, 1996; NCET, 1996). As a result of this researchers and theorists went on to suggest that CD-ROM designers should pay more attention to the classification systems they adopt when structuring information databases (Sparrowhawk, 1996; Trumbull et al, 1992; NCET, 1996; Marchionini, 1989). However, as Perzylo and Oliver (1992) aptly pointed out:

*"If it is the case that unskilled learners do not fare well with such instructional design, then it is necessary to consider changes to the way learners use the programs (CD-ROMs) rather than changes to the instructional design of the application" (*Perzylo and Oliver, 1992:227)

It is also the writers' feeling that the most probable explanation for children's inefficient searching strategies lies within the use of CD-ROM databases rather than their design. The following interview extracts are quite illustrative of this:

Interview Extracts

"INT: What do you think about searching in Encarta?

"I don't know…You really need someone to tell you what every button in the programme does and how you can search about different things. I didn't know anything about all this staff until the training session you did on Encarta"

"INT: Would you say that what you did today was of any use or it was rather useless?

No, it added to my knowledge. I am now able to search a bit more confidently and know that I'm going to find it. If it's there I'm definitely going to find it".

"I've learned how to find media and use the Pinpointer, cause I haven't used them before"

"I learned a lot more about searching and finding information that I didn't know before. Nobody has shown us these things before".

"I some ways it was of use, because I now know how to use it properly. So I'll use it more now. A few days before, I'd go straight to search by typing in a title and if it wasn't there, I'd look at other sources. But now, learning all these things, I know now how to search more in depth for a topic. So I now know how to use it properly to find information"

"Int: What about searching? How do you usually search for information?

"I didn't know that all these existed. I only knew about the title thing.

"I didn't know about Word search, until you showed us…

Of the children interviewed, 80.6% (29 out of 36 children) pointed out that their participation in this research project was a learning experience in the sense that they found out a lot more about "Encarta's" search engines. Following this, one may actually suggest with considerable assurance that the children had never received adequate help and proper advice or direction on how to use CD-ROM information retrieval systems. Necessarily, the unavoidable consequence of students' ignorance of the systems' searching features is inappropriate use of them. Considering this, it appears quite reasonable and logical that the children would predominantly use the alphabetical Index for it is the only search that they already knew quite well from searching through books. It is also rational that they would follow interactive and heuristic strategies rather than planned and well constructed searches, because one cannot select and plan his/her form of action before he/she knows what are the potential choices or the possible plans.

As with earlier researchers and educators (NCET, 1994b; NCET, 1994c; NCET, 1996; Oliver and Oliver, 1996; Martin, 1997; Sharp, 1995; Plowman and Chambers, 1994; Sparrowhawk, 1994; Morgan, 1996; Underwood and Underwood, 1990; Underwood, 1994), the main recommendation arising from the data collected and analysed, is that children should be trained adequately on how CD-ROM databases and their search systems function, and how they are structured and that children must be given opportunities to develop appropriate navigation strategies.

Conclusions – Implications

The above summary of findings represents a somewhat "gloomy" and "inert" picture of hypermedia use, which is in opposition to the active and inquiry learning style that their use supposedly develops and promises to education. One

can clearly support the idea that indeed children tend to have an impaired and incomplete conception of "Encarta's" searching system. This was demonstrated through their disproportionate and ineffective use of the alphabetical Index, clumsy utilisation of the keyword search and, in general, an entirely speculative and thoughtless searching strategy. Yet, this falsely elucidated mental model and its corresponding implications appear neither to be entirely created by the program's design nor be totally associated with children's inexperience and difficulties in formulating effective queries, as other researchers have suggested (Marchionini, 1989; Underwood and Underwood, 1990; Spavold, 1989). It appears that children need to be taught how to search effectively and this has not been done. Teachers possibly assume that the use of encyclopaedic CD-ROMs is intuitive, or they lack experience or knowledge of their use and this gives rise to a non-interventionist stance.

One may wonder why. The response is clearly associated with teachers. Whilst teachers conceptualise CD-ROMs as *"a metre or two of new book material for the library"* (Sparrowhawk, 1995:10) or as tools for developing skills of a purely IT nature (NCET, 1994b; Sparrowhawk, 1995), one cannot expect them to appreciate and understand their potential in encouraging an independent style of learning and developing information and problem solving skills. It seems possible that teachers themselves lack information skills and resultantly one cannot teach a topic of which has only a vague idea, or no idea at all. Necessarily then, it is not only pupils that need to be educated in using these new learning tools but also their teachers. This is a need recognised by the UK government, which recently announced the urgency of training teachers and librarians to make the most of information databases (Carvel, 1998; TTA, 1998).

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Appendix I: The Activities

1. How do honeybees communicate? Do whales communicate in the same way?

Optimal searches in order of appropriateness

A. Article Searching box: Word search (Descriptor: "Honeybees AND Whales AND Communicate/tion") → A highlighted paragraph in a single article about animal communication containing all information needed.

B. Article Searching box: Two Word searches ("Honeybees AND Communication" → highlighted occurrences of both words in article about honeybees) + ("Whales AND Communication" → highlighted occurrences of both words in article about whales)

C. Article searching box: Two Index searches ("Honeybee" → Article about honeybees) + ("Whales" → Article about whales).

2. Find all pictures whose captions contain the word "alphabet".
Optimal searches in order of appropriateness

A. Media Searching box: Word Search (Descriptor: "Alphabet") + Media Search (Descriptor: "Pictures") →The 3 pictures required.

B. Media Searching Box: Word Search (Descriptor: "Alphabet") → 5 media items (The 3 pictures needed + 1 Table + 1 Music clip).

3. Find the video about floods in Europe.
Optimal searches

A. Media Searching box: Word search (Descriptor :"Floods") [+ Media search (Descriptor: "Videos")] → the video clip required. ([ ] = optional)

B. Media Searching box: Index search (Descriptor: "Floods in Europe") → the video clip required.

4. Find the article about Callanish.
Optimal search

A. Article searching box: Index Search (Descriptor: "Callanish") → the article required

5. Find the animation about Fish Locomotion.
Optimal searches

A. Media Searching box: Word search (Descriptor: "Fish AND Locomotion") [+ Media Search (Descriptor: "Animations")] → the animation required. ([ ] = optional)

B. Index Search (Descriptor: "Fish Locomotion") → the animation requested

6. Find the videos "Larva to Pupa", "Emerging Butterfly" and the picture "Caterpillar Pulling Free From Egg".
Optimal searches in order of appropriateness

A. Media Searching box: Word Search (Descriptor: "Butterfly/ies") → all 3 sources required.

B. Media Searching box: 3 Index searches, one for each source (Descriptor: "Larva to Pupa" → the corresponding video clip), (Descriptor: "Emerging Butterfly" → the video clip titled as such) and (Descriptor "Caterpillar Pulling Free From Egg" → the corresponding picture).

7. Find the animation about the heart in the encyclopedia.

<u>Optimal searches</u>

A. Media searching box: Word search (Descriptor: "Heart") [+Media search (Descriptor: "Animations")] → the source requested. ([ ] = optional).

B. Media Searching box: Index search (Descriptor: "Heart") → the source requested.