Perspectives on children's navigation of the World Wide Web: does the type of search task make a difference?

Dania Bilal

The author

Dania Bilal is Assistant Professor in the School of Information Sciences at the University of Tennessee-Knoxville, Knoxville, Tennessee, USA.

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Abstract

Reports the key findings of a three-part research project that examined the information seeking behaviour and success of 22 seventh grade science students in using the Web. Children used the Yahooligans! search engine/directory to locate information for three different types of search tasks: one assigned fact-finding task, one assigned research-oriented task, and one fully self-generated task. Children´s information-seeking behaviour was studied from the cognitive, affective, and physical perspectives. Both quantitative and qualitative inquiry methods were employed to collect the data. Children´s behaviour and success were compared on the three tasks. Children were more successful on the fully self-generated task than the fact-based and the research-oriented tasks. Children experienced difficulty in using Yahooligans! Their inadequate knowledge of how to use the engine, their poor level of research skills, as well as the poor structure of Yahooligans! keyword searching all surfaced as problems. Implications for Web training and system design improvements are provided.

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Introduction

"The Web is causing educators, from preschool to graduate school, to rethink the very nature of teaching, learning, and schooling" (Owston 1997, p. 27). In a recent survey of Internet use by young people ages 12-17, 94 percent mentioned that they use the Internet for school research and 78 percent said they believe the Internet helps them with schoolwork (Pew Research Center, 2001). How do young people interact with this powerful information tool that they conceive as the major source for their school project?

The Web is a dynamic and heterogeneous multimedia information retrieval system. Many children may lack cognitive skills necessary to navigate Web space effectively and efficiently (Bilal, 2000). Research has shown that young people, especially children, experience difficulty using CD-ROM multimedia encyclopaedias and online public access catalogues (OPACs) (Marchionini, 1989; Solomon, 1993, 1994; Borgman *et al.*, 1995; Garland, 1995; Large *et al.*, 1998).

There is little evidence in the literature of how children locate information on the Web for different types of search tasks. This study focused on the cognitive, affective, and physical dimensions of seventh grade science students' information-seeking behaviour and success in using Yahooligans!, a Web engine and directory designed for children ages 7-12. Results gained from this study will have implications for system design improvements and Web training.

Related research

Research on children's information seeking in traditional IRs has been conducted for over a decade. However, prior to 1998, children's information seeking on the Web/Internet was an unexplored area of research. Today, there are a handful of studies in this new field of study. Bilal and Kirby (2001) examined and compared young people's use of the Web with the information-seeking behaviour and success of adults. A total of 22 seventh grade children and nine graduate students in information science used Yahooligans! to find

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the answer for an assigned fact-based task. Data were gathered using both quantitative and qualitative inquiry methods. Results reveal that 89 percent of the graduate students succeeded in finding the correct answer to the task as opposed to 50 percent of the children. The main factor that seemed to influence success was graduate students' ability to recover quickly from the "breakdown" caused by the poor structure of Yahooligans! keyword searching. When searches failed, for example, graduate students abandoned keyword searching and adopted a browsing strategy. Conversely, children repeated keyword searches even when they continued to fail. The study also revealed similarities in information seeking between children and graduate students. Both groups:

- employed keyword searching;
- were more successful when they browsed subject hierarchies than when they searched by keyword;
- looped searches and hyperlinks;
- activated Netscape Back command exclusively to navigate among the Web pages retrieved;
- did not use any navigational shortcuts (e.g. History list, Go list, Home, Bookmarks);
- employed incorrect search syntax; and
- they encountered difficulty in finding relevant information.

In addition, the study showed differences in information seeking between the two groups. These pertained to the use of advanced search syntax, keyword searching, browsing, screen scrolling, number of Web moves, time taken to complete the task, target location and deviation, navigational style, looping searches and hyperlinks, and use of the Back command to navigate among the Web pages retrieved. Overall, graduate students were more successful and more efficient than the children in locating the correct answer to the task.

Large and Beheshti (2000) examined the searching behaviour and reactions of 53 middle school students in using the Web for a class-related project. The students had problems with selecting appropriate search terms. They were unable, in most cases, to find the precise information they needed. Students preferred using the Web to print sources, but found it harder to use.

In a pilot study, Bilal (1998) examined the success and searching behaviour of 22 middle school children in using the Web to find relevant information for a research task about "diet". Children experienced difficulty with selecting appropriate terms and with spelling. They hardly scrolled the returned results, examined the returned hits minimally, and spent most of their search time repeating searches they had previously executed. Most children employed incorrect search syntax, but when they submitted queries with correct syntax, they found few materials relevant to the topic.

Schacter *et al.* (1998) explored the performance and searching behaviours of 32 students in fifth and sixth grades in using the Web for two assigned tasks: one closed (i.e. fact-based) and one open-ended (i.e. research-based). Children were significantly more successful on the open task than the closed task. Most children employed incorrect search syntax in querying the search engines they used. Children browsed significantly more than searched by keyword on both tasks. They employed significantly more analytic search strategies on the closed task as opposed to the open task. The findings of this study indicate that the nature of the task had a significant effect on children's performance.

Kafai and Bates (1997) investigated elementary school students' interaction with the Internet in five different elementary classrooms that participated in the SNAPdragon Project. Children evaluated Web sites and created an annotated directory for use by other children. The study findings show that children were reluctant to read or scan the results returned. Younger children (grades 1-4) had more difficulty evaluating Web sites and writing annotations than older children (grades 5-6), and needed more instruction and assistance at different stages of their search process. Children's cognitive developmental levels and abilities had a strong influence on their information-seeking behaviour.

In sum, the literature reveals that while children are capable of using various types of information retrieval systems, they possess inadequate knowledge of how to use them effectively and efficiently. Children's information-seeking behaviour is influenced by the type of task they pursue (fact-finding vs. research-based), cognitive developmental ability, level of research skills, and the

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approach they take to complete the tasks. Many children perceive the Web as harder to use than print sources. The inadequate design of search engines, including those developed specifically for children (e.g. Yahooligans!), has a strong impact on children's information-seeking behaviour and success.

A handful of studies have explored children's use of Web search engines that are specifically designed to support their information seeking. While the literature shows that children's success on fact-finding tasks differed from their success on research-based tasks, no studies have examined children's success on fully self-generated tasks. Are children more successful in finding information on fully self-generated tasks than assigned tasks?

As more children will go online at school than at home by 2005 (NUA, 2001), it becomes essential to investigate the processes children adopt in using Web search engines and their success in finding information. Results gained from such research will provide a framework for planning effective Web training programmes, as well as developing interfaces that support children's information seeking and success.

Research questions

This study reports the results of a three-part research project that investigated the information-seeking behaviour and success of a group of seventh grade science students in using the Yahooligans! Web search engine/directory to locate information for three different tasks: fact-based; research; and self-generated. It sought answers to these questions:

- How successful are children in finding information in Yahooligans! on three different types of search tasks (fact-based, research, and fully self-generated)?
- What information-seeking behaviour do children demonstrate in finding information in Yahooligans! on three different types of search tasks (fact-based, research, and fully self-generated)?
- What type of search task (fact-based, research, fully self-generated) do children prefer and why?
- What affective states do children experience in using Yahooligans!?
- What recommendations do children make for improving the design of Yahooligans!?

Method

This study employed both quantitative and qualitative inquiry methods. The quantitative method provided empirical data about children's activities in Yahooligans! Lotus ScreenCam (http://www.lotus.com), a Windows-based software package that records, saves, and replays activities in Web browsers, was employed to capture children's Web moves. Through the qualitative method, children's prior knowledge of using the Internet and Yahooligans!, as well as their affective states were gathered via a questionnaire and individual exit interviews.

Population and sample

This study took place in a middle school located in East Tennessee. The population consisted of 90 students enrolled in three seventh grade science classes taught by one teacher. The final sample comprised 22 children who were willing to participate in this project and whose parents gave them permission for this participation.

Search tasks

Tasks vary in complexity. Simple tasks, for example, "are routine information processing tasks where the elements of the tasks are predetermined, i.e. [the user] knows them" (Vakkari, 1999, p. 826). A simple task, also known as fact-based or closed task, has a target answer that the information seeker should find. Complex tasks, however, do not have target answers. They require critical thinking to extract "meaning" from the information found. Complex tasks are also known as research-based or open-ended. Self-generated tasks can be fact-based or research-oriented. They can be fully self-generated or semi self-generated. If an information seeker chooses both the topic of a task and an aspect of the topic to pursue, the task is "fully self-generated". If the information seeker chooses only an aspect of an assigned task to pursue, the task is "semi self-generated". Typically, teachers assign class-related tasks to children to pursue. The science teacher assigned the fact-based and research-oriented tasks the children

performed in this study. For the fact-based task, children had to find the correct answer about the "age of alligators in the wild and in captivity". For the research-based task, they had to locate relevant information about "the depletion of the ozone layer".

A number of researchers have recommended that children be given tasks of interest to them to enrich their motivation, increase their challenge, and give them a sense of control (Solomon, 1994; Garland, 1995; Gross, 1997; Hirsh, 1999; Small, 1999). Children were asked to choose tasks of interest to them (i.e. fully self-generated) to pursue in Yahooligans! They selected a variety of topics. Examples are: Spice Girls, Ice skating and acting, Free Willy, Ebola Virus, Poetry, Endangered species, Road Runner, Michael Jordan, Movies, Olympic Games, Law, Psychology as a career, and Horses.

Instruments

The researcher developed three instruments to collect the empirical data: an Internet/Web quiz, a personal question sheet, and an exit interview. The quiz comprised two main sections: Experience with the Internet/Web (six questions), and Fun Quiz about Yahooligans! (seven questions). The quiz took an average of ten minutes to complete. The personal question sheet was used for writing the fully self-generated tasks. The exit interview instrument comprised questions about children's likes and dislikes in using Yahooligans!, task preference, and affective experience in using the engine. It took an average of 20 minutes to complete. These instruments were pilot-tested and refined.

Success measure

Fact-finding task

Children were judged to be fully successful if they found and extracted the correct fact (i.e. age of alligator in the wild and in captivity). They were judged to be partially successful if they submitted an incomplete or partial answer (i.e. age of alligator in the wild or in captivity); otherwise they were judged to be unsuccessful. The researcher and a research assistant judged the answers children submitted.

Research-oriented task

Children were judged to be fully successful if they printed and submitted either the whole text (12 pages) found under Ozone Depletion in Yahooligans! or the four pages that relate to the impact of ozone depletion on forests. They were judged to be partially successful if they printed and submitted one page of text. They were judged to be unsuccessful if they printed and submitted text that was irrelevant to the task. Children were given a maximum of 30 minutes to complete each task. Two science teachers and an expert in environmental science judged the results children submitted.

Fully self-generated tasks

Children were judged to be successful if they found any relevant information pertaining to their topics. They were judged to be unsuccessful if they did not find any information about the topics or if they submitted irrelevant information. In addition, children were asked to write down on their sheets whether they were able to locate the information they needed. When they did not locate any information of interest, children were asked to indicate so on their sheets. The researcher and a research assistant judged the results children submitted.

Yahooligans!

Yahooligans! is a search engine and directory designed for children ages 7-12. The engine provides both keyword searching and browsing by subject hierarchies from its search interface. Yahooligans! does not employ advanced search syntax such as Boolean logic, proximity, nesting, or natural language. It does not have a natural language interface and lacks a spell-checking technique (Yahooligans!, 1994-2000).

Procedure

The research experiment began in April 1998. It was conducted over the course of one week and occupied three days. Children completed the fact-based task on the first day of the week, the fully self-generated task on the third day, and the research-oriented task on the fifth day. Individual exit interviews were conducted at the conclusion of the experiment. Children were not given prior instruction or training about how to use the search engine. The intent was to examine how, as novices, children used Yahooligans! that is specifically designed to support their information seeking.

Limitations of the study

This study was limited to a group of seventh graders enrolled in three science classes taught by one teacher. It took place in one middle school, and included use of only Yahooligans! The children who participated in this study may not represent all middle school students in Tennessee, nor may they represent the whole population of seventh grade science students.

A second limitation includes the reliability of the children's affective states gathered from the exit interviews. Unlike the quantitative method that provided 100 percent accuracy of children's behaviours in using Yahooligans!, the qualitative method used exit interviews and relied on children's perceptions of and feelings about their experience in using the search engine. This experience was not checked against sources such as verbalisation during searching or videotapes of children's Web activities. Therefore, the reliability of the interview data may be affected.

Another limitation concerns lack of concurrent verbalisation while using Yahooligans! The fact that the exit interviews took place at the end of the research experiment (i.e. day five) rather than immediately after children completed their tasks may impact the reliability of the responses due to recall.

Results

This study employed descriptive statistics. The results are reported for success, searching, browsing, backtracking, looping searches and hyperlinks, time taken to complete each task, task preference, and affective experience in using Yahooligans! The results are based on 14 usable Web sessions.

Success

Children's success varied by task. A total of 50 percent were fully successful on the fact-based task, 69 percent were "partially" successful on the research-oriented task, and 73 percent were successful on the fully self-generated task. Children had more difficulty with the research-oriented task than with the fact-based task. This is not surprising since the research-oriented task had many facets and did not have a prescribed answer. In addition, the approach children took to complete this task had an impact on their success level. They sought specific answers to the task and did not attempt to seek meaning from the information found. As for the fully self-generated task, children had problems identifying the true information need. This was evident in the "broad" topics that most of them selected to pursue. What may have contributed to children's higher success rate on the fully self-generated tasks were:

- the assistance the researcher and the media specialist provided to narrow the broad topics they chose and to identify their true information needs;
- the simplicity of the topics they pursued;
- their ability to modify topics when they were dissatisfied with the results and/or when they changed their mind;
- their satisfaction with the results they retrieved; and
- their possible motivation and sense of control in pursuing topics of interest to them.

Searching

The search moves children made varied by task (see Table I). They performed the highest number of keyword searches (analytic) on the fact-based task (mean = 6.7) and the fully self-generated (mean = 5.05). The lowest number of analytic searches was made on the research-oriented task (mean=3.07). Another difference in search moves was seen in the use of natural language queries. A total of 35 percent of the children submitted this type of query on the fact-based task, as opposed to 8 percent who did so on the research-oriented task and none used this method on the fully self-generated task. Most searches on the fact-based and research-oriented tasks contained single concrete concepts, whereas most searches on the fully self-generated tasks had two concrete concepts. Very few searches had abstract

Table I Children's Web activities and success on three tasks by mean

Activity	Fact-based	Research-based	Fully self-generated
Searching	6.7	3.07	5.05
Browsing	8.4	4.15	12.26
Looping	5.1	1.54	1.93
Backtracking	12.2	6.07	7.4
Web moves	49	41	78
Time (min.)	15.78	10.42	14.35
Success (%)	50	69 (partial)	73

concepts. This finding is not surprising since children performed in line with their cognitive developmental ability, as identified by Piaget and Inhelder (1969). No child used Boolean operators, indicating children's unfamiliarity with this type of searching.

Browsing
The browse moves children made also varied by task. They browsed more on the fully self-generated task (mean = 12.26) than the fact-based task (mean = 8.4) and the research-oriented task (mean = 4.15). It is noteworthy that many children selected more than one topic to pursue for the fully self-generated tasks. In addition, a few modified their topics during searching when they did not find the information they sought. The number of topics children pursued on the fully self-generated task has influenced the number of browsing moves. Comparing the mean scores of search moves to those of browse moves, one finds that children browsed more than searched by keyword on the three tasks. Failure to find relevant hits and the poor structure of Yahooligans! keyword searching may have increased children's amount of browsing.

Looping moves
Children looped searches and hyperlinks often. Search looping is the re-submission of previously executed searches. Hyperlink looping is the re-activation of previously visited sites. These moves varied by task. Children looped many more searches and hyperlinks on the fact-based task (mean = 5.1), as opposed to the fully self-generated task (mean = 1.93) and the research-oriented task (mean = 1.54). Typically, search looping occurs when one needs to revisit the retrieved results. Most of the searches that children looped were caused by mistakenly clicking on the Next Search command provided in Yahooligans! This command appears next to the Search box when results are returned. In this box, pre-executed search statements remain until erased or modified by the user. Children's possible minimal recall of the searches they submitted may have contributed to looping. As for hyperlink looping, it typically occurs when one decides to re-examine the returned results hoping to find relevant information the second time around. When searches and hyperlinks are looped often, however, they affect user efficiency in finding the information sought.

Backtracking
Backtracking refers to use of the Netscape Back command to navigate among Web pages retrieved. Children's backtracking moves also varied by task. Children backtracked most frequently on the fact-based task (mean = 12.2), as opposed to the fully self-generated task (mean = 7.4) and the research-oriented task (mean = 6.07). While backtracking by the children in this study may be typical of user behaviour on the Web (Tauscher and Greenberg, 1997), activation of shortcuts, such as the History list and Go list may be more efficient. Lack of use of these shortcuts by the children in this study indicates their unfamiliarity with this feature.

Web moves
The number of Web moves children made varied by task. Children made more moves on the fully self-generated task (mean = 78) than on the fact-based task (mean = 49) and the research-oriented task (mean = 41). The number of topics children pursued for their fully self-generated tasks may have influenced the number of moves they made. In addition, children who experienced difficulty in finding information made more moves on each task than those who succeeded.

Time
The amount of time children took to find the information sought varied by task. They took more time to complete the fact-based task (mean = 15.78 minutes) than the fully self-generated task (mean = 14.35 minutes) and the research-oriented task (mean = 10.42 minutes). This finding was surprising, especially since prior studies showed that children spent more time locating information for research or open-ended tasks than fact-based or closed tasks (Marchionini, 1989; Borgman, *et al.*, 1995). The approach children adopted to complete the research-oriented task may have influenced the amount of time they took to complete it. Children stopped their search process after locating the page of text that they believed contained the "answer" and went no further. The "learning effect" may have also contributed to a decline in the time taken. Children performed the research-oriented task on the last day of the experiment after

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they had used Yahooligans! to find information for the fact-based and the fully self-generated task.

Task preference

At the conclusion of the research experiment (day five), children were interviewed individually and asked about which task they preferred. Most children (47 percent) preferred the fully self-generated task, 20 percent liked the research-oriented task, another 20 percent mentioned the fact-finding task, and 13 percent were unsure. Only four children articulated reasons for their task preference. Those who preferred the fully self-generated task felt they could use the Web effectively and that they were able to retrieve more information on this task than on the other two tasks. Those who mentioned the fact-finding and research-oriented tasks said they were successful in finding the information they needed. This finding indicates that success in locating information and a sense of ability to use the Web effectively rather than the nature of the tasks influenced task preference. This finding is inconclusive, however, since only four out of 15 children expressed the reasons for their task preference.

Affective experience

Affective experience relates to user feelings, motivation, and likes and dislikes. Examination of the user affective experience and cognitive constructs provides a holistic view of the information-seeking process (Kuhlthau, 1993; Nahl, 1997). Children were asked during the exit interview about their experience with Yahooligans! Most children (87 percent) enjoyed Yahooligans! due to ease of use, ability to perform keyword searching, ability to visit different Web sites, availability of graphics, and fun. Children who did not enjoy using the engine commented on lack of matches, difficulty in finding the answer, slow response time, and a confusing screen display. Overall, children were motivated to use the Web because it gave them self-confidence and increased their motivation in locating the needed information. These feelings surfaced as main factors that positively influenced children's persistence and patience in using Yahooligans!, despite the difficulty they experienced in finding relevant information.

Children's design recommendations

Children were asked for ideas to improve Yahooligans! They recommended that Yahooligans!:

- add more sites (denoting the need for enriching the database);
- add more categories (implying the need for more subject headings);
- add more keywords (indicating the need for augmenting the indexing);
- improve screen display (suggesting the need for redesign of the retrieval interface, especially the categories and sites within them); and
- make response time faster.

Designers of Yahooligans! should take these recommendations into account in redesigning the engine's interfaces.

Discussion

This paper reported the main findings of a three-part research project that examined the information-seeking behaviour and success of 14 middle school students as they used the Yahooligans! search engine/directory to locate information on three tasks: one fact-finding, one research-oriented, and one fully self-generated. The findings of this project revealed important characteristics about children's information-seeking behaviour and success.

Children's success varied by the type of the task. A total of 50 percent succeeded in locating the correct answer to the fact-based task, 69 percent only "partially" succeeded in finding relevant information for the research-oriented task, and 73 percent succeeded on the fully self-generated task. This success was influenced by these factors:

Examination of retrieved results

On the fact-finding task, 40 percent of the results that children retrieved were not explored. In addition, 64 percent were seeking information about the topic of the task rather than the specific answer to it. Conversely, the children tended to seek specific answers to the research-oriented task rather than find relevant information about it. It seems that children lacked an adequate level of understanding the difference between a fact-finding and a research-oriented task, an important issue that should be addressed by school

librarians as they teach students information literacy skills. The fact that 73 percent of the children succeeded on the fully self-generated task deserves some explanation. The researcher and the media specialist assisted the children in identifying their true information need when they selected topics that were broad in nature. The simplicity of the topics children pursued, their ability to modify the topics as they needed to, and their possible motivation in pursuing topics of interest may have influenced their success rate. Although they were more successful on the fully self-generated tasks than on the assigned tasks, children should not be given the liberty to pursue topics of interest without providing guidance in how to identify the "true" information need. Had children been left to find information on the "broad" topics they had initially selected, they would not have been able to succeed at the rate they did. Teachers and media specialists should assist children in negotiating their information need before they use any IR system.

Use of incorrect search syntax
Most children used incorrect search syntax (i.e. natural language). This finding indicates that children had an inadequate knowledge of how to use the engine. No child explored the engine's online help to view the search features provided. Information professionals who teach information skills should assist children in transferring their knowledge from one search engine to another.

Misspelling
Children committed misspelling errors on the three tasks. The fact that Yahooligans! does not provide a spell-checking technique has contributed to the difficulty that children encountered in finding relevant information when they searched by keyword.

Looping searches and hyperlinks
Most children looped searches and hyperlinks. Since the Web, by nature, imposes disorientation and cognitive overload on users, children are prone to loop hyperlinks and searches when they use the Web due to memory recall (Siegler, 1991). This problem can be remedied through effective Web training. One method is to teach children, especially novices, to keep a list of the searches they execute. Similarly, teaching children how to use a browser's History list may assist them in recalling the hyperlinks that they visit.

Backtracking
All children used the browser's Back command exclusively to navigate among the Web pages they retrieved. No child used shortcuts (e.g. History list, Go list), indicating unfamiliarity with these navigation commands. Prior research has shown that users, regardless of age, use the Back command frequently (Catledge and Pitkow, 1995; Tauscher and Greenberg, 1997; Large and Beheshti, 2000; Wang *et al.*, 2000). Consequently, backtracking by the children in this study is considered typical of Web users' behaviour; however, it decreased their efficiency in navigating the Web. This problem can also be remedied through effective Web training.

Lack of incentive
Children performed the fact-finding and research-oriented tasks to gain experience in using the Web. Their teacher did not make these tasks a part of class-related projects. Therefore, no grade or other incentive was given. On these tasks, children maximised their interest in using the Web as an end in itself rather than completing the tasks successfully. It is possible that children's low level of engagement and cognitive processing of the tasks discouraged them from completing the tasks successfully. Oliver and Oliver (1997) note that contexts and purposes for information-seeking activities will motivate and encourage students to process and analyse the information they retrieve. However, this view may not be true in all situations. In a study of middle school students' use of the Web, for example, Wallace and Kupperman (1997) found that most students who performed class-related research tasks for which they selected topics of interest did not fully succeed. In the present study, 73 percent of the children succeeded on the fully self-generated task. This success rate was due to the fact that they were given permission to modify the topics during searching, they were given guidance throughout the information seeking process, and they selected simple tasks to pursue. More research is needed in this area of study to determine the impact assigned and fully

self-generated tasks have on children's success.

Yahooligans! inadequate design

Although Yahooligans! is designed for children aged 7-12, it does not support their information-seeking effectively. The structure of keyword searching is very poor. This is mainly because Yahooligans! is designed as a directory rather than an engine. However, placing the Search box above the subject hierarchies encourages keyword searching. Most of the "breakdowns" children experienced were due to keyword searching and misspelling. Yahooligans! also lacks a context-driven online help, a spell-checking technique, and a corrective feedback mechanism. The Help file does not have adequate guidance on how to use the engine/directory or the syntax provided. In addition, the retrieval interface that displays subject categories and sites within categories can be confusing to children, especially when they are very "deep". Children have to click on multiple subcategories to locate the subject pursued. System developers should redesign Yahooligans! to make it the engine of choice for children aged 7-12.

Conclusions

This paper presented the key findings of a research project that investigated the information-seeking behaviour and success of seventh grade students in using the Yahooligans! search engine/directory. Children performed three tasks of which two were assigned by their science teacher.

A total of 50 percent of the children succeeded on the fact-finding task, 69 percent "partially" succeeded on the research-oriented task, and 73 percent did so on the fully self-generated task. Overall, children had more difficulty with the research-oriented task than with the other two tasks. This finding should not entirely confirm, however, that fact-finding tasks are better suited for Web use than research-oriented tasks. This study found that children's preference for the fully self-generated task was due to finding the information sought rather than the topic they pursued. This finding is inconclusive, however, since four out of 15 children articulated their preference. More research is needed in this area of study.

Regardless of success, children had difficulty using Yahooligans!, experienced "breakdowns" with keyword searching, and found few relevant hits. These problems were attributed to these primary factors: inadequate knowledge of how to use the engine, inadequate level of research skills, inappropriate approach to complete the research-oriented task, naïve Web navigation skills, and inadequacy of Yahooligans! design. There is no doubt that children need to be exposed to effective Web training and that the developers of Yahooligans! need to redesign its interfaces. Information professionals should capitalise on children's motivation in using the Web (Watson, 1998) by developing formal Web training programmes that incorporate use of models of the information-seeking process, such as the Big6 Skills (Eisenberg and Berkowitz, 1990).

As children use the Web as the major source for their school projects (Pew Research Centre, 2001), there is a need to learn about these young people's information-seeking behaviour and success. The Web is a complex, unstructured information retrieval system that means not only children, but also "adults have a difficult time constructing a meaningful mental model of the Internet" (Jacobson, 1995, p. 71). Two of the questions that bear study include: what kind of interfaces will support children's cognitive ability, developmental level, and information-seeking behaviour? What type of training programmes should be provided to children?

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