View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by E-LIS repository

Web Portal Design Guidelines as Identified by Children through the Processes of Design and Evaluation

Andrew Large, Jamshid Beheshti, Valerie Nesset & Leanne Bowler
Graduate School of Library & Information Studies, McGill University
3459 McTavish
Montreal, Quebec H3A 1Y1, Canada
andrew.large@mcgill.ca

Abstract

The Web is an important source of information for school projects, but young users do not always find it easy to locate relevant material. A critical factor in success is the portal through which they search or browse web content. Traditionally web portals have been designed by adults with young users in mind, but there is very little evidence that the latter make use of them. In this paper design guidelines are elaborated for such portals that are based upon focus group and operational evaluations by elementary school students of two prototype web portals designed by two intergenerational teams, each comprising elementary school students and adult designers. The evaluations offer strong support for involving children throughout the design process for portals that both in presentation and functionality reflect the cognitive and affective needs of young users rather than adults.

Introduction

In today's wired world, elementary school students as a matter of course consult the Web to find information in support of class-based assignments. They may enter the URL of a page known to them or given them by the teacher, but at some point most likely they will employ a web portal's search engine or hierarchically organized subject directories, followed perhaps by hypertext browsing, to locate relevant information. Many such portals are available on the Web, and some, like Yahooligans!, Lycos Zone or Ask Jeeves for Kids, are designed by adults explicitly to be used by children. But do they include the functional and presentation features that children themselves want to see in a portal? Previous studies have indicated that they encounter obstacles when searching for information (see for example, Hirsh, 1999; Large & Beheshti, 2000; Schacter, Chung & Dorr, 1998). In order to shed more light on what elementary students are looking for in a web portal, two intergenerational teams of elementary students and adult researchers were constituted with the task of designing low-tech portals. Operational prototypes of these two designs were then evaluated by different elementary students in a series of focus groups as well as in two operational studies where the portals were used to find information for a class project. This paper presents lessons learned about web portal design and the design guidelines that have emerged from this evaluation.

Children's Web Portals

A number of web portals have been designed specifically with young users in mind. Bilal (1999) compared the information retrieval performance of grade–seven students when using three such portals: Yahooligans!, Ask Jeeves for Kids, and Super Snooper. She concluded that as novices, children should use the portals designed for them, but also found that each of these portals had its own strengths and weaknesses for information retrieval. In a later study of Yahooligans!, Bilal (2000) offered a number of suggestions to system designers, who "should develop search engines with powerful searching and browsing mechanisms that built on children's cognitive and physical behaviors to search, browse, navigate and explore information with certainty and positive affective behavior" (p. 662). She also has argued for more research into how the interface design of web-search engines affects children's information-seeking behavior and success (Bilal, 2002a).

As a step toward a better design of interfaces for children's search engines on the Web, Large and Beheshti (2000) interviewed children aged 11 and 12 after they had been seeking over several sessions information from the Web for a class project, but the researchers failed to elicit many comments from the children as to how the these interfaces might be improved (although the children provided many other comments regarding their information-seeking behavior). Fidel and her colleagues (1999) reported a similar inability of somewhat older high school students to offer criticisms beyond a desire for faster response times. Large, Beheshti and Rahman

(2002) therefore decided to adopt a different technique to elicit children's evaluations: focus groups. With little need for prompting, the members (aged between 10 and 13) of four focus groups were able to critique several children's portals and to make suggestions for improvements.

Bilal (2002b, 2003) involved eleven grade-seven students in a design study. Each student individually was asked to draw a web portal interface on paper, and to write on the verso the purposes of the interface. They then used one children's portal, Yahooligans!, to find information on a topic of interest to them. Afterwards they said what they liked and disliked about Yahooligans!, and wrote down the features from it that they would choose to add to their drawing. Then they did a search using a second children's web portal, KidsClick, and again said what they liked and disliked, and what new features from it they would add to their drawing. Bilal (2002b) concluded that "children can be effective design partners and informants in developing their own web search engines" (p. 213). The project reported in this paper went a step further than Bilal by involving elementary school students along with adults in two intergenerational teams, each of whose task was to design from scratch a web portal for use by students to locate information for class assignments. In so doing the researchers built upon several existing design models in order to constitute a new model that they have termed "Bonded Design".

Design Process

Theoretical Basis

Four design models initially influenced this work. From Contextual Inquiry came the idea of a team approach to the design and production of low-tech prototypes (Beyer & Holtzblatt, 1999). Participatory Design's premise is that users are the best qualified to determine how to improve their work and work life, and that their perceptions about technology are as important as technical specifications (Carmel, Whitaker & George, 1993). Prototyping is integral to the Participatory Design methodology, since cooperative prototyping involves heightened user participation and supports learning by promoting cooperative communication. The principles of Participatory Design are suitable for design projects involving children, where the school or home environment substitutes for the workplace and their creativity and enthusiasm thrive within a flexible structure that encourages mutual learning. Nevertheless, at least some advocates of participatory design (see, for example, Muller & Kuhn, 1993) are disinclined to accept the notion that users, especially when children, can contribute to the process as true design partners. Informant Design includes children in the design process, but questions the extent to which they can be equals with the adult designers (Scaife & Rogers, 1999; Scaife et al., 1997). Cooperative Inquiry is a combination of techniques from different design methodologies that have proven effective when working with children. It treats children as full design partners—equals to the professional adult designers on the intergenerational team. This design model advocates that children and adults should work closely together in small groups as critics, designers and inventors (Druin, 1996, 2002; Druin et al., 1999).

Bonded Design

The design approach in this research followed a participatory design model that is related to Cooperative Inquiry and where the adults provide expertise in HCI and the children provide expertise on the cognitive, physical and affective states of children. This new model, "Bonded Design" (Large et al., 2006), is represented diagrammatically in Figure 1. Like Cooperative Inquiry, Bonded Design emphasizes an intergenerational partnership in working towards a common goal. It also shares with it the idea that children should play an active role in design rather than merely being evaluators or testers at the end of the design process. It does question, however, the nature of the cooperation between adults and children within the team. In this respect it shares some of the reservations voiced by Scaife and his colleagues concerning the extent to which true equality can exist within an intergenerational team (Scaife & Rogers, 1999; Scaife et al., 1997).

The Design Teams

Two design teams were established in Winter 2003 comprising eight grade-six students (aged 11 and 12 years) and three adult researchers, and six grade-three students (aged 8 and 9 years) and the same three adults. The students were volunteers drawn from an elementary school located in a middle-class suburb of Montreal. The only stipulation was that there should be equal numbers of boys and girls in each team. All the students had prior Internet experience both from school and from home.

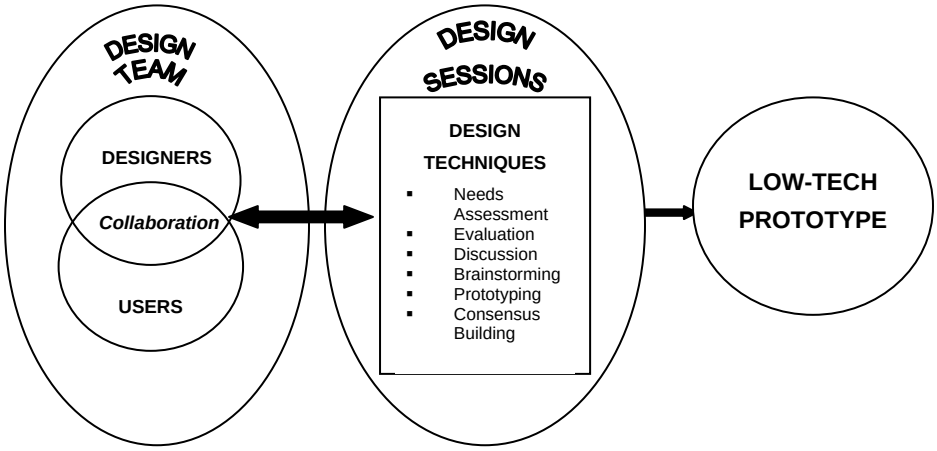

Figure 1. Bonded Design Model

The teams met twice per week, the Grade-six team for 13 sessions and the Grade-three team for 9 sessions; each session lasted about 70 minutes. A typical session involved some/all of the following: a quick résumé of the previous session, team discussion of portal features, brainstorming about portal design, viewing existing portals on the Web, prototyping through individual paper drawings of portals, and consensus building. The Grade-six team members also conducted a questionnaire-based, user needs analysis of their classroom peers to identify their current likes and dislikes of the Internet as a means of finding information to support class projects (the Grade-three students whose reading, language and writing skills were still at a rudimentary level were considered too young to do the same). Through consensus building individual prototype designs evolved into colored drawings of three screens (search, display and help screens) for each portal. These drawings then were transformed by a graphic artist into on-screen images using Photoshop, and this constituted the low-tech prototypes from each team. A more detailed discussion of the design team methodology can be found in Large et al., (2006).

Subject Coverage

It was decided at the outset that the portals should be confined to retrieving information in one subject area – Canadian history. This decision was largely based upon the problems likely to be encountered when the low-tech portal designs had to be converted into working prototypes, and especially the difficulty of building a database of links to web sites that the prototypes would search. In any event (see below) the subsequent evaluations undertaken by elementary school students approved the concept of subject-specific portals. Both portals also had bilingual (English and French) interfaces, a requirement specified by the design teams and unsurprising as the student members lived in Quebec and in their school were taught in both of Canada's official languages. In the case of both portals the two language versions comprised identical features, except that spellchecking only worked in English (see below).

The Web Portals

Both the low-tech portal designs were converted into working web prototypes. Only one major modification was made at this stage: the email and chat facilities included in both low-tech designs were not reproduced in their operational equivalents. Within the confines of the research project it was not feasible to link students with subject experts (the intended purpose of email) nor to provide a closed forum for classmates to interact over school assignments (the intended purpose of chat). Each portal was also tested with a focus group of four students, and some modifications were made based on their comments (these all related to the clarity of screen captions). Screen reproductions as well as a discussion of both designs can be found in Large et al., (2003). Both portals are currently operational on the Web but are password-protected.

Almost 2,500 web sites in English or French were identified by research assistants as relevant to Canadian history and appropriate in vocabulary and syntax for elementary school students (Bowler et al., 2004). Links to these same sites are retrieved by both the portals. For each site a short (one or two sentences) description was written in child-friendly language.

The G6 Portal, History Trek

The opening screen of the Grade-six (G6) portal is shown in Figure 2. The team chose to call the portal "History Trek: A Canadian History Site", to reflect the portal's subject focus. The design metaphor for this screen (and the subsequent screens) is the Canadian flag. Maple leaves (associated with Canada) provide the background motif, as well as appearing on each side of the portal name. The left and right side vertical borders are colored red, and the center section of the screen white, reflecting the colors of the Canadian flag. The portal mascot, Willy the Web Wonder, prominently located in the center of the screen, is also based on the maple leaf. The only animation requested by the design team was that the flag held by the mascot should move backwards and forwards.

Figure 2. G6 Portal (main screen)

The portal offers several approaches to information retrieval: a keyword search box and a natural language search box in the top right, an alphabetical search feature on the middle right, a scrollable timeline at the bottom, and a tree-structured topic menu on the left (to accommodate the latter a hierarchical subject index to Canadian history using child-friendly terms was constructed). An "Advanced Search" option allows a search to be restricted either to the title or assigned index terms of a site, or to phrase searching within the site title or description. Words entered as either keyword or natural language searches are spellchecked in the English-language version of the interface (a similar capability in French was unavailable). The portal also has a hyperlink to three other web portals (Google, MSN and Yahoo, but not other "children's portals" like Yahooligans!) in case users wish to try elsewhere.

Games and quizzes were seen by the design team as potential distractions from the primary task of information seeking, but it was decided that a portal targeted at young people should have some element of entertainment. A link therefore was provided to several web-based quizzes dealing with Canadian history.

Portal personalization is offered through the "My site" icon (the design team students were unfamiliar with the term "personalization") and allows users to choose among four versions of the Willy mascot.

Early in the design process the students had expressed skepticism about the help features typically found on portals, which they considered of little or no use. They said that they needed help in how to find information, and that is precisely the kind of help they never received. If such in-context help could be provided, they were all for including it in their portal, and believed that students then would avail themselves of it. The icon of Willy the Web Wonder serves both as the portal mascot and the means to elicit help. It links to "Willy's Help Page, reproduced in Figure 3. The critical item here is "Help me with my search" which they wanted to offer dynamic and interactive guidance on term selection and search strategy.

The design team devoted quite a lot of time to discussing how retrieved web pages should be presented to users. While the younger team members wanted enough information on each item written in language that they could

understand to enable accurate relevance judgments to be drawn, they wanted to avoid long statements that not only would limit the number of records displayed on any one screen but would also take too long for them to scan. The result can be seen in Figure 4. For each retrieved link the following information is provided: the website title; a short description of its content; the topic to which it has been assigned; the other subordinate index terms assigned to it; and who made it. The title is written in a larger font size than the remaining data. Up to 10 hits are displayed per scrolling screen, and buttons allow further navigation. The sought term as entered or chosen by the user is displayed at the top of the screen as well as the number of hits retrieved. “Click here to see website” links the user to the retrieved website itself.

Figure 3. Help screen in G6 portal

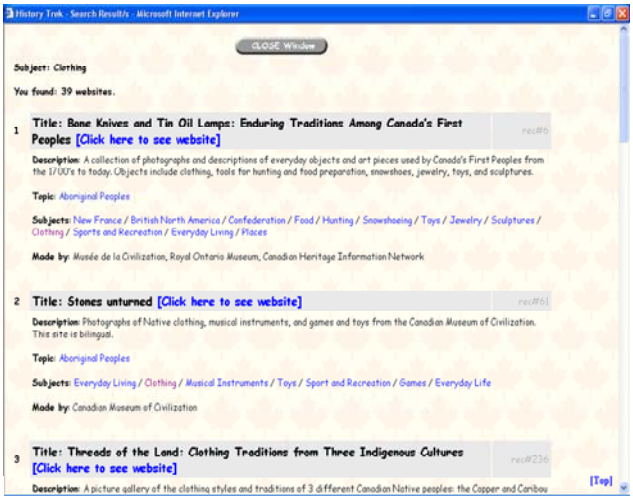

Figure 4. Result display screen in G6 portal

In total, the G6 portal comprises almost 100 individual screens in each language when all the screens related to the individual help, topic index and alphabetical search screens are included (and obviously excluding the hit screens generated as a result of any search). A button on the main screen toggles between the two language versions of the interface.

The G3 Portal, KidSearch Canada

Even at a first glance, the Grade-three (G3) team portal’s main screen (Figure 5) visually is quite different from the G6 portal. It is designed on the concept of a student’s desk. Above the desk is a shelf of books, and attached to the wall on either side of the computer is a bulletin board holding several notes, and a poster. The design as a whole has much less of a Canadian flavor than the G6 portal (although the computer’s background screen presents Canadian images (a maple leaf in Figure 5) and the surfing moose on the poster (the portal mascot) is an animal associated with Canada. The portal is entitled KidSearch Canada.

The G3 portal offers three approaches to information retrieval which are labeled in language suggested by the children. Keywords can be entered in a search box on the computer’s screen (“Put in your search words”); the letters on the keyboard provide an alphabetic topic search option (“Search by letter”), and the books on the shelves are used to begin a topic search. The topics are identical to those in the G6 portal.

Figure 5. G3 Portal (main screen)

Personalization ("Screen change") is used to select between four different Canadian images for the background screen on the computer (in Figure 5 the maple leaf has been chosen, but also available are a beaver, a moose and a Royal Canadian Mountie). The globe is used to toggle interface languages between English and French. A link is provided to the same web-based history quizzes as on the G6 portal. The help screens are similar to those on the G6 portal, but obviously describe the features of the G3 portal where these differ from the G6 version. The hit display screens also are similar to those on the G6 portal. The G3 portal has slightly fewer screens than its G6 equivalent – around 70.

Portal Evaluation

The intergenerational design teams shed light on young people's ideas about web portal design (Large et al, 2004, 2004b) but could not say whether or not the portals would prove acceptable to their target audience - elementary school students. Two methods were employed therefore to evaluate the portals: focus groups, and an operational study. In Fall 2004 and Winter 2005 twelve focus groups (eight using the English-language interface and four using the French-language interface) met in their schools. Half of the groups comprised students from grade six and half from grade three. Each group had either four boys or four girls (therefore involving 48 students in total in the focus group evaluation). Additionally a facilitator, note-taker and observer were present at the focus group sessions. Each session lasted about one hour and was audio taped. The students were volunteers from two elementary schools in similar socio-economic areas to the school from which the design team students had been drawn. The following procedure was followed. The students were asked to give their first impressions of the portal. They were then asked to find websites that would provide an answer to two questions on Canadian history that were presented to them. As they did so they were encouraged to talk about the portal and express their likes and dislikes. Then they were asked to comment generally on the portal. This process was repeated with the second portal (and two different questions). Finally the students were asked to compare the G6 and G3 portals one with another and also with other portals with which they were familiar. The order in which the two portals were viewed, and the questions posed to each portal were rotated to ensure equal treatment.

Two operational evaluations also were carried out in another elementary school. Two classes of grade-six students used the G6 portal over several weeks to find information for a project on aboriginal peoples that had been set by their teacher. They accessed the portal from the school's IT Lab but could also use it from home. Two grade-three classes used the G3 portal for a similar project, though in this case their teacher only wanted them to search during IT Lab sessions. The students in both grades were observed during lab sessions, and were individually interviewed about the portals immediately after their project was completed. The interviews were based on open-ended questions and were audio taped. Around 80 students (40 from each grade) took part.

The focus group evaluations overall were more enthusiastic about the G3 and G6 portals than were the interviews with participants in the two operational studies. It could be argued that the latter are more reliable because the portals were used more extensively in the operational study and to find information for a genuine class project. On

the other hand, for this very reason the students' reactions to the portals, at least in part, were determined by their individual success at finding information for the project. Many did find without difficulty relevant information, but some encountered problems. This was particularly the case for the grade-three project where the teacher required students to find information about specific tribes; in some cases students chose a tribe about which little was written. Furthermore, a general problem (commented upon by the teacher) was the shortage of material on the Web appropriate in content and style for young students in grade three. Any shortcomings in the retrieved websites might then be blamed on the portal. As with other areas of information science, a reliable and effective evaluation mechanism is not easily implemented.

The evaluation data were analyzed using the constant comparative method (Glaser & Strauss, 1967), which enabled segments of data to be described and compared within and across categories in order to discover constructs and themes (see also Miles and Huberman, 1994).

Lessons Learned

What can be learned about the design of web portals intended for young students from the evaluation by grade-three and grade-six students of two such portals that had been designed by two intergenerational teams including student volunteers from these grades?

Portal Objective

A portal can have three possible objectives: to provide information, education or entertainment (Rosenfeld & Morville, 1998). While the objective of an entertainment portal would be to provide leisure and fun, and the objective of an educational portal would be to promote learning, the objective of an information portal is to retrieve information that might be to support leisure activities, or, in the context of this study, to support school-based projects and assignments. The design teams had the task of elaborating design criteria for an information portal, but were asked to comment upon the extent to which they thought this might be furthered by the incorporation of entertainment elements. They believed that an entertainment option could distract students from the information task at hand. They rejected the idea of including games or other such diversionary activities; the furthest they were prepared to go in this respect was a quiz, but even here one which would be directly related to the portal's informational objective – in their case, a quiz on Canadian history. The students involved in evaluating the resulting portals, however, were less convinced of this distraction factor; some of them considered that entertainment could offer a welcome temporary diversion from the search for information. They suggested that one or two games might profitably have been included in children's portals. This was in conformity with the findings of Large, Beheshti and Rahman (2002) whose focus groups were divided on this question.

Both the G3 and G6 portals were designed to find information in one specific subject area for class-based projects. The decision to confine the scope to Canadian history, however, initially had been a pragmatic one, largely based on the infeasibility of trying to build a prototype that could provide links to the whole gamut of information on the Web. In the event, however, this subject focus proved advantageous. A major problem often encountered by students (and indeed anyone else) when searching on the Web for information is the irrelevancy of many retrieved sites; as one student said, "sometimes [Google] gives you something that doesn't have to do with what you wrote so you have to write something different". In part this is caused by the multiple meanings assigned to many words (homonyms) so that sites are retrieved that match the search term morphologically but not semantically. Children find this not only extremely frustrating but difficult to overcome as they tend to find search strategy reformulation difficult. They realized that by restricting the subject nature of the portal many potential problems caused by homonyms would be avoided. Some students, nevertheless, would have liked a wider subject scope, extending at least to US history.

Visual Design

The most striking aspect of presentation is that both portal designs have the hallmark of design by children for children. First impressions of both portals were expressed by focus group members in terms such as "cool", "really attractive" and "very visual". What design aspects appealed to the students? First, they seek meaning in design. That is to say, the portal's design should be related to its purpose. This is especially apparent in the G6 portal whose Canadian-oriented motif was clearly related to its objective – finding information about Canadian history. The Canadian presence in the G3 portal was less, but here the students appreciated its metaphor of a child's work desk on which are located familiar objects. This concept of relatedness is further emphasized by the titles given to the two portals: "History Trek: A Canadian History Site" and "KidSearch Canada". For the students titles did matter.

Color is important for children, but color preferences vary from child to child. Overall, however, bright colors were favored. It is a little surprising that the large areas of white space found on the G6 portal were not criticized, as previous research had found a strong dislike by children of colorless areas on a portal (Large, Beheshti & Rahman, 2002). The reason most probably is that the white areas were accepted because they played an integral role in the design motif – the Canadian flag.

The intergenerational team designers had largely rejected animation – the G6 portal only contained one animated action and the G3 portal none – on the grounds that animation might distract users from the portals' primary purpose: efficient retrieval of relevant information for class projects. As Kuntz (2000) argues, design attractiveness can lead to user distraction. In the evaluations, however, students were more equivocal about this lack of animation, and indeed some students based their preference for the G6 portal in part on its inclusion of an animation. This latter finding is in conformity with the focus group studies conducted by Large, Beheshti and Rahman (2002). Designers might consider including more animation, but not to the point at which the portal presents an entertainment delivery rather than information finding intent.

Students reacted positively to the use of icons on the G6 portal to represent topics, and several suggestions were made that similar icons should be included on the spines of the books used on the G3 portal to designate topics. Previous research (Large, Beheshti & Rahman, 2002) has suggested that children interpret icons very literally and therefore icons can be problematic when used to represent abstract concepts. In the evaluations students did not seem concerned about, for example, an icon with a picture of a railway engine representing the broader topic "Transport".

Children appreciate mascots that play a role in the interface and have a meaning for them. Willy, the maple leaf shaped mascot on the G6 portal, and the mouse (saying "hi") on the G3 portal were both very popular, and the former had the function of activating the help screens on the portal.

The name given to a portal has importance for children. It should convey the portal's purpose, and ideally be fun (Large, Beheshti & Rahman, 2002). The student evaluators liked the names given to both portals by their design teams (History Trek and KidSearch Canada) because they did just this.

Personalization also was popular, although this term itself was not understood by the children, and nor could they suggest a better one (neither "My site" on the G6 portal nor "Screen change" on the G3 portal were understood in the evaluations). Ideally the children undertaking the evaluations would have liked more personalization than was offered by either portal, including icon selection and color choices.

The student evaluators did not seem concerned that the student designers had disregarded in some instances established interface design norms. Examples are the small keyword search boxes on both the G3 and G6 portals, and the natural-language search box on the G6 portal: words often scrolled out of sight within these boxes. This design "shortcoming" did not trouble students, even when explicitly discussed with them. They thought the boxes were in proportion to the overall design and did not believe they needed to be enlarged. This raises questions about the applicability of well-established design guidelines to interfaces intended for use by children.

Terminology

Interface terminology proved a challenge for the design teams. On an interface it is necessary to encapsulate functions in no more than a short phrase, yet this risks confusing young users. A good example comes from the G6 portal. The design team in the low-tech prototype had included under the maple leaf mascot the phrase "I'm Willy the Web Wonder. Need help? Ask Me!" When the portal was tested (before formal evaluation) with a group of grade-six students they thought that it was only necessary to click on Willy and he would immediately and effortlessly answer their information query! This required a change in wording to "I'm Willy the Web Wonder. Need Search Tips? Click on me!". On the results display screen of the French-language interface the phrase "cliquer ici pour naviguer" (in place of "Click here to see website" in the English version) confused many students who were unfamiliar with the concept of "navigating" the Web and assumed some kind of nautical connotation. In contrast, some students on the English-language interface did not understand the term "keyword", whereas its French

translation, “Recherche par mots-clès” seemed clearer. Terminology for children requires not only careful initial consideration by designers but subsequent user testing to ensure intelligibility.

Information Retrieval

Previous research (for example, Large & Beheshti, 2000; Large, Beheshti & Moukdad, 1999; Schacter, Chung & Dorr, 1998) has indicated that young people tend to prefer browsing to searching when seeking information. This preference was supported in the evaluations. Both the portals provide browsing via a hierarchical subject index whose top level is represented by topic icons (G6 portal) and books (G3 Portal), and browsing was the most common approach chosen by students when seeking information during the evaluations. They would opt for browsing whenever they found it easy to identify an appropriate topic, and tended to use a different approach only when it was hard for them to decide which topic was likely to lead to the information. In such cases they opted for either a keyword or a natural-language search on the G6 portal (it is unclear as to the extent to which they appreciated the difference between the two), and a keyword search on the G3 portal. This indicates that more research is needed on children’s own categorization processes to ensure that the categories (topics) used in any browsing hierarchy are in conformity with young users’ perceptions (Bilal & Wang, 2005).

Spellchecking should be considered an essential component of searching when children are involved. The alphabetical search facility provided on both portals removes the need to spell keywords; the user need only click on the first letter of the word to see an alphabetical display of search terms beginning with that letter. The design team liked this idea, and the students in the two operational studies also widely used it (although in the focus groups it was often overlooked) despite the fact that in some cases, the lists were quite long.

The G6 portal included several other retrieval tools, and in the evaluations students liked this multiplicity of approaches rather than finding it confusing. At the same time, they did not greatly use these additional search features. For example, the scrolling timeline for searching on dates was greeted positively when pointed out to students, and some used it in the operational study. “Advanced Search”, however, was almost never activated. The link provided to other search engines was considered useful but not widely employed.

Students were very critical of the way in which portals like Google display search results. In particular they found the site descriptions very unhelpful. In contrast, responses were enthusiastic to the clear displays of results on both the G3 and G6 portals, and to the child-friendly short descriptions of the sites. The spaced layout and large fonts were appreciated. At the same time, the students did not find it especially helpful to see the Topic and subject index terms that had been assigned to the retrieved sites. These were hyperlinked with the idea that a student could explore related sites, but in practice students either ignored this capability or used it inadvertently, thereby often being taken from a relevant site to an irrelevant one. Finally, the inclusion of an author statement (“made by”) was deemed irrelevant by students even though it ought to help them judge the authority of any website. Scrolling through results (up to 10 were displayed per screen) was not a problem

Help Features

Students in the design teams were unanimous in asserting that help features would only be useful if they could provide concrete advice on how to find the information being sought. Help given through such approaches as tutorials, examples, or general guidelines on search strategy construction were of little or no assistance, and would not be consulted. Unfortunately, the operational prototypes were unable to attain this exacting standard, and the students in their evaluations of the help features were correspondingly critical of them.

Bilingualism

The interfaces of both portals were available in two language versions. There is no default language; the language in which the portal is closed is the language in which it appears when re-activated. This avoids the sensitive issue of choosing one language as a default, or alternatively of including an opening screen that only chooses language. The design team had decided that French-language websites would only be retrieved when using the French-language interface, and English websites when using the English-language interface; in the evaluations this was rated preferable to each interface finding everything (as normally in class at any one time the children will be working in one language rather than both). The interface was originally designed in English – both design teams worked in that language - and subsequently translated into French. A few translation problems were encountered (one has been cited above), but these can be readily identified with evaluation. The tendency of

French to require more words than English (for example, “Tests de connaisances sur l’histoire” instead of “History quizzes”) potentially can create interface layout problems when such localization is undertaken.

Portal Preference

Did the students in their evaluations of the two portals express any preferences? In the 12 focus groups the 48 students explicitly were asked this question. Their assessment was unaffected by grade (three or six) or by interface language (English or French); however, boys were more likely than girls to prefer the G6 portal, and to a lesser extent girls were more likely to prefer the G3 portal. It had been anticipated that student evaluators from grade three would prefer the portal from the grade-three design team, and likewise the grade-six design would be preferred by the grade-six evaluators. Nielsen (2002) has commented on the keen awareness that children have about their age relative to those even slightly younger or older than themselves. This was supported in the design teams, especially when the student members looked at and commented upon each other’s designs; the grade-six team thought the grade-six design most appropriate for that grade, and the grade-three team thought the grade-three design most appropriate for its grade. In the light of the evaluations, however, it seems probable that the students in the design teams were just too wedded to their own designs; students involved in the evaluation who did not have any ties to the two designs could not discern any age-significant differences in the two interfaces. This suggests that it is unnecessary (as well as impractical) to design different interfaces for individual elementary school grades.

Design Guidelines

As with any evaluation, unanimity is an improbable outcome. Student opinions diverged on design guidelines during evaluation just as they had during the design stage. Nevertheless, clear guidelines for designing children’s web portals did emerge from the two design teams and the subsequent evaluations of their work, in many cases further confirming results from earlier studies. Based on these evaluations, web portals for young people should:

- Choose between informational, educational or entertainment objectives;
- Not be designed for students in individual elementary school grades – one design should be appropriate for students at least between grades three and six;
- Employ a thematic design concept (for example, Canada in the G6 portal) or a metaphor (such as the student’s desktop in the G3 portal) to provide a unifying design framework for portal features.
- Include efficient and effective mechanisms for information retrieval, such as natural-language, keyword searching and an alphabetical search feature as well as browsing capabilities;
- Employ browsing structures that are in conformity with children’s own categorization processes (more research is required to identify such structures);
- Not include advanced search capabilities (for example searching by field) that are unlikely to be used.
- In a bilingual portal separate the two languages so that documents are only retrieved in the language to which the interface is set;
- Provide effective spellchecking capabilities;
- Incorporate color and images to enliven the design, but not at the expense either of clarity or operational usefulness.
- Display results clearly, with a brief but accurate summary of a document’s content in language that young people will understand. This supports the findings by Kafai and Bates (1997) that both titles and descriptions can prove very misleading for students unless they are designed specifically with them in mind.
- Include interface personalization (although in practice it was difficult to choose a good term that children can understand to express this concept);
- Incorporate a help feature that offers dynamic and interactive guidance on term selection and search strategy and is capable of directing a student from a failed search directly to a successful search; anything short of this will not be much used (see also Large, Beheshti & Moukdad, 1999; Large & Beheshti, 2000).

Conclusions

The design guidelines that emerged from the web portal design and evaluation stages of this project provide valuable information for designers of children’s web portals. The fact that children were involved, through Bonded Design, in the initial portal designs as well as through focus groups and an operational study in the evaluation of these designs only lends added credibility to the findings. At the same time it must be conceded that only two portals were evaluated, and that even for these portals important questions remained unanswered. For example,

questions were raised about the most appropriate ways to construct browsable topic structures and to display them within an interface that still seek answers. A body of research relating to children as information seekers is slowly accumulating, though generalizations from this research are still hampered by the use of different methodologies and the inclusion of children at different ages and with different cognitive levels of development. Only by a continued research interest in this important young user community can such generalizable conclusions be effectively pursued.

Acknowledgments

The authors express gratitude to the students in the four schools who participated in the design teams and the evaluation studies. Financial support from the Social Sciences and Humanities Research Council of Canada is gratefully acknowledged.

References

Beyer, H. & Holtzblatt, K. (1999). Contextual Design. *ACM Interactions,* 6 (1), 32-42.

Bilal, D. (1999). Web search engines for children: A comparative study and performance evaluation of Yahooligans!, Ask Jeeves for Kids, and Super Snooper. In *Proc. ASIS Annual 1999*, Information Today, 70-83.

Bilal, D. (2000). Children's use of the Yahooligans! Web search engine: 1. Cognitive, physical and affective behaviors on fact-based search tasks. *Journal of the American Society for Information Science* 51 (7), 646-665.

Bilal, D. (2002a). Children's use of the Yahooligans! Web search engine. III. Cognitive and physical behaviors on fully self-generated search tasks. *Journal of the American Society for Information Science and Technology* 53 (13), 1170-1183.

Bilal, D. (2002b). Children design their interfaces for Web search engines: A participatory approach. In *Proc. CAIS 2002*, CAIS, 204-214.

Bilal, D. (2003). Draw and tell: children as designers of web interfaces. In *Proc. ASIST 2003,* Information Today, 135-141.

Bilal, D. & Wang, P. (2005). Children's conceptual structures of science categories and the design of web directories. *Journal of the American Society for Information Science and Technology,* 56 (12), 1303-1313

Bowler, L., Nesset, V., Large, A. & Beheshti, J. (2004). Using the Web for Canadian History Projects: What Will Children Find? *Canadian Journal of Library and Information Science*. 28 (3), 3 – 24.

Carmel, E., Whitaker, R. & George, J. (1993). PD and Joint application design: A transatlantic comparison. *Communications of the ACM* 36 (4), 40-48.

Druin, A. (1996). A place called childhood. *Interactions* 3 (1), 17-22.

Druin, A. (2002). The role of children in the design of new technology. *Behaviour and Information Technology*, 21 (1), 1-25.

Druin, A., Bederson, B., Boltman, A., Miura, A., Knotts-Callahan, D. & Platt, M. (1999). Children as our technology design partners, in A. Druin (ed.), *The Design of Children's Technology.* Morgan Kaufmann, San Francisco, CA, 51-72.

Fidel, R., Davies, R. K., Douglass, M. H., Holder, J. K., Hopkins, C. J., Kushner, E. J., Miyagishima, B. K. & Toney, C. D. (1999). A visit to the information mall: Web searching behavior of high school students. *Journal of the American Society for Information Science* 50 (1), 24-37.

Glaser, B.G. & Strauss, A.L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago: Aldine.

Hirsh, Sandra G. (1999). Children's relevance criteria and information seeking on electronic resources. *Journal of the American Society for Information Science* 50 (14), 1265-1283.

Kafai, Y., & Bates, M. (1997). Internet web-searching instruction in the elementary classroom: building a foundation for information literacy. *School Library Media Quarterly.* 25 (2), 103-111.

Kuntz, J. (2000). Criteria for comparing children's Web search tools. *Library Computing* 18 (3), 203-207.

Large, A. & Beheshti, J. (2000). The Web as a classroom resource: Reactions from the users. *Journal of the American Society for Information Science* 51 (12), 1069-1080.

Large, A., Beheshti, J. & Moukdad, H. (1999). Information seeking on the Web: navigational skills of grade-six primary school students. In *Proc. ASIST 1999.* Information Today, 84-97.

Large, A., Beheshti, J., Nesset, V. & Bowler, L. (2003). Children as designers of web portals. In *Proc.ASIST* 2003, Information Today, 142-149.

Large, A., Beheshti, J., Nesset, V. & Bowler, L. (2004a). Designing web portals in intergenerational teams: Two prototype portals for elementary school students. *Journal of the American Society for Information Science and Technology*, 55 (13), 1-15.

Large, A., Beheshti, J. & Rahman, T. (2002). Design Criteria for children's Web portals: The users speak out. *Journal of the American Society for Information Science and Technology* 53 (2), 79-94.

Large, A., Nesset, V., Beheshti, J. & Bowler, L. (2004b). Design criteria for children's web portals » a comparison of two studies. *Canadian Journal of Information and Library Science* 28 (4), 45-72.

Large, A., Nesset, V., Beheshti, J. & Bowler, L. (2006). "Bonded Design": A Novel Approach to Intergenerational Information Technology Design. *Library and Information Science Research*, 28 (1), 64-82.

Miles, M. B. & Huberman, A. M. (1994). *Qualitative data analysis: An Expanded Sourcebook.* SAGE Publications, Thousand Oaks, CA.

Muller, M. & Kuhn, S. (1993). PD. *Communications of the ACM*, 36 (6), 24-28.

Nielsen, J. (2002). *Kid's Corner: Website Usability for Children*.
Available at: http://www.useit.com/alertbox/20020414.html [Accessed 6 January 2006].

Rosenfeld, L. & Morville, P. (1998). *Information Architecture for the World Wide Web*. Sebastopol, CA: O'Reilly.

Scaife, M. & Rogers, Y. (1999). Kids as informants: Telling us what we didn't know or confirming what we knew already, in A. Druin (ed.), *The Design of Children's Technology.* Morgan Kaufmann, San Francisco, CA, 27-50.

Scaife, M., Rogers, Y., Aldrich, F. & Davies, M. (1997). Designing for or designing with? Informant design for interactive learning environments. In *Proc. CHI 1997*, 343-350.

Schacter, J., Chung, G., & Dorr, A. (1998). Children's Internet searching on complex problems: performance and process analysis. *Journal of the American Society for Information Science*, 49, 840-849.