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Children Digital Libraries and User Interfaces: Proposing a Set of Criteria

Zeinab Sedighi
PhD Candidate in Knowledge and Information Science, Department of Knowledge and Information Science, Islamic Azad University, Hamedan, Iran
Email: z.sedighi@yahoo.com

Abbas Gilvari
Assictant Prof. Agricultural Research, Education & Extension Organization (AREO), Tehran, Iran

Fatemeh Nooshinfard
PhD, Department of Library and Information Science,
Science and research Branch, Islamic Azad University, Tehran, IRAN

Abstract

The purpose of this paper is to investigate the user interfaces of the most important world's children digital libraries and consider their conformity with the experts' opinions. This is done with the aim of proposing a set of unique and applicable criteria for Iranian children digital libraries that was not provided by the previous studies. The data for this study were collected by a check list for each of 6 world's most famous children digital libraries. This study applied survey as its methodology. This study showed that the compliance of the children digital libraries with selected criteria totally was 63.43 percent. Among the analyzed criteria, the criterion of "study facilities of retrieved resources" (94.33 percent) and "options for customizing the texts" (3.33 per cent) indicated the highest and lowest level respectively. From the expert's point of view, the option of "show error messages" reached the maximum and "customizing the texts" grasped the minimum levels. Finally, based on the study outcomes, a set of criteria is proposed for children digital library user interfaces. Due to the lack of a known and complete list on the web, some important children digital libraries might be missed. Also, the proposed set of criteria only can be used to evaluate the user interfaces of children digital libraries. Applying a unique set of criteria in designing children's digital Library interfaces could increase the amount of children's use of such libraries.

Keywords: children digital library, user interfaces, Iran.

Introduction

In a digital library what provides interaction between user and library is user interface. It should be prepared and designed according to the information needs of their user community (in this case, children). Since children have specific behaviors and cognitive characteristics, so interfaces should be designed carefully and enriched with the capabilities so that children will be able to use them with ease and comfort.

User interface in a children digital library is similar to a traditional library entrance. When a user is entering the traditional libraries, entrance is the first place that a user faces. Therefore, most library directors and librarians select this place to demonstrate new library resources, library rules, scholarly materials and their services in order to attract the users' attention. As Large, Tedd and Hartley (1999) declared, "user interface is a bridge which relates the users with storage and retrieval systems". Good user interface should be used to establish effective interaction between users and digital libraries to help them to use and access desired information resources effectively. A user interface allows the users to obtain 'what they need, in a desired way and in a user friendly manner' (ibid).

Children, like the other users, need to interact with interfaces for access to information resources in a digital environment. If this module is designed compatible with children's abilities and needs, it would increase the success of children to achieve the desired information and increase their reading interests. Simplicity, attractiveness, being easy to understand, and offering search facilities are most important criteria which must be considered in designing a children user interface. Therefore, it would be very important to present a set of criteria for user interfaces in children digital libraries. Therefore, this study intends to investigate and determine the most important criteria used in user interfaces of some important children digital libraries of the world (6 libraries), achieving the experts' point of view about these criteria and recommend a sample set of criteria for world's children digital library user interfaces.

Research Questions

1. What are the most applied criteria in the interfaces of the most important children digital libraries of the world?
2. What are the most important criteria in designing a children digital library user interface from experts' point of view?
3. What criteria could be proposed for the interface of children digital libraries?

Literature review

Druin et al (2001) aimed to develop a digital library interface appropriate for young children and as the result they offered a graphical user interface for querying, browsing and reviewing search result. In his research on the same subject, Namazi (2003) determined the impacts of some factors on designing digital libraries in Iran. Mehrad and Zahedi (2006) compared the user interface abilities of two Iranian information Centers (Regional Information Center for Science & Technology, and Iranian Research Institute for Scientific Information and Documentation) with four non-Iranian ones (Emerald, Ebsco, Elsevier and ProQuest). Results of this study showed that, in designing user interface of a database, criteria such as user experience, subject coverage of database, and user friendliness of interface are among the

most important criteria. They finally determined five common criteria for a good user interface. Zerehsaz, Fattahi and Davarpanah (2006) measured the student satisfaction of user interface in Simorgh (an Iranian library system) software. They found out that there is a significant relationship between students' satisfaction and the measures acquaintance of an interface. They also specified some important specifications and factors which are important in Simorgh user interface. In another study, Bilal and Bachair (2006) studied the children's interaction with cross-cultural and multilingual digital libraries. The results of their study revealed that children digital library navigation module should be judged based on the extent of supporting navigation tasks.

Bilal (2006) evaluated and surveyed the current version of a children digital library software, its design logic and creation process of searching and browsing tools. In his MA thesis in the same field, Abbaspour (2006) evaluated the user interface of Thesis Database belongs to Scientific Information and Documentation Center (IRANDOC). He dragged out some pitfalls of this user interface. Zaker Shahrak (2007) also studied the necessity of establishing a children digital library in an international level. Najafinia (2007), in his research paper entitled "A comparison study of Children Digital Libraries", introduced specifications of International Children Digital Library (ICDL) and compared these specifications with some other children libraries. He indicated that ICDL's has only and most comprehensive user interfaces. Aligani, Mousaviyan, Alizadeh, and Karami (2009) compared and evaluated the user interfaces of public search engines such as Google, Altavista, Yahoo, and the entire web. They proposed some criteria which were common among these search engines.

Reviewing the current literature shows that, they mostly concentrated on physical and instructional aspects of designing searching and browsing tools for children digital libraries and/or on the evaluation of their user interfaces from children's point of views. Almost none of them investigate the needed criteria for designing a children digital library user interface in detail. The current study focuses on both experts' opinion and comparative study of the world's most famous children digital libraries to achieve a unique and approved set of criteria for user interfaces and proposed them for children digital libraries.

Methodology

The present study used survey as the methodology. Through the reviewing the related scientific texts and resources, the researchers prepared a checklist consisting of 15 criteria and 98 components. The results were evaluated according to these 15 criteria in response to research questions. The research population included six world's most important children digital libraries (Table 1). These Digital Children Libraries were more cited and using worldwide, frequently mentioned in professional subject literatures and reached most hints in Google searching.

Through the direct observation, one checklist was completed for each of libraries in order to determine the most common criteria in their user interfaces. During the investigation, additional missed or unconsidered criteria are added to checklists and examined again for the reminder and previous examined library ones. Final checklist was also emailed to a couple of experts to gather their opinion about the importance of each criterion. The list of criteria which highly ranked by the experts was compared with high frequency appeared criteria on the investigated libraries interfaces and those common criteria with higher ranks and frequencies were selected. Finally, T-Score test was performed as an evaluation device for acceptance or rejection of a criterion. Those criteria which obtained T-Score between 50 to 100, were accepted as an element to be included in the proposed criteria for children digital library interfaces.

Table 1

List of Surveyed Children Digital Libraries

Name of library	URL
France children digital library (Bibliotheque numerique des infants')	http://enfants.bnf.fr/
Iranian children digital library	http://icnl.nlai.ir/Default.aspx
International children`s digital library	http://www.icdl.org
Story Place	http://www.storyplace.org/storyplace.asp
children`s storybooks online	http://www.childrensbooksonline.org/
children`s books online	http://www.magickeys.com/books/

User Interface design characteristics for children

The design elements that make a digital library interface effective could be classified as follows:

Presentation components and capabilities

What children see in their first visit of a digital library is the interface and it has a clear impact on their decision to use the library again or not. If children confront attractive pages, it will increase their enthusiasm to use the digital library again and again or vice versa. Displaying components and capabilities include the criteria which provide interaction of children by the library. Therefore, displaying capabilities (screen capabilities, ability of organizing the screen, options for customizing the texts, visual symbols and images, and picture quality) could attract the children to the library. The most important display features of a children digital library are as follow:

- *Screen capabilities*: It is necessary for the screen to be attractive and show the contents

in the middle of a page (Zerehsaz and Fattahi, 2006). Minimum scrolling, particularly on the homepage, is necessary because the children might not be familiar with the tool and not be able to find the rest of the page. Children prefer to see all the information on a page (Blowers and Bryan, 2004). Therefore, it is better to use multiple pages instead of one long page (Abbaspour, 2006). The patterns, colors, links, images and illustrations used should attract children to the digital library and encourage them to communicate with it (Druin, Weeks, Massey, and Bederson, 2007; Theng, Norliza and Harold, 2007).

- *Ability of organizing the screen*: There is a need for a consistent page layout throughout the screens of digital library. 'Consistent placement of interface elements can help users to easily recognize them, and allows maximum benefit from using the site' (Barder, 2002). As Nielsen states, this helps improve the usability of a digital library (Nielsen and Norman, 2004). Functions, programs and different methods of display should be so integrated to each other that children understand it (Moore and George, 1991; Nilson, 2006). Children often do better with category browsing (Borgman, Hirsh, Walter, 1995; Cooper, 2006; Moore and George, 1991).

- *Options for customizing the texts:* The interface should provide facilities by which children feel a high level of freedom to use the library. Children should be able to choose required size and font style (Bilal, 2006; Cooper, 2006; Large, 2004; Ohishi and Nonogaki, 1999).

- *Visual symbols and images:* Interaction between children and a digital library are possible through communication channels. Communication channels include interface and options by which children are able to use the library (Ohishi and Nonogaki, 1999).

Visual symbols and options play an important role in the children's use of a digital library (Cooper, 2006). Using good graphics could be one of the important elements for attracting younger children to use a digital library. Graphics must be efficiently added to the library interfaces (Demner, 2001). Graphical symbols of some library search modules lack the attraction. Smallness of some used icons makes it difficult for children to choose them by mouse. Therefore, designed interface symbols with a big size can help children to use the library with more ease (Busey and Doerr, 1993; Druin et al. 2003; Hutchinson, Druin and Bederson, 2007).

- *Picture quality*: Children like to use elements such as sound, image, and animation on library pages because they provoke their feels (Cooper, 2006; Ohishi and Nonogaki, 1999; Theng, Norliza and Harold 2007). Quality appearance of these elements will help children to have a good picture of digital library and encourage them to study and reuse it (Cooper, 2006). Children enjoy an environment with high images and graphics although older children may be more excited by pages with less graphic and more information (Blowers and Bryan, 2004).

Search components and capabilities

Providing facilities by which children can search in the digital library and find their desired resources are the main purpose of search components and capabilities. Therefore, we should provide libraries which could be easily used by children. Attending to skills, needs and search capabilities of children can help the children in retrieving desired resources from digital libraries. In the process of seeking, children may face specific problems. To solve these problems, they need guidance and help tools. Also, they need feedback facilities to express their opinion and ideas. The most components of search module of children digital libraries which must be considered are discussed in brief:

- *Search facilities:* Many searching and browsing interfaces for children's suffer from one or more of three problems. First, they do not take into account the information processing and skill abilities of children, specifically their difficulties to manipulate small objects with a mouse (Hourcade et al., 2003). Second, they do not consider children searching and browsing skills, specifically their difficulties with spelling, typing, navigation and composing queries (Borgman et al., 1995; Moore and George, 1991). Third, they do not consider how children prefer to search. The presented criteria are more appropriate for adults, but not for children (Busey and Doerr, 1993; Druin et al., 2001; Moore and George, 1991). In traditional libraries, young children choose books based on the appearance of the cover and illustrations (Kragler and Nolley, 1996; Moore and George, 1991), while older children focus on content of books (Wendelin and Zink, 1983). These trends are also true in digital libraries (Reuter and Druin, 2004) and search module functions should fulfill this goal.

- *Help services and Tips:* children should be able to click help icon in case of encountering a problem in each stage of library processes (searching, retrieval and etc.) or when they did not understand the interface symbols or part of operations (Cooper, 2006; Entezaryan and Fattahi, 2009; Mehrad and Asari Shahri, 2007).

Trenner (1989) suggested six specifications for help module of a digital library. These requirements include online help at any time, easy use of and exit to help, good structure of help facilities, good display of help and guidance facilities on the screen, good sentences, and help for users of different age groups.

- *Error message alert:* Error messages should be clear, visible, and relevant. Also, it should have a fixed location in the screen. It is most important to warn user from problems has occurred and give vocal short message for solve it. The vocal error message should be courteous, productive and suitable for different age groups of children. Messages must not be threatening and should avoid the joke mode (Norouzi, 2009).

- *Interaction and feedback facilities:* A child should be able to use the digital library system easily while he/she is watching, listening and reading the materials on it. A digital library system should be capable of meeting the expectations of children through the interactions and feedbacks (Cummins, 2004; Demner, 2001; Dorner and Curits, 2003; Ohishi and Nonogaki, 1999). Providing facilities such as sending paints, messages or sound

messages and etc. in addition to textual (writing) counterparts, can be useful for younger children (Ohishi and Nonogaki, 1999).

- *Links:* the children digital library should be able to provide dynamic and active environment to encourage active engagement of children in using it (Theng et al., 2007). The collaboration and relationship with other children's digital libraries would affect the dynamisms and activeness of libraries (Cooper, 2006; Theng et al., 2007). Links and relationships between different parts of a digital library, link to homepage on each page, moving backward and forward through the pages are necessity in any digital library (Entezaryan and Fattahi, 2009; Mehrad and Asari Shahri, 2007). A link indicating the numbers of matching books are exit in other children digital libraries.

Facilities of retrieved resources

After finding the desired resources from the digital library, user needs to read the retrieved resources. If libraries can provide facilities which make users able to study retrieved sources in desired manner, or change source appearance according to their needs and interests, it may increase their interest in the library. According to Salman (2002), outputs of each system should be providing adequately to users' needs and capabilities. As the name implies, attention should be paid to the users of children digital libraries. As a result, it is necessary to provide various formats of resources (audio, text, multimedia and etc.) in these kinds of libraries. In the following, the most important features of use facilities of retrieved resources in a digital library interface, by special attention to the children digital library, are discussed:

- *Superficial features of retrieved resources from the library* provide books with colored pictures that are fascinating to the children (Eboni, 2002). Using the picture would be helpful for children in understanding the content (Cooper, 2006; Demner, 2001; Nilson, 2006). Using bright and attractive colors are suggested in order to attract the children into the use of digital library. Also, matching the colored backgrounds and texts (which is preventing the eye fatigue and harassment) is suggested**.**

- *Feature of Content retrieved from the library:* children like other users, are not only searching and retrieving resources, but also they tend to use retrieved resources from the library. In fact, using resources is their motivation to search (Druin et al., 2007). For the resources to be well-used by children, it is necessary to provide resources with simple and understandable language (Theng, et al., 2007).

- *Personalization of retrieved resources:* the ability to select among the different storytellers will be very attractive to the children (Cummins, 2004). Eboni (2002) and Rao (2001) also mentioned the use of facilities such as the possibility of making pages larger or smaller and changing or selecting the color background by children in a digital library text.

- *Library resources in various format:* libraries should be applied all their efforts to provide various types of resources (include textual, audio, and multimedia resources) for

higher efficiency and attract more users (Cummins, 2004).

- *Study facilities of retrieved resources from the library:* Always most of information retrieval systems allow users to save (store) retrieved information on the hard disk or diskette. Other common option is the ability of publishing retrieved information through a local or remote printer (Zavaraqi, 2005).

Finding

This survey sought experts' point of view and libraries compliance through a twofold examination, and selected set of criteria is proposed for the children digital library interfaces. The findings of the survey are presented in the following sections.

Incompliance of children digital libraries with the criteria

As it was mentioned earlier, there were 15 criteria and 98 components. Table 2 shows the result of evaluation of the most children digital libraries in the world against these criteria:

Table 2

The level of applied of each criterion in most children digital library

Criterion \ Library	Number of component of each criterion	International children`s digital library	National children`s digital library of Iran	France National children`s digital library	children`s story books on-line	children`s books on-line	story place	Mean score (percent)
Displaying capabilities	12	8	9	10	9	8	10	75.01
Ability of organizing the screen	9	6	9	9	7	9	8	88.89
Options for customizing the text	5	0	0	1	0	0	0	3.33
Visual symbols and images	12	9	9	10	8	7	8	70.83
Picture quality	4	3	3	4	3	3	3	79.17
Search facilities	9	8	8	7	6	6	4	72.23
Help services and tips	9	7	3	6	2	3	2	72.59
Error messages alert	4	4	3	3	3	3	3	79.17
Interaction and feedback facilities	7	1	0	1	1	0	0	7.14
Links	5	4	5	4	4	2	3	73.33
Superficial features of resources retrieved resources form the library	8	7	7	7	6	6	5	79.17

Library / Criterion	Number of component of each criterion	International children`s digital library	National children`s digital library of Iran	France National children`s digital library	children`s story books on-line	children`s books on-line	story place	Mean score (percent)
Features content of retrieved resources from the library	3	2	2	3	2	2	3	77.77
Personalizing resources retrieves resources from the library	5	2	3	3	2	1	0	37.5
Library resources in various formats	3	1	2	2	3	3	3	72.22
Study facilities of retrieved from the library	3	3	3	3	3	3	2	94.33
total	98	65	66	73	59	56	54	
percent	100	66.33	67.35	74.49	60.2	57.14	55.1	
Average	63.44							

The findings showed among the evaluated criteria, the criteria of «study facilities of retrieved resources from the library» (mean score = %94.33) and the criteria «personalizing resource retrieved from the library» (mean score= %3.33) reached the highest and lowest scores respectively. Also, among the 15 evaluated criteria, only 3 criteria i.e. «personalizing resources retrieved from the library», «options for customizing the texts» and «interaction and feedback facilities» did not win more than %50 of points. Among studied children digital libraries, «France national children`s digital library» with 73 (74.49 percent) of 93 considered point was located in the first place. «National children`s digital library of Iran» with 66 (%67.35) and «International children`s digital library» with 65 points (66.33 percent) were located in second and third place, respectively.

Importance of each criterion from the experts' point of view

Experts were asked of their opinion about the degree of importance of each criterion. The results of their response are showed in Table 3:

Table 3

Rate of importance of each criterion from the experts point of view

Creation	Mean T-Score	Percent
Error messages alert	4.7	94
Personalizing resources retrieves resources from the library	4.55	91
Library resources in various formats	4.53	90.6
Features content of retrieved resources from the library	4.5	90
Search facilities	4.34	86.8
Picture quality	4.33	86.6
Help services and tips	4.3	86
Superficial features of retrieved resources form the library	4.28	85.6
Displaying capabilities	4.27	85.4
Visual symbols and images	4.26	85.2
Ability of organizing the screen	4.14	82.8
Study facilities of retrieved from the library	4.13	82.6
Links	4.09	81.8
Interaction and feedback facilities	3.87	77.4
Options for customizing the text	3.72	74.4

As the Table 3 shows, it was found that among the criteria, the respondents gave the highest rating to «Error messages alert» (mean T-Score = 4.7 and 94 per cent agrees) and the lowest to «options for customizing the texts» (mean T-Score = 3.72 and 74.4 per cent agrees). Two other criteria i.e. 'Personalizing resources retrieves resources from the library' and 'Library resources in various formats' reached the second and third levels, respectively.

Proposed criteria for children digital library user interfaces

In this section a sample criteria are proposed according to the important parts of a children digital libraries interface and arranged according to the checklist topics. These criteria are vital for each children digital library user interface and provide areas for more and better use of children digital libraries by a child. These components were derived from the research results and have achieved necessary T-Score (50 and above which is equivalent to 3.96 and higher in t-score) through the study.

1) Displaying capabilities

- Using bright and happy colors
- Using attractive colors
- Fitness of screen design with background colors
- Coordinate between field and user interface color

- Using different colors for different children's age groups
- Using different design for different children's age groups
- Page outline should be understandable
- Using simple, clear and easy to understand language to express the content
- Consistent (uniform) terminology
- Showing the entire contents of a related subject at once and at one display screen

2) Ability of organizing the screen

- Consistent placement of interface elements
- Subject categorizing of links
- Suitable firmness of information in the screen
- Uniform observation side of presented information in display screen
- Providing appropriate reading lists for different children's age groups
- Subject categorization of contained books and other reading materials
- Having title for any pages
- Determining and displaying library or parent organization name at top of the homepage

3) Options for customizing the texts

- Possibility of changing the user interface figures for different age groups by users

4) Visual symbols and images

- Using simple visual symbols
- Using visual symbols together with written symbols
- Using visual symbols together with sound symbols
- All symbols should be simple
- Large enough and featured symbols
- Ease of understanding the meaning of the symbols
- Using different symbols to each other
- Ease of children communication with symbols

5) Picture quality

- Using new and creative images
- Using cartooned images
- Using enough photo quality
- Using moving pictures and animations

6) Search facilities

- Providing simple search option
- Providing subject search option
- Possibility of searching through a selective visual symbol
- Possible movement from search results to relevant information
- Using understandable search symbols

- Displaying search results in visual symbols together with its text counterpart
- Using simple language in search help module
- Providing search ability beyond the retrieved results

7) Help services and tips

- Providing help icon on each page
- Providing help services for different age groups
- Using simple and understandable language for help and guidance
- Providing voiced option for 'asks a librarian' choice
- Help text should be clear and easy to understand
- Ease of entrance and exit to help
- Providing supplementary information about the circumstance and usage of the Library

8) Error messages alert

- Error alertness through signals such as sounds or specific colors
- Providing short messages
- Using simple and understandable error messages language by children
- Suitable sound error messages

9) Interaction and feedback facilities

- Providing feedback capabilities
- Possibility of interaction and dialogue between children (through chat rooms, discussion groups and etc.).
- Possibility of sharing product resources (stories, poetry and etc.) by children

10) Links

- Link to other children digital libraries
- Link to other sections of the library
- Link to homepage from any pages
- Link to previous and next pages (going backward and forward)

11) Superficial features of library retrieved resources

- Using suitable letter size display for reading
- Avoiding use of thorough capital letters texts
- Compatibility of background color and text
- Avoiding the use of long text
- Providing possibility of background color changes in order to differ between read and unread pages
- Providing books with color images

12) Content features of library retrieved resources

- Applying simple and understandable text language for different children age groups
- Providing images in the text in order to increase more grasping of content by

Children

- Providing sound explanation for some texts

13) Personalizing retrieved library resources

- Possibility of increasing and decreasing the size of pages
- Option to save the favorite parts of resources
- Possibility of saving the search strategies in order to use at next sessions
- Choices for selecting background color
- Possibility of selecting among the storytellers

14) Different formats of library resources

- Audio resources
- Text resources
- Multimedia resources

15) Study services of retrieved resources from the library

- Possibility of studying retrieved and saved resources on a personal computer
- Printing options

Conclusion

The results of this research showed that children digital libraries are different in terms of adoption of user interfaces criteria and experts have also different opinions about the importance of each criterion. It appeared that most of examined children digital library interfaces did not fully comply with the set of criteria. The same results were obtained by Bilal and Bachair (2006), too. The results also revealed that among the analyzed criteria, the criteria of 'study facilities of retrieved resources' (%94.33) and the criterion of 'options for customizing the texts' (3.33) reached the highest and lowest scores, respectively. This is completely compatible with Mehrad and Zahedi (2006) investigation which examined the national and international ISP interfaces. From the expert's point of view, the 'show error messages' and 'options for customizing the texts' criteria reached the maximum and minimum levels, respectively. Libraries also reached totally %75 of scores relating to the superficial display and %77.78 relating to help services and Tips option; a compatible result with Abbaspour (2006) and mismatched with Aligani, et al. (2009) achievements. The results showed that the most adopted children digital libraries with criteria are respectively as follow: 'France National children`s Digital Library', 'National Children's Digital Library of Iran,' 'International Children's Digital Library', 'Children`s story book on-line ',' Children `s books on-line', and 'Story Place'.

Finally, according to the rate applied by specialists and the scores assigned to each component in each of surveyed children digital libraries, a sample criterion of user interfaces was proposed for children digital libraries. Consequently, it could be stated that studied children digital libraries pay less attention to criteria which play an important role in the

interaction of users with the system (i.e. interaction and feedback facilities, help services and tips, personalizing resources retrieved from the library and options for customizing the texts). On the other hand, they paid more attention to superficial features (i.e. ability such as organizing the screen, picture quality, superficial features of retrieved resources displaying capabilities). This result is in line with those of Zerehsaz, Fattahi, and Davarpanah (2006) and Abbaspour (2006). Although the average rate of applied criteria in children digital libraries was above the mean number (50 percent), nearly none of them adopt the 15 criteria completely (100 percent). The children digital library user interface designers should pay more attention to user-friendliness and similarity of their communication modules; diversity in user interfaces will confuse the children. To avoid such a problem, it is necessary to utilize at least the minimum principles of user interface criteria. The results of this study can be considered as a beginning effort for developing international standard criteria for children digital libraries in order to increase the quality and quantity of their user interfaces.

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