Winter 1-1-2021

DESIGN AND DEVELOPMENT RESEARCH: PROTOTYPING IN WEB OPAC FOR INDONESIAN CHILDREN

Rifa Nadila
Indonesia University of Education, rifanadila@upi.edu

Riche Cynthia Johan
Indonesia University of Education, riche@upi.edu

Gema Rullyana
Indonesia University of Education, gemarullyana@upi.edu

DESIGN AND DEVELOPMENT RESEARCH: PROTOTYPING IN WEB OPAC FOR INDONESIAN CHILDREN

Rifa Nadila[1], Riche Cynthia Johan[2], Gema Rullyana[3]

Curriculum and Educational Technology Department, Faculty of Educational Science, Universitas Pendidikan Indonesia[123]

Corresponding email: rifanadila@upi.edu

Abstract

As a searching tool for bibliography sources in libraries, OPAC should provide convenience to meet the users' information needs, with notes that every user has different needs and characteristics. OPAC at large libraries in Indonesia, including the National Library of Republic Indonesia, is designed without adjusting children's ability and is mostly used for adults. The need for children's OPAC development in Indonesia and children's unique characteristics in searching strategies is defined as problem backgrounds. Therefore, this study aims to develop a simple search OPAC in simulated prototype form. The Design and Development method is used by adapting stages of the prototyping model. The participants in this research consisted of two information technology experts, an expert at child information service & resources for the OPAC prototype validation test, and ten librarians for the OPAC prototype usability test. The data analysis technique used the Likert scale and qualitative descriptive analysis. The study showed that the designed OPAC prototype was considered very feasible according to compatibility OPAC to information retrieval system criteria for children with the result of 80.5% and 72.1% on its usability tests by the librarians at Pustakalana Children's Library, the Indonesia University of Education Library and Library of the Ministry of Education and Culture Republic of Indonesia. Overall reviews from participants in qualitative description revealed that the appearance and features of OPAC need to be improved in some aspects and develop an advanced search standard to meet the needs of librarians, parents, and teachers, who guide the children to search in the future.

Keywords: Children OPAC, Prototyping Model, Indonesia, Design and Development Research

Introduction

Online Public Access Catalogue (OPAC) is online access of bibliography designed for users to check the availability of library collections. OPAC is primarily defined by Anna (2018) as one of the knowledge portals that offer various information to users. As library users, children have unique characteristics and requirements that the library community has recognized since the 19th century (Stričević, 2005). Their uniqueness is perceived from intellectual, searching behaviour, and bibliographical treatment of library materials (Jacobsen, 2011). Hence, the libraries should be diligent in considering using information technology to support children's characteristics and information needs. Rankin (2018) asserted that a library should be a place where children are able to use technology, access resources and information, and learn how to evaluate information critically.

Children OPAC is an information technology factor in the environmental variable that impresses children when using a library. In the National Library and Public Information Taiwan, only 11% of one hundred children users do not like to use a children OPAC. Unfortunately, it is observed that OPAC designed for children has not been implemented in Indonesia. (Anna & Harisanty, 2019).

Table 1. Children OPAC Availability at Public Libraries in Indonesia

S/N	LIBRARIES	OPAC AVAILABILITY
1	The National Library of Indonesia (PERPUSNAS)	Not available
2	The Ministry of Education and Culture Republic of Indonesia – Library	Not available
3	The Department of Library and Archives of Jakarta Province	Not available
4	The Department of Library and Archives of Surabaya	Not available
5	The Department of Library and Archives of West Java Province	Not available
6	The Department of Library and Archives of Pekanbaru	Not available
7	The Department of Library and Archives of Garut Regency	Not available

Children OPAC unavailability in Indonesian library is across the national, province, regency and even the ministry library. According to the Technical Guidelines of Center Library and Information Services, The National Library of the Republic of Indonesia stated that “In children’s service should provide computers searching facilities/OPAC for children aged 5 to 12 years” (PERPUSNAS, 2018). Wicaksono, a librarian of PERPUSNAS, said the children OPAC has not been implemented, whereas the guideline is prescribed standards for providing services in the library (A. Wicaksono, Tanya Pustakawan, May 15, 2020). A similar issue by Anna & Harisanty (2019) stated at the Department of Library and Archives of East Java Province that Indonesian children who went to the library with their friends were not facilitated with user-friendly OPAC.

Ideal conditions of libraries for children should have a responsibility to empower children, advocate for their freedom and safety, encourage them to become confident and competent people, and even give their right to being a citizen (IFLA, 2015). Children OPAC must begin to develop in Indonesia, empowering children to find relevant information aligned with their needs, separated with general OPAC whose users are commonly adults.

The objective of the study aimed to (1) establish web-based children OPAC prototype objectives, (2) define web-based children OPAC prototype functionality, (3) develop a web-based children OPAC prototype, (4) evaluate web-based children OPAC prototype.

LITERATUR REVIEW

Children OPAC is a search tool developed based on the characteristics and needs of children as users, making it easier for children searching for collections in the library, both independently or with adult guidance. Jacobsen (2011) noted that in providing a successful children's catalogue, the library community must understand children's information literacy because it will impact the design of information retrieval systems, including web search engines, databases, and catalogue interfaces.

Many studies concur that children have limited information retrieval abilities. An issue stated by Jacobsen (2006) is when young children at ages five to ten are forced to negotiate digital library interfaces will have problems understanding complex typing, proper spelling, reading skills, an abstract concept, or other knowledge content that exceed their still-developing ability. Corresponding scholarship by Wu et al. (2014) has mentioned that information-seeking in conventional digital library interfaces is not suitable for children due to its rigidity, text-based, and task-oriented. Thus, the lack of information retrieval skills will necessitate an enhanced interface design to overcome their information-seeking barrier (Wu et al., 2014).

To succeed in dealing with children information-seeking barrier, Wentzel (2019) described characteristics of a good information retrieval system (IRS) for children encompas : (1) Relevant information, which consists of provide relevant information, ranking results aspect, relevance cues, credibility or reliability of the information given, and visualization of the results; (2) Not irrelevant information include no advertisements and no clutter; (3) Understandable results extends to readability and understandability title: (4) Align with childrens' emotions such as affectivity, interestingness, fun, and speed; (5) Clear presentation, which intend to analyze various media types availability, separation results, keyword highlighting, font size, summary in results, text characteristics, and picture in result; (6) Logical steps of operation system include reachability homepage and back button; (7) Satisfy information needs which consists of supporting browsing, keyword searching, faceted navigation, aggregated search, helper functions, assisting in formulating queries, spell checking, and supporting natural language; (8) Ethical consern including privacy, propogation,

persuasive design, and child-safe content; (9) Adaptable for all children's including personalisability of search user interface, evolving search user interface, allowed collaborative searching and accessibility; (10) Support the children motor skills namely the size of clickable elements, scrolling requirement, single point-and-click, supporting audio and alternative input methods.

Hence, it gives children the opportunity to access resources and learn how to evaluate information either alone or with adult guidance, e.g., librarian, parents, teachers or, caregivers. Librarians are able to help users in information work through OPAC to make effective use of a library (Srirahayu & Anugrah, 2019), as the teachers and parents are allowed to take into account every library services for their students or children (Harisanty & Anna, 2020; Srirahayu et al., 2021). In addition to the library's effectiveness, Fountain (2011) mentioned that parents, teachers and, caregivers would also benefit from using a library catalogue created to provide complete and straightforward information about library content materials for children and readers who have less ability.

RESEARCH METHODOLOGY

Using the prototyping model by Sommerville (2011), this design and development research is one of the System Development Life Cycle (SDLC) models and general methodology used to develop information systems.

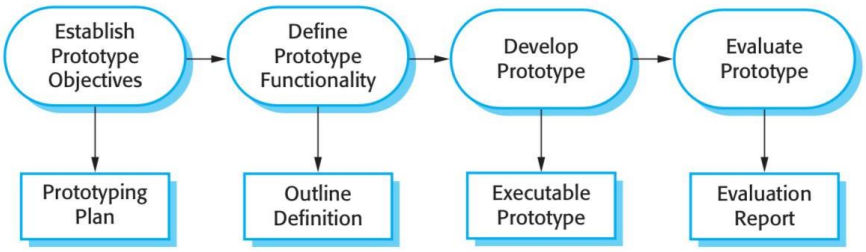


Fig 1. Model Prototyping (Sommerville, 2011)

This model is suitable for the simulation prototype. The model prototyping workflow is as follows : (1) Establish prototype objectives, which is the phase of identifying problems, determining limitations and objectives of the OPAC prototype; (2) Define prototype functionality, is the phase of defining function of the OPAC prototype; (3) Develop a prototype, is the phase of system requirements analysis, designing database and user interface, and implementing the simulated OPAC prototype; (4) Evaluate prototype, which includes verification and validation tests. Black box testing at the verification stage is a test that focuses

on the functional requirements of the software and allows developers to create a set of input conditions that match the functional requirements in a program (Ayuliana, 2009). After verification, the initial validation test assesses the OPAC prototype's compatibility with the modified criteria of information retrieval system for children by Wentzel (2019). The criteria were amended based on developmental limitations. Three experts who participated in the initial validation test were Noor Zaidi Sahid, PhD and M. Ridwan Sutisna, M.Pd from information technology backgrounds, and Susanti Agustina M.I.Kom an expert at children information service and resources. The second validation test was to test the usability criteria by Nielsen (2012). Usability evaluation is one of key success of web application (McGlinn et al., 2017). Ten librarians who participated in the second validation test were two from Pustakalana Children's Library, four from the Indonesia University of Education Library, and four from the Library of the Ministry of Education and Culture Republic of Indonesia.

RESULT AND DISCUSSION

Establish Prototype Objectives

This stage determines the purpose of the prototype, preceded by identifying the problem by reviewing the preliminary study. Identification problems according to children OPAC requirements mentioned by Nadila & Rullyana (2021) revealed that (1) alpha and beta generation children experience born-digital; (2) In general, children need to introduce books and libraries; (3) Library OPAC still merged into one conventional public service for all users; (4) Many parents are looking for children collection; (5) There is a classification for children's collections specifically that distinguished based on children's reading abilities. Besides these five elaborate problems, the unavailability of child-friendly OPAC at several substantial libraries in Indonesia is this study's general problem. Hence, this study aims to produce a simple search for children OPAC.

The research is expected to be the beginning of child-friendly OPAC development in Indonesia and contribute indirectly to the development of information technology for children in the library. The children OPAC prototype has the following features: keyword searching based on the title of the collection and using natural language queries, browsing collections, faceted navigation by subject, aggregated search based on collection materials. This catalogue has collections for children aged 3 - 12 years old with 60 titles with a safe design that is not persuasive and supports the limitations of children's motor skills by determining the size of certain elements; subsequently, they will be easily and logically clicked. The display

presentation and information is easy to understand. In addition, the design of the OPAC prototype adapts to the reading characteristics of children aged 5 - 12 years because children have relatively good reading skills at this age, which is seen from the semantic language component of children when they enter school (Agustina, 2017).

Regarding access points by the author, they were omitted in the design of this OPAC by considering that children aged 6-9 years tend to perceive subjects or stories through illustrations, characters, and titles (Beak, 2014). Another research revealed that searches by the author only reached 1%, simple searches reached 71%, and keywords reached 10% based on users of the International Children's Digital Library digital collection (Nashihuddin, 2020). In addition, the limitation in designing children OPAC prototypes is that the web is not hosted because the prototype is only intended for testing. It is not publicly accessible due to the simulation prototype, which means it does not represent any library collection data; hence, the collection number is also limited.

Define Prototype Functionality

The second stage in the prototype design process is defining the prototype's function. The functions of this prototype are to become (1) a reference source for application or software developers in implementing children OPAC designs; (2) a source for further research to refine the previously designs; (3) Indirectly, giving opportunities for child users to use technology to access OPAC in the library according to their abilities.

Develop Prototype

The third stage in designing children's OPAC prototype is to build a prototype consisting of three stages: system requirements analysis, design database system, design user interface, and designing a children OPAC as a simulated prototype.

The software implicated in the development process are XAMPP, Visual Studio Code, Git Bash, Laravel Framework, and Canva. The database system and interface design encompass the flowcharts, Data Flow Diagrams (DFD), Entity Relationship Diagrams (ERD), and interface designs.

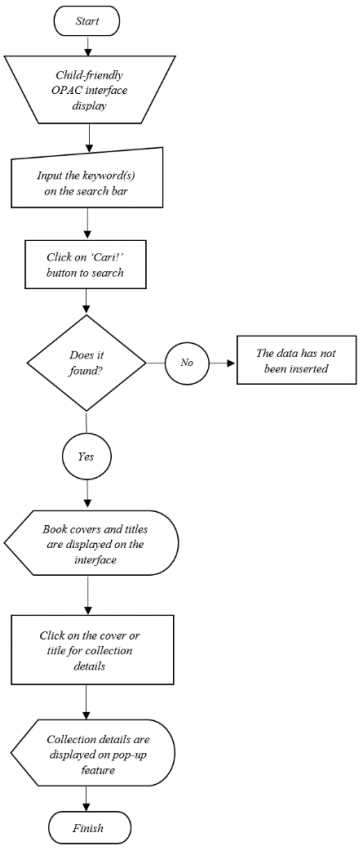


Fig 2. Search Bar Flowchart

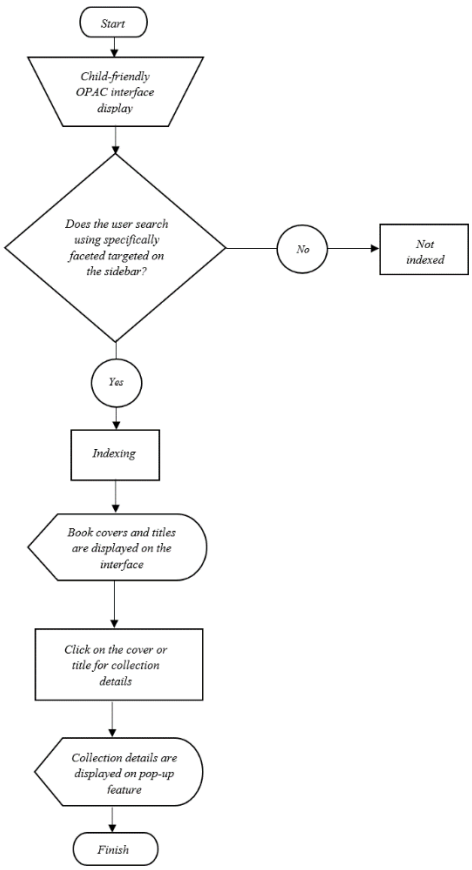


Fig 3. Faceted Navigation and Aggregated Search Flowchart

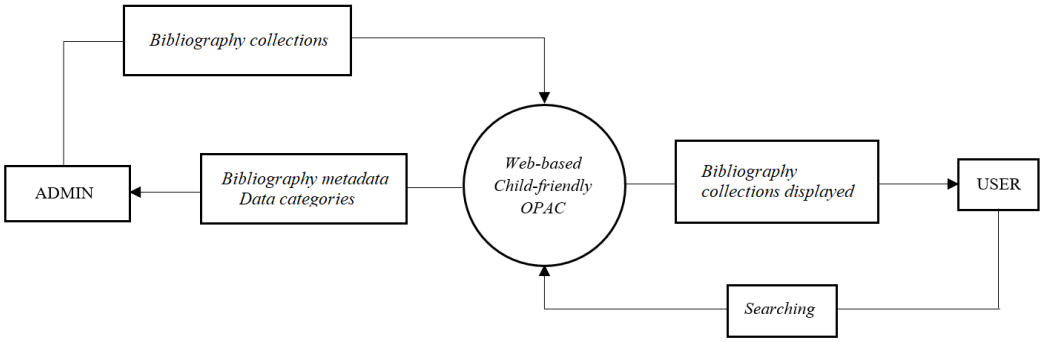


Fig 4. DFD Level 0 Child-friendly OPAC

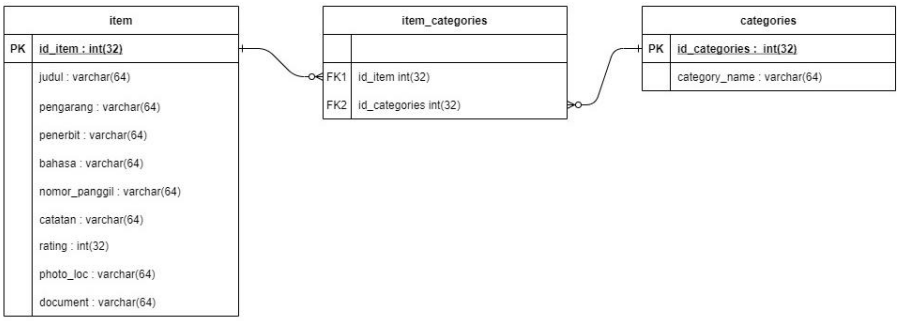


Fig 5. ERD Database Child-friendly OPAC

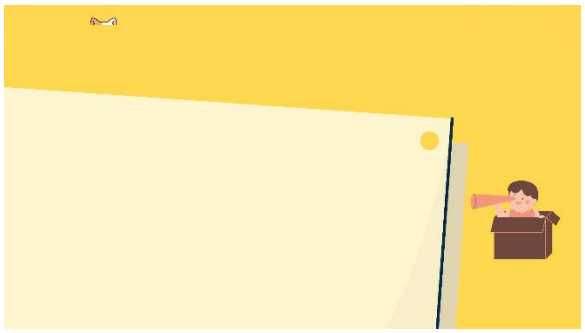


Fig 6. Background

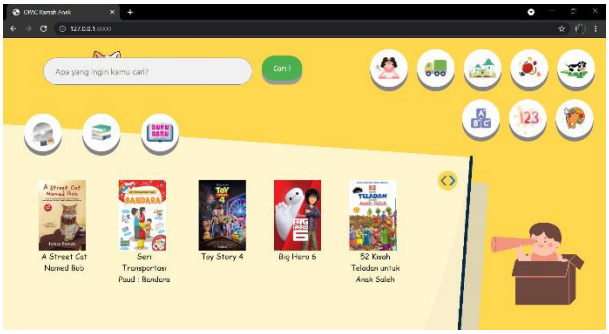


Fig 7. Homepage

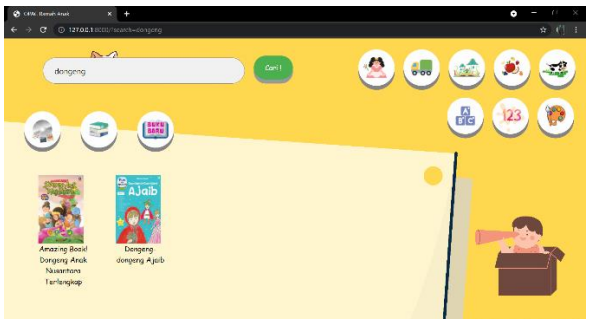


Fig 8. Search Results

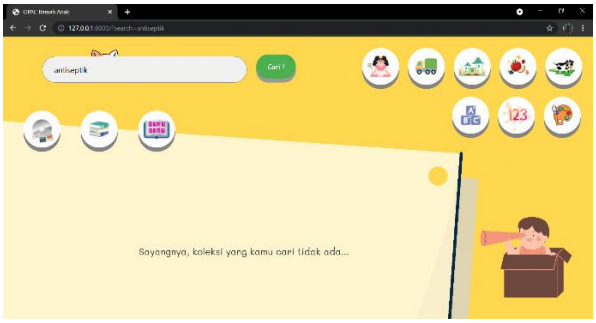


Fig 9. Empty Search Results

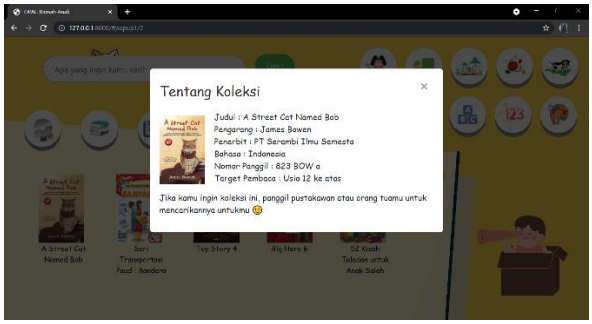


Fig 10. Pop-up Feature

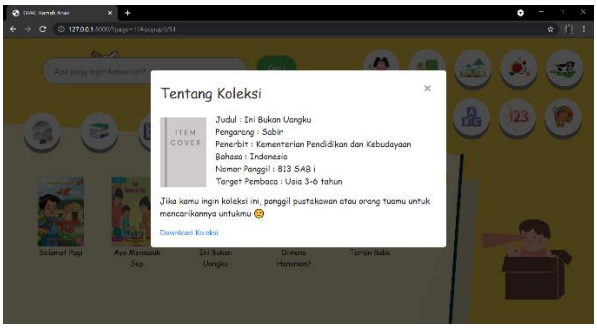


Fig 11. Pop-up Feature with No Book Cover

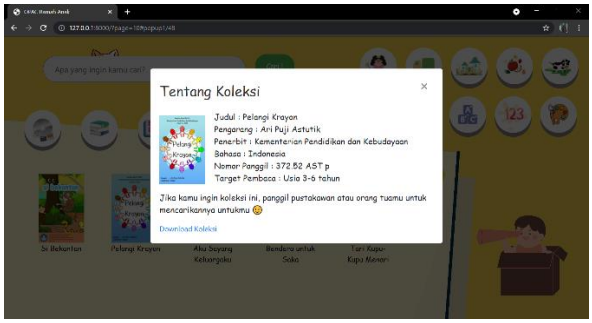


Fig 12. Pop-up Feature with Document Download

Evaluate Prototype

Researchers completed prototype verification using the black box testing method. The verification test results showed that the OPAC features function properly, consisting of the search form, search category buttons, pagination, pop-ups, and document downloads.

Table 2. Black Box Testing Result

Page	**Testing Features**	**Status**
Homepage	Search form	Succeed
	Faceted navigation	Succeed
	Aggregated search	Succeed
	Pagination	Succeed
	Pop-up	Succeed

At the validation stage, the rate of children's OPAC is ascertained by descriptive quantitative using the Likert scale. Meanwhile, the qualitative approaches to receive participants' points of view on the development of the children OPAC. The following results of the prototype validation test in the quantitative approach are elaborated below.

Table 3. Compatibility of OPAC Prototype with the IRS for Children Criteria

Indicators Adapted from (Wentzel, 2019)	**Components**	**Score**	**Ideal Score**	**%**
A. *Relevant*				
It returns relevant information	OPAC displays relevant information in search results	22	24	91,7%
	OPAC displays credible and reliable search results			
B. *Not irrelevant*				
It does not return irrelevant information	OPAC has no advertising	19	24	79,2%
	There is an absence of something untidy/messy on the OPAC			
C. *Understandable*				
It shows understandable results	OPAC displays easy-to-read results	22	24	91,7%
	The title of the search results on the OPAC is easy to understand			
D. *Emotions*				
It aligns with the emotions of children	The system has a positive affective value	39	48	81,3%
	The search results on the OPAC are displayed attractively			

Indicators Adapted from (Wentzel, 2019)	**Components**	**Score**	**Ideal Score**	**%**
	OPAC has several fun factors			
	The OPAC system does not have a slow response time			
E. *Presentation*				
It presents the results in a child-friendly way	OPAC provides different media types	47	60	78,3%
	The search results on the OPAC presented separately			
	The unavailable result displayed in a font size suitable for children (≥12)			
	OPAC search results have different text characteristics			
	Each search result on the OPAC contains an image or visualization			
F. *Logical Steps*				
It has logical steps	The use of the button feature is logical and easy to use	9	12	75%
G. *Information Need*				
It supports their information need	The OPAC system supports browsing	57	72	79,2%
	The OPAC system supports searching			
	The OPAC system supports faceted navigation			
	The OPAC system supports aggregated search			
	The OPAC help children formulate keywords			
	The OPAC system supports natural language queries			
H. *Ethical*				
It considers children as users in an ethical way	OPAC does not have a persuasive design used in its interface	30	36	83,3%
	No propagation or truncation in the search results			
	Content is safe for children and does not show results that inappropriate			
I. *Adaptable*				
It is adaptable for all types of children	OPAC shows results according to the age of the child	7	12	58,3%
J. *Skills*				
It supports children's motor skill	OPAC features clickable and customizable element sizes (area ≥ 322 pixels)	28	36	77,8%
	No scrolling feature			

Indicators Adapted from (Wentzel, 2019)	Components	Score	Ideal Score	%
	The OPAC supports single point-and-click actions			
Total Average Percentage		280	348	80,5%

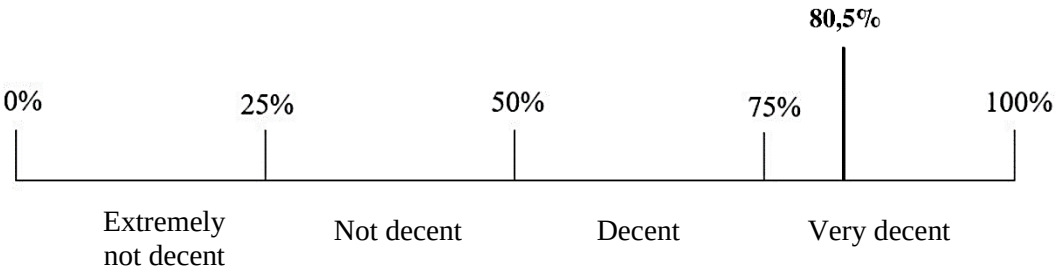


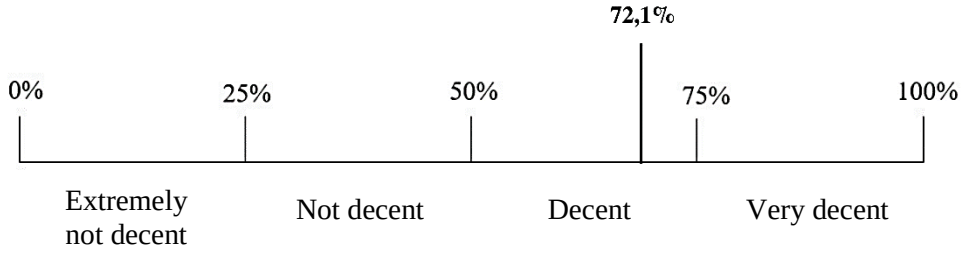
Fig 13. Average Validation Test Results by Experts

The total score for ten aspects based on three experts is 280 out of 348 or equals 80.5%; as a result, the children OPAC is in very decent criteria. Besides, ten librarians were involved in revealing the usability of children OPAC.

Table 4. Children OPAC Prototype Usability Result

Indicators Adapted from (Nielsen, 2012)	Components	Score	Ideal Score	%
A. Learnability				
Easy to access and identify searches on a children OPAC prototype	OPAC is easy to learn	160	240	66,7%
	The collection categories in OPAC is easy to understand			
	The search flow in OPAC is simple to understand			
	All features usage are easy			
	Bibliographic search in OPAC easily completed			
	Ease of understanding the presented information			
B. Efficiency				
How fast in accessing the children OPAC prototype	The search form in the OPAC is able accessed quickly	118	160	73,8%
	The collection categories in OPAC are quickly accessible			
	The bibliographic data is quickly accessible			
	Completion of tasks in OPAC quickly done			
C. Memorability				

Indicators Adapted from (Nielsen, 2012)	Components	Score	Ideal Score	%
The children OPAC prototype usage is easy to remember	The bibliographic search in OPAC is easy to remember	91	120	75,8%
	The bibliographic data in OPAC is easy to remember			
	The overall usage of OPAC is easy to remember			
D. Errors				
How many errors occur when accessing a children OPAC prototype	No error occurred when accessing OPAC	57	80	71,3%
	Errors easily resolved			
E. Satisfaction				
How enjoyable it is for users to access children's OPAC prototype	OPAC provides comfortable used	64	80	80%
	The appearance of the OPAC design is convenient			
Total Average Percentage		490	680	72,1%



The total score for OPAC usability is 490 out of 680; as a result, the percentage is 72,1% that in scale criteria described as decent. In qualitative approaches, OPAC received many reviews, such as suggestions and comments from both experts and librarians. The researchers summarized them into three, i.e., advantages, disadvantages, and recommendations, are described as follows:

1. Advantages

a. In general, the OPAC performance is outstanding
b. OPAC has excellent focus and simplicity
c. The user interface is sufficient enough to meet the visual criteria that are flexible and easy to use
d. The use of images on the subject of the OPAC category easier for children to find the collection they like

e. The choice of yellow as the background colour feels right. It is bright but does not bother the eyes
f. The size on the search form makes it easier for children to read because it is made bigger
g. Non-scrolling features in supporting children's motor characteristics are considered good

2. Weaknesses

a. There is no caption to elucidate the button on the subject category and material
b. There are some blank book covers and category merging that does not work
c. The limited database of collections giving consequent of reliability to load data had not been well-tested
d. To click one by one on the collection details to find out the type of collection by age

3. Recommendations

Recommendations are grouped based on existing system features that need developing in the future and the new features outside the system.

The recommendations for the search form feature are as follows:

1) Expected to support the use of keywords from cross-language equivalents
2) Expected to support search by author and subject
3) The 'Search!' button should be enlarged to make the text more eye-catching

The recommendations for the faceted navigation and aggregated search features, namely:

1) Adding more subject categories according to the children's preferences and needs but still maintaining the layout to avoid a crowded appearance
2) The use of the phrase "new book" on the aggregated search button is more suitable with "new collection"
3) Adding a caption or guidance for the button
4) The use of active category icons should be more dominant or have bright colours. Additionally, they should be automatically deactivated when other buttons are activated. Additionally, the active button should be written to increase awareness

Recommendations for the metadata in OPAC, including:

1) Removing the publisher

2) Adding bibliographic annotations or summary information of the contents of the collection
3) The distinguish between book materials and non-book materials should be clear
4) The rating feature in a collection that appears on the front page has required a star icon to mark the most favorite book

Respondents expect the children's OPAC to contain more features beyond developed. The recommendations for adding features outside the OPAC system are :

1) Adding information or demo on how to use OPAC
2) Adding a search based on author filters, target age of readers, types of books, tiers of collections, and collections that have digital sources
3) The item suggestion feature
4) Feature for book proposal if a certain collection is unavailable
5) Adding a variety of theme options and colourful interface. Additionally, OPAC should be able to personalized based on beginner, intermediate, and advanced levels of users
6) Adding specific colours based on the Dewey Decimal Classification to the collection so that children can search the collection without the help of the librarian or parents
7) Supports data import would be needed if it integrated for a library to avoid input data repeatedly
8) Providing an online version of OPAC for its use in numerous libraries
9) Besides being friendly to children, OPAC should be adequate for parents
10) Adding a children's song or music feature to make it more fun
11) OPAC supports mobile-friendly
12) Adding administrative information regarding product developer contact

The recommendations given are taken into consideration for future children's OPAC development.

CONCLUSION

The children OPAC simulated prototype has met standards in providing simple searching tools based on experts' and librarians' perspectives, but the appearance and features need to be improved to meet the standard of a comprehensive and advanced search, not for children only but also librarians, parents, and teachers, which guides the children to search. The children OPAC compatibility reaches 80,5% (very decent) in the IRS criteria for children

and reaches 72,1% (decent) in its usability. The prototyping model supports the construction system visibility to improve product development, even in simulation prototypes. If children OPAC is implemented in a library, use a functional prototype to test the success of the children's search directly.

REFERENCES

Anna, N. E. V. (2018). Transformation of public library websites in Indonesia. *Library Hi Tech News*, *35*(8), 10–14. https://doi.org/10.1108/LHTN-02-2018-0011

Anna, N. E. V., & Harisanty, D. (2019). Factors affecting children while using public libraries in Indonesia and Taiwan. *Library Philosophy and Practice*, *2019*(September).

Ayuliana. (2009). Blackbox testing. In *Testing dan implementasi* (pp. 1–6).

Beak, J. (2014). A Child-Driven Metadata Schema: A Holistic Analysis of Children's Cognitive Processes During Book Selection [University of Wisconsin-Milwaukee]. In *Theses and Dissertations*. https://dc.uwm.edu/etd/449

Fountain, J. F. (2011). Guidelines for Standardized Cataloging for Children. In J. F. F. & J. W. S. S. Intner (Ed.), *Cataloging Correctly for Kids* (pp. 1–18).

Harisanty, D., & Anna, N. (2020). Information Behavior of Children Using Public Libraries in Taiwan and Indonesia. *Library Philosophy and Practice*, *2020*(October), 1–12.

IFLA. (2015). *How libraries for children and young adults are supporting development by providing access to information*. https://www.ifla.org/publications/node/9682

Jacobsen, L. A. (2006). Cataloging Correctly for Kids. In *Library Resources & Technical Services* (Vol. 51, p. 155).

Jacobsen, L. A. (2011). How Children Search. In S. S. Intner, J. F. Fountain, & J. Weihs (Eds.), *Cataloging Correctly for Kids* (5th ed., pp. 19–23). American Library Association.

McGlinn, K., Yuce, B., Wicaksono, H., Howell, S., & Rezgui, Y. (2017). Usability evaluation of a web-based tool for supporting holistic building energy management. *Automation in Construction*, *84*(September), 154–165. https://doi.org/10.1016/j.autcon.2017.08.033

Nadila, R., & Rullyana, G. (2021). Kebutuhan Pengembangan OPAC Ramah Anak pada Perpustakaan Kementerian Pendidikan dan Kebudayaan. *Jurnal Ilmu Informasi, Perpustakaan, Dan Kearsipan*, *23(1)*(April), 35–43.

http://dx.doi.org/10.7454/jipk.v23i1.240

Nashihuddin, W. (2020). *ANALISIS INFORMASI WEBSITE INTERNATIONAL CHILDREN ' S DIGITAL LIBRARY (ICDL)*. *February*.

Nielsen, J. (2012, January 3). *Usability 101: Introduction to Usability*. https://www.nngroup.com/articles/usability-101-introduction-to-usability/

PERPUSNAS. (2018). *Pedoman Teknis Pusat Jasa Perpustakaan dan Informasi Perpustakaan Nasional Republik Indonesia*. https://www.perpusnas.go.id/webforms/uploads/files/1812180816504D5LurEHeW.pdf

Rankin, C. (2018). IFLA Guidelines for Library Services to Children aged 0-18. *IFLA Journal*, *August*, 1–19. https://www.ifla.org/publications/node/67343

Sommerville, I. (2011). Software Engineering. In *Clinical Engineering: A Handbook for Clinical and Biomedical Engineers* (9th ed.). Pearson Education. https://doi.org/10.1016/B978-0-12-396961-3.00009-3

Srirahayu, D. P., & Anugrah, E. P. (2019). The interpretation of OPAC service in the Library of Universitas Airlangga. *Library Philosophy and Practice*, *2019*(May).

Srirahayu, D. P., Kusumaningtiyas, T., & Harisanty, D. (2021). The Role of the School Librarian toward the Implementation of the School Literacy Movement (Gerakan Literasi Sekolah) in East Java. *Library Philosophy and Practice*, *2021*(January), 1–15.

Stričević, I. (2005). *World Library and Information Congress : 71th IFLA General Conference and Council" Libraries - A voyage of discovery "Government Publications and Information Dissemination : Indian Scenario*. *January*, 1–17.

Wentzel, S. (2019). *Evaluating Information Retrieval Systems for Children in an Educational Context*. 1–12. www.wizenoze.com

Wu, K., Tang, Y., & Tsai, C. (2014). Graphical interface design for children seeking information in a digital library. *Visualization in Engineering*, *2*(1), 5. https://doi.org/10.1186/2213-7459-2-5