Enhancing Accessibility: A Heuristic Evaluation of Social Presence Interface Design for E-Resources in University Libraries

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Abstract – **In this preliminary investigation, a discerning evaluation reveals that users face pervasive challenges accessing e-resources within university libraries. A social presence interface design for e-resources is introduced, recognizing the need for user support through effective communication with librarians and assistance for swift information navigation and system function. This research presents a meticulous usability assessment grounded in heuristic evaluation, engaging six expert evaluators comprising specialists in human-computer interaction and librarians. The primary objective is to ascertain the intuitiveness of the interface design and identify potential issues through expert scrutiny. The study unveiled compelling insights by employing a tailored usability heuristic questionnaire encompassing 39 questions aligned with the developed design. Notably, 75.54% of evaluators agreed unanimously regarding the design's adherence to heuristic principles, indicating their concurrence with the established criteria.**

Additionally, evaluators provided valuable commentary and feedback focusing on aspects related to icons, labels, and the efficacy of the help function. This comprehensive evaluation informs and enhances the ongoing discourse surrounding optimal user interface design for e-resources in university library settings.

Keywords – **Human-Computer interaction, interface design, usability, e-resources, university libraries, heuristic evaluation.**

1.   Introduction

The electronic resources interface of university libraries serves as a crucial link between information seekers and the service itself. However, challenges persist in users' ability to access these resources, as evidenced by the complexities highlighted in existing literature [1], [2], [3]. Users report difficulties in navigating the intricate interface [4], coping with information overload [5], and experiencing confusion and distress [6], [7]. Addressing these issues involves understanding the cognitive and affective aspects of the problem [8].

Virani *et al.* underscore the significance of an organized user interface that streamlines the search process and minimizes clicks for efficiency. Effective user interface design is pivotal for user satisfaction and system development [9]. Furthermore, facilitating easy access is crucial for attracting users to electronic resources [10]. Hence, the initial step in meeting user needs involves the creation of a user-friendly interface [11].

Rohmiyati *et al.* [12] propose incorporating social elements to enhance user interaction and support, especially in seeking help from librarians and accessing e-resources. Social and technological factors have been identified as catalysts for increased engagement with learning systems [13].

Various social activities, such as chats, greetings, and images, can be integrated to create a more dynamic and user-friendly system [14], [15], [16]. Molinillo *et al.* [17] assert that incorporating social elements influences users to engage cognitively and affectively with e-resources.

Despite extensive studies on e-resource usage in libraries, the role of social presence in interface design receives limited attention. Hence, this research aims to analyze the social presence elements within the library's system or pages, investigating their potential benefits. Previous studies have shown that social presence enhances user engagement in e-learning and e-commerce contexts.

This research focuses on developing a user interface design for e-resource services in university libraries, emphasizing integrating social elements such as live chat with text, voice, and video. The prototype user interface is evaluated through heuristic evaluation by experts in human-computer interaction and librarians. The study's findings contribute to both fields: human-computer interaction and library services.

2. Related Work

This section delves into the implementation of social presence in designing e-resource interfaces within university libraries, elucidating the primary concepts guiding this design evaluation. The utilization of social presence aims to address users' challenges, including difficulty finding information and the lack of librarian assistance, which may contribute to users' stress and reluctance to utilize e-resources within university libraries.

2.1. Social Presence

Social presence is defined as the degree of salience of others in an interaction and the consequent salience of interpersonal relationships [18]. It encompasses users' mental states, fostering a sense of closeness to others, even in a virtual environment [19]. Social presence is recognized for its importance in human interaction with technology; it contributes to engaging and interactive experiences [20]. Turk *et al.* [21] suggest incorporating social presence elements to enhance usability and productivity, fostering interpersonal relationships built on mutual trust.

In the online environment, trust emerges as a significant variable [22]. Social presence elements encompass various features, including chat, pictures, video, personalized greetings, usernames, emoticons, sharing options, color, and ratings [16], [23], [24], [25]. Trust and interaction dynamics are interwoven, emphasizing the importance of social presence in creating a satisfying user experience within electronic resource interfaces.

Table 1. Social presence element from a literature review

Author	Social Presence Elements
S. S. Engku Alwi and T. S. M. Tengku Wook	• Communication With Retailers, • Feedback/ Comments, • Frequently Asked Questions, • Chat. • Language Choices, • Advertising. • Photos, • Animation, • Audio, • Video, • Product Description. • Recommender System, • Rating, • User Review [23][23]
Papadopoulou and Ganguly *et al.*	• Image, • Color, • Graphic [26]
Y. J. Kang and W. J. Lee	• Avatar [27][27], • Animated Gif, • Username, • Greeting [16]
W. Nadeem *et al.*	• Comment, • Rating, • Exchange Options, • Tagging [25].
J. Wei *et al.*	• Text Chat • Voice Chat • Shared Navigation [28]
W. Pongpaew *et al.*	• Pictures • Welcoming Members by Name, • Text Components • Likes, • Interaction Functions, • Emoticons [29]

2.2. Implementation of Social Presence Elements in E-Resource Services Interface Design

The concept of social presence, rooted in computer-mediated communication, has found applications in various domains, including education [30], e-commerce [31], social media [32], e-service [33], and social TV [34]. This section outlines the implementation of social presence elements in the design of the e-resources interface of a university library.

a. Live Chat: Live chat emerges as a pivotal element, recognized as a sign of social presence and an avenue for social activities [35]. Initially employed for referral services, live chat facilitates real-time communication with library staff, a feature unique to human interaction. Components of live chat include chat, staff name, staff photo, voice, text, emoticons, help, and video [23], [29], [36].

The addition of video enhances the impression of presence, enabling users to engage with staff or librarians in a face-to-face manner online.

b. Library Account: This element encompasses user accounts, digital library cards, and download histories, providing users with a reliable and manageable account. Personalized features such as welcome messages, recommender systems, QR codes, like, share, and rating options [37] are integrated to cater to individual needs in e-resources services in university libraries.

c. Links: Links play a vital role in enhancing system performance and simplifying connections for library users. Components include links to organizations, referral managers, forum discussions, and social media, facilitating seamless user experiences and knowledge exchange.

d. Accessibility: The accessibility component focuses on features that simplify online resource usage designed to cater to users with disabilities. Considering factors such as common font readability, colors, screen brightness, and language preferences, this design addresses accessibility issues and aids users with reading difficulties [23], [38].

The amalgamation of these social presence elements aims to create an enjoyable and practical e-resources interface for a university library. The anticipated outcome includes increased ease of use, convenience, and user satisfaction, ultimately enhancing the university library's overall performance and making e-resources more accessible to users with limitations.

2.3. Usability Evaluation

Usability evaluation is a critical aspect of assessing the effectiveness and user-friendliness of a design [39]. Usability, characterized by the ease of system use, is pivotal in enabling users to achieve their goals efficiently [40]. A highly usable e-resources system ensures minimal frustration, error-free manipulation, and a positive emotional user experience [41].

Nielsen's usability elements encompass learning ability, efficiency, memory, error, and satisfaction [42], [43], [44]. Additional usability elements include connection, simplicity, direction, information, effectiveness, friendliness, earnestness, comprehensiveness, continuity, personalization, and internal [45]. Further dimensions encompass function, desirability, retrievability, accessibility, reliability, and value [46].

Effectiveness, efficiency, security, and cognitive load are critical factors explaining a system's usability.

Understanding the users' perspective and feedback and evaluating usability issues are imperative for refining interface designs. Heuristic evaluation, grounded in general utility principles [47], proves effective in diagnosing usability problems. This study integrates and adapts these heuristics to address low-fidelity e-resource interface design challenges [48].

3. Methodology

This research employs heuristic evaluation to identify issues within the e-resources interface design. Evaluation involves collaboration with experts and librarians to pinpoint usability problems, and the findings are utilized to enhance the overall design.

3.1. Study Procedure

This study undertakes a heuristic evaluation, seeking validation from expert users [49], [50] to scrutinize the interface design of e-resources in university libraries. The procedural steps for conducting heuristic evaluation are as follows:

a. Identification of Experts:
Researchers identified experts in human-computer interaction (HCI) and library services willing to serve as evaluators.

b. Application and Appointment:
Researchers sent evaluation invitations via email and scheduled online or face-to-face appointments based on evaluators' preferences, considering factors such as geographical location and time constraints.

c. Introduction and Briefing:
The researchers provided a 30-minute briefing to the evaluators, introducing the prototype, explaining the evaluation purpose, and distributing heuristic evaluation questionnaires referencing Nielsen's set.

d. Prototype Testing:
Evaluators examined the prototype, perform assigned tasks, and completed the heuristic evaluation questionnaire.

e. Recorded Sessions:
Researchers recorded evaluation sessions, face-to-face or online, for comprehensive analysis and improvement insights.

f. Data Analysis and Improvement:
Researchers analyzed the completed questionnaires and used the feedback to enhance the usability of the existing e-resource interface design.

3.2. Sample Selection

Heuristic evaluation typically involves 3–5 evaluators [47]. However, this study engaged six expert evaluators chosen based on their qualifications, expertise, and experience in HCI and library services to ensure a thorough and detailed assessment. Abidin *et al.* [49] suggest a total of 5–8 evaluators, aligning with the selection in this study.

The criteria and qualifications for expert evaluators are outlined in Table 1. Understanding the evaluators' areas of expertise ensures that the evaluation results are contextually relevant to the prototype development.

Table 1. Evaluator criteria and qualification

No	Criteria	Description
1	Professional role	A position in a specific field or a particular job in an institution a person holds. The professional role criteria in this study are experts in HCI and librarians who have worked for at least four years.
2	Experience as expertise	More than four years
3	Experience accessing e-resources	More than ten years
4	Education	Minimum master
5	Age	More than 30 years

Table 2 provides detailed profiles of the selected expert evaluators, offering insights into their qualifications and expertise in HCI and library services.

Table 2. The profile of expert evaluators

Evaluator	Professional Role	Institution	Field of expertise	Experience as expertise (Years)	Experience accessing e-resources (Years)	Education	Age (Years)
1	Researcher	University Kebangsaan Malaysia	HCI	4	12	Doctoral	35
2	Lecturer	MARA University of Technology	HCI	5	13	Doctoral	40
3	Lecturer	University Kebangsaan Malaysia	HCI	10	18	Doctoral	55
4	Lecturer	University Kebangsaan Malaysia	HCI	10	18	Doctoral	55
5	Librarian	Gadjah Mada University	Library automation	11	19	Master	45
6	Librarian	Diponegoro University	Information Technology in Library	20	25	Master	45

3.3. Research Instruments

This study employs two key instruments: a low-fidelity prototype assessed by experts through a heuristic questionnaire.

a. Low-Fidelity Prototype:
Figures 1–5 showcase the low-fidelity prototype utilized in this evaluation. The interface is designed using PowerPoint (PPT).
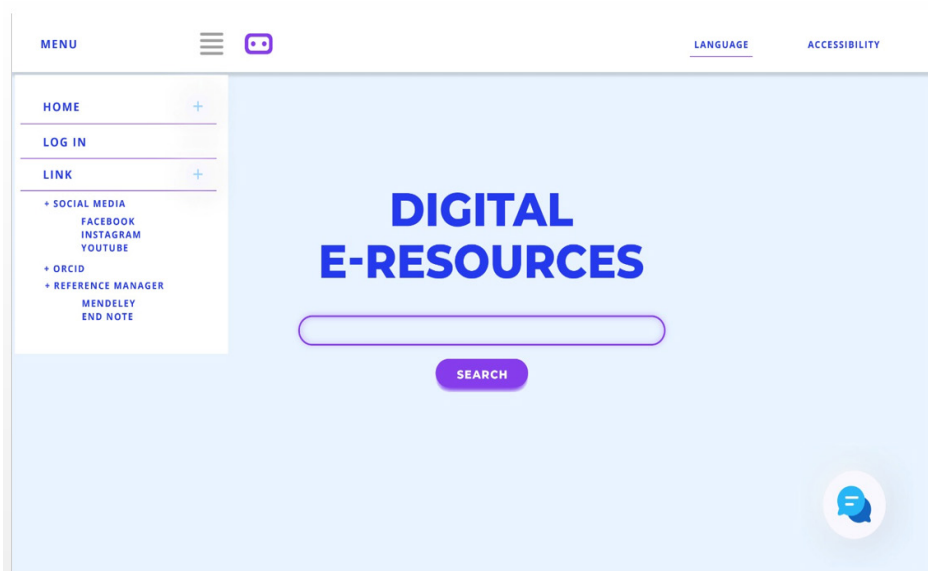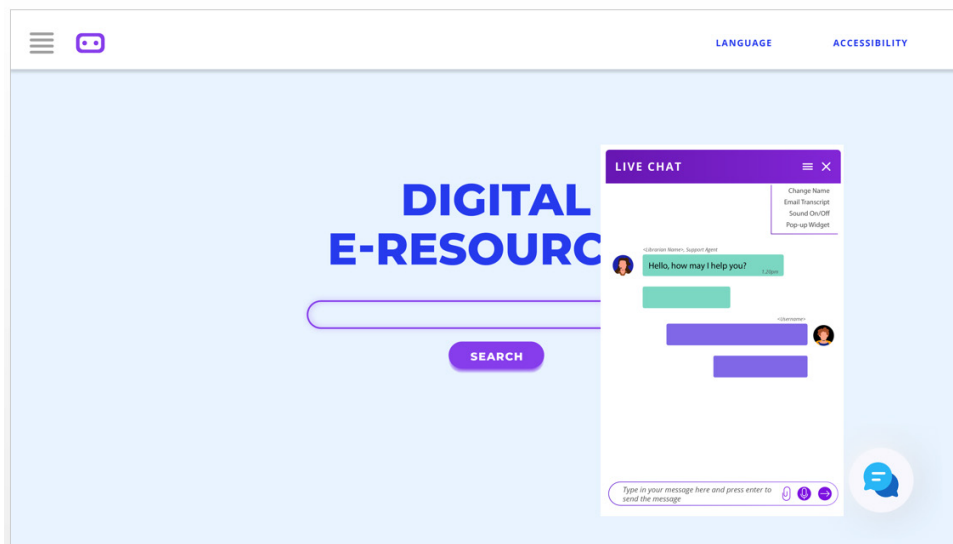
Figure 1. A screenshot of the prototype: Home
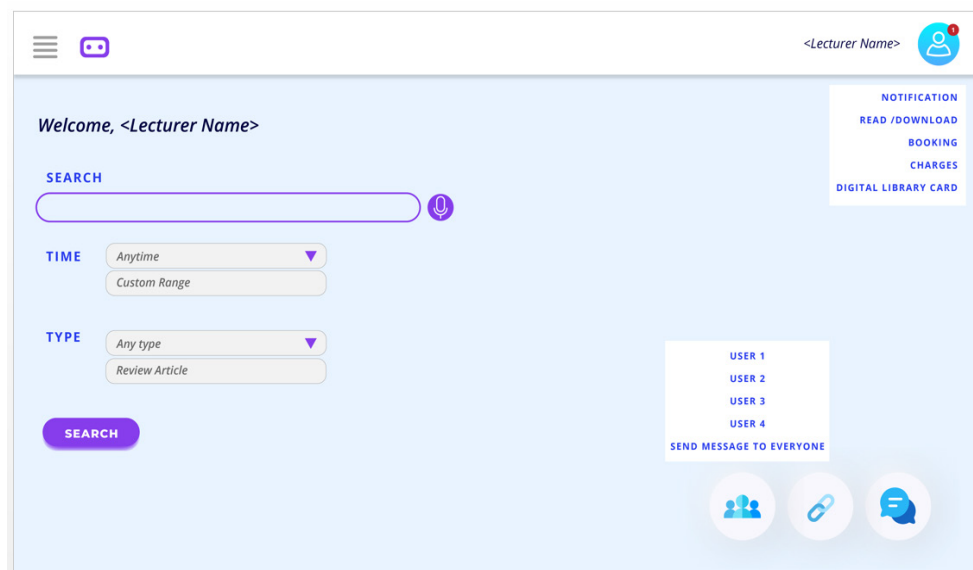

Figure 2. A screenshot for the Live Chat prototype

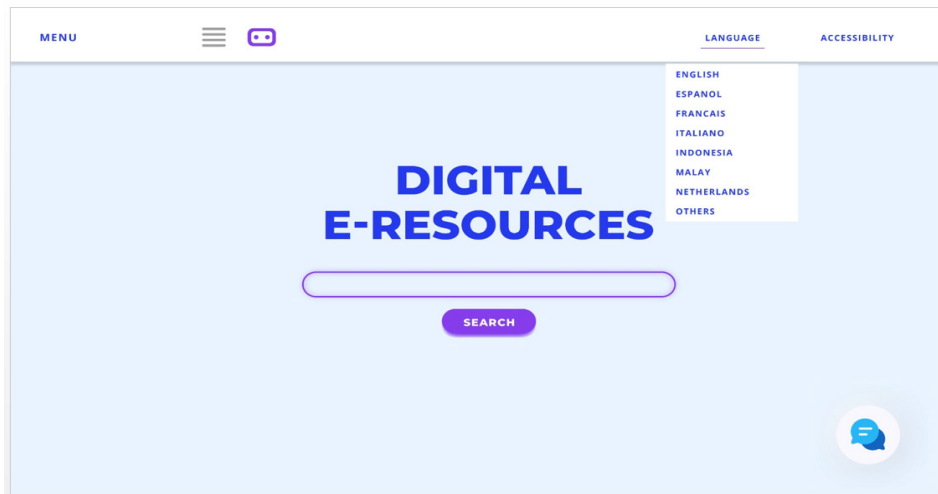*Figure 3. A screenshot for the Link and Forum Discussion prototype*

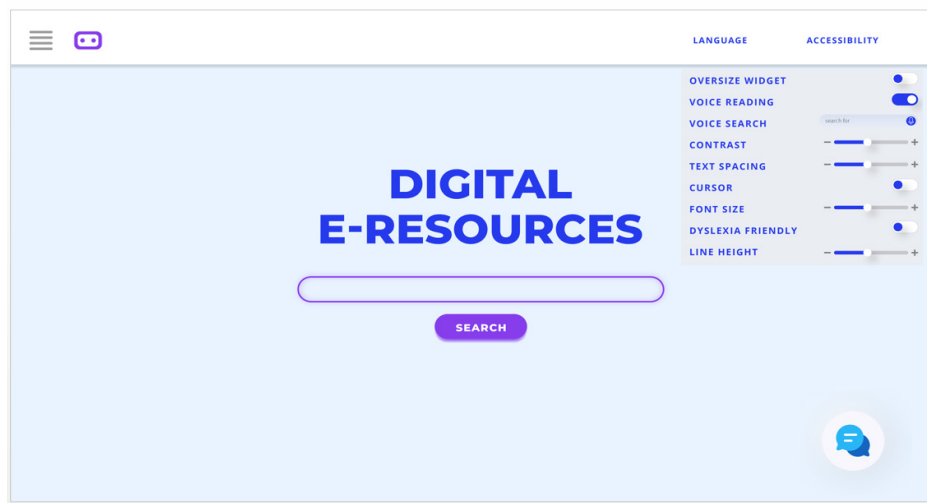*Figure 4. A screenshot for the Language Preference prototype*

Figure 5. A screenshot for the Accessibility prototype

b. Evaluator Task

The evaluator task comprises a set of six tasks assigned to experts for prototype testing. These tasks include instructions for interacting with the prototype, covering login procedures, live chat functionality, language changes, link navigation, discussion forums, and font size adjustments. Experts receive the task list to assess the effectiveness of the implemented social presence elements.

c. Questionnaire

The evaluation adheres to the heuristic evaluation principle, employing a set of usability principles by Jakob Nielsen (1994). The chosen principles, tailored to the design, encompass (1) visible system status; (2) match between the system and the real world; (3) user control and freedom; (4) consistency and sophistication; (5) aesthetic and minimalist design; and (6) help and documentation. This principle-driven approach guides the inspection process.

Additionally, six selected lists [51] for an e-resources user interface are adapted and implemented in this study. The heuristic questions are aligned with the display of the user interface prototype, facilitating evaluation by experts.

3.4. Evaluation Process

The heuristic evaluation of e-resource designs unfolds through a combination of offline and online activities, with designs downloaded onto the researchers' laptops. The evaluation process encompasses the following steps:

a) The researchers disseminated the evaluator application file, a checklist, user tasks, the e-resource interface design, and the questionnaire.

b) The researchers scheduled an appointment to explain, brief, and demonstrate the design and evaluation procedures.

c) Evaluators provided feedback to the researcher, assessing the design through the provided questionnaire. Each participant responded to 39 questions (Table 3), indicating "yes" or "no." Subsequently, the questionnaires were collected, and experts offered suggestions for addressing the identified issues and enhancing the application.

Table 3. Number of heuristic questions

Heuristic Principle	Number of questions
Visibility of system status	8 questions
Match between the system and the real world	7 questions
User control and freedom	3 questions
Consistency and standards error	6 questions
Aesthetic and minimalist design	6 questions
Help and documentation	9 questions
Total	39 questions

Upon completion of the evaluation process, quantitative data analysis ensues using the percentage formula.

$$P = \left(\frac{f}{N}\right) x \ 100\%$$

As for P: percentage, f: frequency, and N: number of evaluators.

4. Results and Discussion

This section presents and discusses the study's findings in relation to the aim of the study, which was to have librarians and human-computer interaction experts evaluate the e-resource interface designs using heuristic evaluation.

4.1. Heuristic Evaluation Results

The outcomes of the heuristic evaluation are presented in Table 4, displaying the mean scores derived from the quantitative analysis of the questionnaire data. All data were processed using a percentage formula [52].

Table 4. Mean score of the questionnaire analysis

No	Heuristic Principles	Yes	Neutral	No	Total
1	System status visibility	83.36	2.08	14.56	100
2	The design matches the system and the real world	88.09	4.77	7.14	100
3	User control and freedom	61.17	27.77	11.07	100

Table 5 provides a breakdown of the results, indicating the evaluators' agreement with specific heuristic principles outlined in Table 5.

Table 5. Heuristic evaluation results

No	Heuristic Principle	Result
1	Visibility of system status	83.36% of evaluators affirmed that the design adhered to the visibility of system status principle, indicating information availability on the system's readiness for use. Only 14.56% dissented, and 2.08% remained neutral.
2	Match between the system and the real world	88.09% of evaluators asserted that the design exhibited alignment with the system and the real world. Only 7.14% disagreed, while 4.77% maintained neutrality.
3	User control and freedom	61.17% of evaluators acknowledged that the design adhered to the principles of user control and freedom in interface navigation. Meanwhile, 27.77% remained neutral, and 11.07% noted the absence of this principle in e-resources designs.
4	Consistency and standards error	73.36% of evaluators attested that the design met the principles of consistency and standards, emphasizing ease of understanding in design and features. 16.64% were neutral, and 10% asserted non-compliance with this principle.
5	Aesthetic and minimalist design	86.13% of evaluators affirmed that the design exhibited aesthetic and minimalist qualities. Conversely, 8.32% disagreed, and 5.55% remained neutral.
6	Help and documentation	61.12% of evaluators stated that the design adhered to the help and documentation principle, providing clear information on its usage. Meanwhile, 22.2% were neutral, and 16.68% asserted a lack of clarity in the design's information provision.

The results suggest a consensus among experts in this heuristic evaluation. The majority agreement on various heuristic principles underscores the positive evaluation of the e-resources interface design. These findings provide valuable insights for refining and optimizing the interface to ensure enhanced usability and user satisfaction.

The comprehensive results of the heuristic evaluation are summarized in Table 6, indicating that 75.54% of evaluators concurred that the design adhered to heuristic principles. This collective agreement underscores alignment with established heuristic criteria.

Table 6. Heuristic evaluation analysis scores

No	Heuristic Principle	Score
1	Visibility of system status	83.36
2	Match between the system and the real world	88.09
3	User control and freedom	61.17
4	Consistency and standards error	73.36
5	Aesthetic and minimalist design	86.13
6	Help and documentation	61.12
Total		75.54

4.2. Feedback and Comments from Experts

This section delves into the outcomes of the usability assessment carried out by experts proficient in heuristics and interface usage. The experts anticipated potential design flaws, offering comments and feedback to refine the prototype. The identified problems under each heuristic are outlined in Table 7.

Table 7. Number of problems

No	Heuristic Principle	Number of problems
1	Visibility of system status	2
2	Match between the system and the real world	3
3	User control and freedom	2
4	Consistency and standards error	3
5	Aesthetic and minimalist design	0
6	Help and documentation	2

The most significant issues were found in the match between the system and the real world and consistency and standards error, as highlighted in Table 7. The ensuing feedback and comments from experts and suggested actions are detailed in Table 8.

Table 8. Feedback and comments

No.	Heuristic Principle	Feedback and comments	Actions to be taken
1.	Visibility of system status	Emphasize the current icon status.	Add the current icon status.
2.	Visibility of system status	Specify the register icon for new users.	Replace the icon register with the icon new user.
3.	Match between the system and the real world	Add an exit button in the design settings.	Add an exit button in the design settings.
4.	Match between the system and the real world	Add the list to the menu.	Add the list to the menu.
5.	Match between the system and the real world	Add overlay text for specific menu pointers.	Add overlay text for specific menu pointers.
6.	User control and freedom	Introduce a 'Back' button for multi-page profiles.	Add a back button in the design setting.
7.	User control and freedom	Clarify the navigation menu map.	Add clarity to the navigation menu map.
8.	Consistency and standards error	Ensure consistent placement of icons.	Consistent icon information is on the left side.
9.	Consistency and standards error	Complete icon labels.	Complete icon labels.
10.	Consistency and standards error	Clarify title and label confusion.	Add clarity to the title and label to the screen.
11.	Help and documentation	Replace "accessibility" with help.	Accessibility as a help feature: change the term "accessibility" to help.
12.	Help and documentation	Introduce live chat as a help function.	Implement live chat as a help function.

The primary outcome of this evaluation is that expert comments predominantly address the innovation of the proposed design, emphasizing a more detailed librarian interface and indicators for answered questions. On the other hand, librarian feedback revolves around technical considerations, such as managing online users and distinguishing between user profiles in e-resources.

5. Conclusion

This research employed Nielsen's heuristic methods, engaging six experts in human-computer interaction and librarians to evaluate prototypes of university library interfaces, particularly for e-resources services. The study systematically conducted procedures, implemented evaluations, selected samples, and employed questionnaires. The article focuses on interface development in university libraries intending to expand e-resources utilization. The technology underpinning university education is thus explored.

The study's contributions lie in 1) applying social presence elements to address users' confusion and stress in the existing library interface, emphasizing the need for quick assistance from librarians when accessing e-resources. Developing an interface design using social presence elements aims to enhance the reach of e-resources provided by university libraries, thereby boosting overall productivity. 2) The heuristic evaluation method was carried out during COVID-19 restrictions, detailing remote evaluation procedures.

This study adopts social presence to develop an interface design of e-resources for university libraries. This concept facilitates easier access for users, as evaluated through heuristic methods. The results underscore strengths and weaknesses, with overall agreement among evaluators on heuristic criteria.

Experts' feedback, predominantly focusing on navigation and feature enhancement, is crucial for refining the application to meet users' expectations. The study's limitations include online evaluation challenges and future work aimed to enhance e-resources design with user filtering interfaces. Monitoring online or remote evaluation methods is crucial for comprehensive results.

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