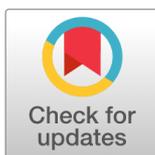


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User Experience: usability analysis of the e-Campo virtual learning environment (EMBRAPA)

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ABSTRACT

Introduction: Users of digital environments have specific characteristics that differ from their social context and the degree of usability of Information and Communication Technologies for access to the most diverse informational platforms, in which such particularities must be considered to meet the informational needs of these individuals and provide a better experience in digital environments. A discipline that proposes to investigate aspects related to user experience in digital environments is User Experience (UX) and, from the application of usability techniques, it is possible to identify barriers that can affect user interaction. **Objective:** The present study aims to analyze the usability of the e-Campo portal, from Embrapa, based on Nielsen's heuristic. **Methodology:** The methodology adopted in this research is characterized as a bibliographical, qualitative and exploratory analysis. **Results:** In the 10 steps identified, 10 usability problems were found, with the violation of heuristic 4 (Consistency and standards) being the most recurrent. **Conclusion:** Aspects related to usability were verified, which may hinder access to the content available on the portal. Thus, the relevance of the user in the context of studies in the area of Information Science is verified so that the construction of more interactive systems that allow a satisfactory user experience can be proposed.

KEYWORDS

User experience. Usability. Virtual learning environment. e-Campo portal.

Experiência do usuário: análise de usabilidade do ambiente virtual de aprendizagem e-Campo (EMBRAPA)

RESUMO

Introdução: Os usuários de ambientes digitais possuem características específicas que diferem a partir do seu contexto social e do grau de usabilidade das Tecnologias de Informação e Comunicação para acesso às mais distintas plataformas informacionais, no qual tais particularidades devem ser consideradas para atender as necessidades informacionais desses indivíduos e proporcionar uma melhor experiência em ambientes digitais. Uma disciplina que se propõe a investigar aspectos relacionados à experiência do usuário nos ambientes digitais é a *User Experience* (UX) e, a partir da aplicação de técnicas de usabilidade é possível identificar barreiras que podem afetar a interação do usuário. **Objetivo:** O presente estudo tem como objetivo analisar a usabilidade do portal e-Campo, da Embrapa, com base nas heurísticas

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de Nielsen. **Metodologia:** A metodologia adotada nesta pesquisa se caracteriza como bibliográfica, de análise qualitativa e de caráter exploratório. **Resultados:** Nas 10 etapas identificadas foram encontrados 10 problemas de usabilidade, sendo a violação da heurística 4 (Consistência e padrões) a mais recorrente. **Conclusão:** Verificou-se aspectos referentes à usabilidade, que podem dificultar o acesso aos conteúdos disponibilizados no portal. Assim, constata-se a relevância do usuário no contexto de estudos na área da Ciência da Informação para que se possa propor a construção de sistemas mais interativos que permitam uma experiência de uso satisfatória.

PALAVRAS-CHAVE

Experiência do usuário. Usabilidade. Ambiente virtual de aprendizagem. Portal e-Campo.

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1 INTRODUCTION

Information plays a fundamental role in human development and the generation of new knowledge. This knowledge production has been impacted by the increasing use of Information and Communication Technologies (ICT). Even more so in the context of accessing and sharing the knowledge recorded in digital and web environments.

Given these perspectives, a factor that deserves to be highlighted is that the volume of data and information generated in recent decades has provided significant changes in the way informational content is presented to users of information systems, generating, in turn, concern about the mode of appropriation of information, especially with the development of increasingly interactive interfaces, whose goal is to establish effective communication between the user and information systems, in the process of information retrieval. (CONEGLIAN et al., 2017).

[...] environments of different utilities [...] are constantly evolving, as well as informal communication in social networks. Consequently, the information made available in the digital environment grows exponentially and the concern about how to find it at the right time has been constant (CONEGLIAN et al., 2017, p. 36).

For this man-machine interaction to be carried out effectively, studies involving User Experience (UX) have focused efforts on the construction of meaning, layouts, and dynamic ways of presenting data and information on the web.

In this scenario, the retrieval of the most diverse types of information resources has become a challenge that permeates the studies in the field of Information Science (IS) through the use of ICT since, given the large volume of data and information, the area seeks to promote the development of methods, technologies and efficient practices in the information retrieval process.

That being said, the IS can play a crucial role in the construction of a theoretical framework from studies on the nature, genesis and effects of the processes of representation, communication and use of information (LE COADIC, 1996; MARCHIONINI, 2017), and in the definition of technological contributions capable of meeting the demands, expanding the flows and the access to the most distinct types of information resources (BORKO, 1968; CAPURRO, 2003).

In recent decades, one of the productive sectors that have made increasing use of ICT is agriculture, whose digital transformation experienced in the rural segment has favored the emergence of new job opportunities, higher productivity, and the possibility of improved life quality (BOLFE, 2021).

According to Bolfe (2021), this is a segment that access to data grows exponentially, which requires a closer look at the existing gaps regarding usability, social aspects, and access to emerging technological tools, these being factors that contribute to the strengthening in the generation of new knowledge, new technologies and innovations at the service of the sustainable development of Brazilian society.

In this context, the studies developed in the context of UX enable the process of information search to become a more interactive task between man and machine, whose main objective is to analyze the various steps taken by the user when using information systems and propose the construction of new models and designs that enable a better user experience, considering that the information should be a practical, usable, desirable, locatable, accessible, credible and valuable asset so that it can meet the informational needs of individuals (MORVILLE, 2004).

From this assumption, Norman and Nielsen (1998) emphasize that the user experience is a point of little attention in the supply of products and services. The studies developed in the discipline of UX can promote improvements in the process of informational search since what makes the user experience something exemplary is to have their needs met accurately, precisely,

and without interference.

In this perspective and considering the scenario of multiple ways of obtaining information, this research presents the following question: What barriers can influence the usability of information systems during the process of informational search by users?

The main objective of this research is to analyze the usability of Embrapa's e-Campo portal, based on the heuristics of Nielsen (1994b), through the identification of existing barriers to accessing the information available on the portal.

e-Campo is an online learning and training portal that aims to enable the technological inclusion of the various segments of Brazilian agriculture, sharing knowledge and technologies generated by Embrapa, aimed at producers, family farmers, agribusiness agents, and the community in general (EMBRAPA, 2022).

This study intends to bring elements to a reflection on the principles that guide the construction of digital environments that favor a minimally satisfactory user experience in their information searches, even if they have limited skills with the available technologies.

2 THE USER EXPERIENCE IN DIGITAL ENVIRONMENTS

The user experience in the interaction in information systems is a strong driver of the dynamics of structuring and presentation of data and information on the web because how the user behaves in his search for information can directly influence his decision-making.

Hence, the studies developed in the IS area to understand the interaction process between individuals and the digital information environment is a relevant factor for developing methods and techniques that can provide an experience at least satisfactory to the individual in his information searches.

Based on the definition advocated by SARACEVIC, IS is understood as:

[...] a field dedicated to scientific issues and professional practice concerned with the problems of effective communication of knowledge and its records among human beings, in the social, institutional or individual context of information use and needs [...] in addressing these issues the advantages of modern information technologies are considered of particular interest. (SARACEVIC, 1996, p.47).

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Regardless of the context to which the individual is inserted, the exponential use of technologies with emphasis on the Web has allowed a significant advance in the way of communicating and obtaining information, in which "[...] the informational subject will be able to act and make decisions that can ensure the exercise of their duties and rights" (RODAS; VIDOTTI; MONTEIRO, 2018, p. 164), allowing the generation of new knowledge and products.

With an increasingly intense informational flow in digital environments, Coneglian et al. (2017, p, 36) highlight that "[...] the resources presented on the Web that provide autonomy of use and choices of tasks to be performed" by users in their demands are growing.

To provide the user with autonomy in their information needs is to give conditions so that they can have the freedom to solve eventual questions during the search for information and have the possibility to fully enjoy the expressive amount of data and information available on the Web (MARTINS; ALENCAR; SANT'ANA, 2022).

According to the International Standard Organization (ISO, 2010), UX is related to the way an individual interacts with products and services he or she has contact with, the efficiency and satisfaction of use.

Such perception is observed by Borba, Affonso, and Sant'Ana (2017) when they highlight that, by serving a diversity of users, UX studies make it possible to understand the habits and opinions of users of computerized systems in their searches for information that meet their needs.

The user experience begins with a need or problem that motivates the use of a product, so it precedes people's interactions with the artifacts. This shifts the meaning of experience from a look restricted to the technology or artifact to a broad understanding of the context in which it occurs, [...] it is necessary to think about what comes before the development of such solutions, asking what people are looking for and what motivates them to be there (GRILO, 2019, p. 14).

In this sense, user experience can be determined in terms of the usability of computerized systems, being a quality characteristic of offering a specific product or service that is related to the effectiveness, efficiency, and satisfaction of use by the individual (ISO, 2010), enabling an ease of learning to use a solution, making few mistakes, and generating a certain degree of satisfaction (NIELSEN, 1994a).

[...] consider the satisfaction of the individual is a factor that is related to the User Experience; in this sense, it is realized that this fact, satisfaction, can represent one of the main conditions for the success or failure of a digital informational environment, because it is associated with issues related to success or frustration, for example, aspects inherent to human emotions. (RODAS; VIDOTTI; MONTEIRO, 2018, p. 167).

Goodman, Kuniavsky, and Moed (2012) consider that only using the techniques proposed by UX does not mean a guarantee of success of a specific product or service and that, if the user has a bad experience, it probably does not reach the desired goal.

In this perspective, the contextualization of information and knowledge may be related to aspects intrinsic to the user because, in certain situations, the search strategies are not well elaborated. In some cases, the information systems interface may not have an efficient semantic architecture to provide broader searches, generating a loss of time and even frustration for users.

For Vechiato and Vidotti (2014, p. 3783),

[...] not always the information found is derived from a previous search, and the accidental discovery of information may occur since subjects may accidentally find something without necessarily searching at the moment of navigation or search, a fact that modifies their behavior.

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With this, access and use of information on a large scale, as a factor resulting from the application of ICT, can be considered from the use of methodologies or techniques applied in constructing an interface between man/machine that provides more remarkable and better usability of systems.

According to Nielsen (2012), usability is characterized as a set of attributes and pre-established rules of qualitative nature that seek to evaluate and improve the interface of information systems, facilitating users' use in their demands. Also, according to the author, this fact should be considered a highly relevant factor in studies on UX, because minimally meeting users' expectations can define the success or failure in offering products and services, especially on the web (NIELSEN, 2012).

For a fluid interface in computerized systems that enables a good user experience, access and interaction cannot be abstract but intuitive with characteristics that facilitate communication, understanding of resources and appropriation of knowledge interactively and coherently by the individual, regardless of their mastery of digital media (LÉVY, 1993).

The information search process may involve the use of specific requirements, which explore the technical and cognitive abilities that users possess. In this respect, UX seeks to reflect on how human-machine interaction can be as intuitive as possible, especially concerning the location and how accessible information can be, these factors being essential in determining how retrievable it will be.

Thus,

[...] considering that the human being is part of this complex informational structure, it becomes relevant that the systems that support this informational architecture are designed considering the informational subject and not only the technical aspects related to computational development. (RODAS; VIDOTTI; MONTEIRO, 2018, p. 167).

In this perspective, the area of Information Science can play a fundamental role, which, besides addressing issues on aspects of organization and representation, also develops studies on the processes of access and use of data and the informational flow in physical or digital environments, in order to ensure the appropriation of information in the best possible way.

3 METHODOLOGY

The methodology adopted in this research is characterized as bibliographic, which aims to address the concepts of User Experience and the contribution of Information Science in the theoretical construction of studies related to the research theme.

It is also characterized as a qualitative research analysis of exploratory nature since it seeks "[...] to understand and analyze the reality of the research approaches" (TREVIÑOS, 1987, p. 117) in their practical applications through usability heuristic evaluation proposed by Nielsen (1994b).

In this study, research was carried out on the functional aspects of Embrapa's e-Campo portal concerning the path users take in their information searches and which contributes to a satisfactory user experience from the point of view of usability.

To build the theoretical framework, sources of information such as books and articles on the proposed theme were researched, as well as articles and documents available in specialized databases such as Brapci, Scopus, and Web of Science, which address the User Experience theme.

The usability evaluation method consists of analyzing the user interface in relation to the information system proposed for this research and how the interaction and usability occur in the system. For this, the usability guidelines highlighted by Nielsen and Loranger (2007, p. 17) can be considered, which establish the following levels of analysis: "general user behavior; specialized findings about specific genres of sites or areas of sites; detailed findings about a specific site and its customers."

In Table 1, we highlight the ten heuristics of Nielsen (1994b), considered as general rules for user interface design and that can be used by developers of computerized systems in the development of agile and interactive digital environments that provide a better experience in terms of usability.

Table 1 General heuristics for usability

Heuristics	Description	Goals
1. Visibility of system status	The design should always keep users informed about what is going on through appropriate feedback within a reasonable period of time.	Allows the user to know the system's status through more consistent and predictable interactions
2. Correspondence between the system and the real world	The design should use the users' language, such as familiar words, phrases, and concepts. Follow real-world conventions by making information appear in a natural and logical order.	Allows the user to make correlations with real-world facts, icons and images, promoting an intuitive interface

3. User control and autonomy	The design establishes an "emergency exit" so the user can leave an unwanted action when acting by mistake without going through a lengthy process.	Allows the user the freedom to quit a process without being frustrated
4. Consistency and standards	The design should follow platform and industry conventions so users can understand if different words, situations, or actions have the same meaning.	It allows users to gain confidence by using products they already know about and expect
5. Error prevention	The design should carefully prevent problems from occurring, eliminating error-prone conditions by presenting users with a confirmation option before committing to the action.	Allows errors or mistakes that occur during use to be fixed quickly
6. Recognition instead of remembering	The design should minimize the user's memory load by making elements, actions, and options visible so that needed information is visible or easily retrievable when needed.	Allows users to recognize information on the interface when accessing digital environments from a pre-established standard
7. Flexibility and efficiency of use	The design should cater to both inexperienced and experienced users, allowing them to customize frequent actions through shortcuts, which can speed up the interaction with the environment.	Allows the user to use features or access shortcuts for smooth navigation
8. Aesthetic and minimalist design	The design should have an interface that does not contain irrelevant or rarely needed information.	Allows the user an interface focused on the essentials
9. Helps users to recognize, diagnose and recover from errors	The design should make it possible for error messages to be expressed in simple language, stating the problem and suggesting a solution in a constructive way.	Allows the user to identify an error and return to the previous step
10. Help and documentation	The design should allow access to documentation to help the user understand how to complete their tasks if they need any further explanation.	Allows quick and easy access to users' assistance documents

Source: Adapted from Nielsen, 1994b.

After the analysis carried out in the e-Campo portal, it was sought to integrate the results obtained from the guidelines of the ten heuristics, highlighting the usability barriers and violation of the heuristics and the challenges that are presented to users of information systems.

The purpose of this study was to use the premises of usability of the heuristics of Nielsen (1994b), seeking to identify the efficiency of the e-Campo portal in meeting the needs of its users, in their informational demands, as well as the user experience regarding the navigation through the system.

4 ANALYSIS OF THE E-CAMPO PORTAL

It is remarkable how much the individual influences the environment in which information circulates because the informational needs of each being is unique and needs to be met in the best way so as not to leave gaps capable of causing damage in the interaction process between the individual and the knowledge.

In this sense, we highlight the importance of research on user experience as a theoretical subsidy for improvements in computerized systems, whose goal is to enable satisfactory interactions with the interfaces of the systems since the information is something essential for the generation of new knowledge, the role of the user is essential for the development of technologies and more efficient processes (DAVENPORT; PRUSAK, 1998).

To analyze the e-Campo portal, developed by Embrapa, two evaluation sessions were conducted. The first session was for recognition of the steps necessary to access the types of courses offered on the portal. The second session was for recognition of the usability barriers, following the methodology proposed by Nielsen (1994a), whose goal was to identify if the process of access and retrieval of information occurs clearly and effectively, if the portal provides good usability of navigation in all its interfaces, and if the findability of information minimally meet the informational needs of users.

Regarding the findability in digital environments, Morville (2005) highlights that such a fact occurs when the quality of the information is easily located, the system or environment promotes a fluid and intuitive navigation and enables easy and agile retrieval.

[...] the definition of findability, in addition to navigation and search in systems and environments, as well as the aspects that outline the characteristics of informational subjects, also combines mobility, convergence, and ubiquity from the technological development, considering the human actions for the search of knowledge in a given environment that has analog and digital characteristics (VECHIATO; VIDOTTI, 2014, p. 3783).

Tangible to the emerging technological context, the development of information systems that provide a more effective integration and interaction with the user have changed the language used in its architecture. The representation serves as a bridge to access a wide range of information and generate new knowledge.

According to Lima et al. (2016), interaction in information systems "[...] occurs through the graphical interfaces [...] that must be attractive to users because they are responsible for the performance and satisfaction [...], as well as the use or not of the system".

For information systems to offer a satisfactory user experience, principles must be followed to build an effective human-machine interface (NIELSEN, 2012), in which the usability of systems can be understood as a "[...] characteristic that determines whether the handling of a product is easy and quickly learned, [...] and offering a high degree of satisfaction, achieving its objectives" (SILVA, 2008, p. 15).

Based on the heuristics of Nielsen (1994b), we sought to identify barriers to the usability of the e-Campo portal through a detailed analysis of the system, observing the particularities of each category concerning the route taken during navigation on the portal.

Five parameters were considered in the analysis that made it possible to perform the usability evaluation of information systems, observing whether the system enables easy interaction with the user, i.e., if it is easy to learn, if it is efficient to use and if the user can locate the information he wants; if it is easy to remember, not being necessary new learning at each new interaction; if it is little prone to errors, allowing a wrong action to be undone; and, if it is pleasant to use, enabling a satisfactory user-machine interaction (NIELSEN, 1994a; ROSA; VERAS, 2013).

Therefore, it is presented in Table 2 a summary of the steps, functions, usability barriers and violation of heuristics found in the e-Campo portal, specifically in the Virtual Learning Environment (VLE) of Embrapa, observing elements that can hinder access to the content provided on the portal.

Table 2 Usability stages and barriers

Stages	Description	Usability Issues	Heuristics Violations
1) Access to the e-Campo Virtual Learning Environment.	A tab titled "Courses and Events" is available on the Embrapa portal. When the user clicks it, they are redirected to a page that offers the following options: search the course by name, events by type (online courses, courses, congresses, field days), upcoming events, and news about events. The user must click on the online courses option and will then be redirected to the e-Campo portal.	(H3) There are no arrows or indicators to help the user return to the previous page. (H4) When the user accesses the e-Campo portal, the interface design differs from the previous page, which may confuse the user. (H4) Does not appear on the home screen if the course is free or paid.	3 and 4.
2) Selection of the course.	Courses with open registration, courses on continuous offer, and courses with closed registration.	(H7) There is no place to search courses by name or filter-free and paid courses. (H8) Too much information and an extended page.	4, 7 and 8.
3) Registration.	The "Learn More" button must be selected for the user to formalize the registration, opening the course page with the option "Enroll now". The enrollment procedure depends on the course chosen. In certain courses, especially paid courses, the user is redirected to the institution's portal promoting the course.	(H4) Redirection to another institution's site may confuse the user since there is no previous information warning about this redirection.	4
4) Registering for free courses - Embrapa Virtual Learning Environment	For the user to be able to take the courses, it is necessary to create an account and provide some personal information such as E-mail, First Name, Last Name, State, Country, and Security Number. After registering, it is necessary to confirm this via e-mail by clicking on the link that redirects to the portal.	(H4) The Terms of Use and Privacy Notice are presented extensively before reaching the identification page. To identify the mandatory information in the registration form, an exclamation symbol in red is used, and the explanation of the symbol can only be found at the end of the form.	4

5) Introduction, terms of use, and participant profile.	<p>After the registration stage, the page is updated with course information and content.</p> <p>The user's awareness of the terms and conditions of use is collected, and it is also compulsory to fill out the questionnaire entitled "Participant Profile", whose objective is to identify the characteristics of the users taking the course. In some courses, a participant's guide instructs the student on navigating through the content available in the environment.</p>	<p>No usability barrier has been identified.</p>	-
6) Access to the Virtual Learning Environment.	<p>The Tour contains explanations of the following blocks: recently accessed courses, course summary, use of the block filters, course summary, and changing the course viewing option.</p>	<p>(H10) There are no explanations about the functionality of the functions available on the right tab (Dashboard, Calendar, Private Files, My courses and My Certificates) and also the functions that are in the upper right corner of the screen (Dashboard, Profile, Notes, Messages, Preferences and My Certificates) are not presented.</p>	10
7) Access to Content.	<p>For specific courses, a multimedia player with interactive text and images is available. In other courses, a narrated video with images and text is linked on the page below the video. Supplementary material in Portable Document Format (PDF) is available for download.</p>	<p>(H2) For courses with multimedia playback, it is not possible to use the accessibility feature (VLIBRAS).</p>	2
8) Learning evaluation.	<p>At the end of the course, a learning evaluation questionnaire is made available, whose number of questions is defined according to the specifics of each course. In the "Survey Navigation" option, located in the upper right corner, it is possible to view the status of each question and the progress in completing the form.</p>	<p>No usability barrier has been identified.</p>	-
9) Satisfaction Evaluation.	<p>In order to improve the courses offered, it is requested to fill out the "Satisfaction Evaluation", with questions grouped into dimensions about the content and structure, graphic interface, applicability, and institutional and logistical support.</p>	<p>No usability barrier has been identified.</p>	-

10) Issuance of the Certificate of Completion.	To issue the certificate, the user must select the option "Get certificate", then it will be available for printing and/or downloading in PDF format.	No usability barrier has been identified.
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Fonte: Formulated by the authors, 2022.

In the usability barriers described in Table 2, it is noteworthy that the violation of heuristic number 4 (Consistency and standards) is the most recurrent; whose premise of the heuristic is to establish the consistency and use of a pre-defined standard, which allows the user to acquire confidence when using information systems, which in some stages of the journey was not observed in the portal, causing doubts about the location of information, being necessary to return to previous stages for better understanding of the information presented.

It was also observed that the main difficulty identified is the lack of guidance for the use of the services offered, making the interface with the system confusing, which can compromise the user's autonomy as to the fluidity of navigation and search for information.

For Rosenfeld, Morville, and Arango (2015, p. 40), it is essential to understand and distinguish the real needs of users so that products and services are directed and offered to generate a satisfactory experience, in addition to "[...] determine how and where to invest efforts and resources used to design the architecture in the construction of websites", providing better interaction and ease of usability by the consumer audience.

It is noteworthy that identifying and measuring user satisfaction is a complex process in the context of UX, in which the subjectivity of the methods used for a better experience is in the fact of satisfying the individual from the access to a particular system through the interfaces that it can provide for more fluid navigation (HASSAN MONTERO; MARTÍN FERNÁNDEZ, 2005).

However, it is observed that there is a strong tendency to develop new solutions in the design of products and services of the e-Campo portal since the institution applies a satisfaction evaluation in which it considers issues related to the graphical interface and language used, demonstrating concern with the user's opinion.

5 CONCLUSION

The access and use of information in digital environments has constantly changed how users interact and search to meet their information needs.

The user experience is a strong driver of the dynamics of structuring and presentation of data on the web because how the user perceives a set of data directly influences his decision-making.

In this context, the field of Information Science plays a fundamental role in studies related to the use of methods and/or techniques applied in constructing a more interactive man-machine interface, which provides better usability of digital environments.

In this study, we considered analyzing the usability of Embrapa's e-Campo portal, with content aimed at online learning and training for producers, family farmers, agribusiness agents, and the community in general, whose proposal is to enable technological inclusion applied to the various segments of Brazilian agriculture.

This project aims to enable technological inclusion applied to various segments of Brazilian agriculture. Identifying the steps involved in the processes within the scope of User Experience, based on the heuristics proposed by Nielsen regarding the interfaces with the information systems to which the users are submitted, made it possible to analyze the various

facets that the user goes through when using products and services, bringing reflections on whether the forms of access provide a satisfactory user experience that minimally meets their needs.

Consequently, the relevance of studies in the area of Information Science is verified, which seeks to understand the informational needs of users and their interaction in digital environments so that the area of IC can propose the construction of systems with interfaces that allow a satisfactory user experience, from the point of view of usability and informational search.

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