Human-Centered Redesign as a Strategy for Value Creation in Educational Information Systems

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Abstract. *Information Systems have become central to higher education, directly influencing student experience, institutional performance, and educational quality. However, many academic systems are still primarily designed with an operational and administrative focus, often lacking systematic human-centered design (HCD) principles. This study positions human-centered redesign as a strategic mechanism for governance and value creation, supporting the alignment between technology, organizational objectives, and student needs in academic environments. The study presents an HCD-based redesign of System X, which achieved high usability scores and resulted in measurable improvements in navigation efficiency, mobile responsiveness, and overall user experience quality.*

1. Introduction

Digital transformation has fundamentally reshaped the role of Information Systems (IS) in higher education [Kimura et al. 2020]. Academic platforms are no longer merely administrative tools; they have become core infrastructures that mediate students' academic journeys, institutional processes, and learning experiences [Silva et al. 2022]. As educational quality has emerged as a global priority [Verger et al. 2018], evaluation criteria have expanded beyond pedagogical content to include the technological environments through which academic interactions occur. In this context, student experience has become a critical dimension of organizational performance in digital educational ecosystems [Maslov et al. 2021].

Despite this growing centrality, many academic IS continue to be designed primarily from an operational and administrative perspective [Noaman and Ahmed 2015]. System architectures often prioritize internal workflows, compliance requirements, and data management efficiency, while insufficient attention is given to user experience, cognitive load, and interaction quality [Resende Júnior and Leite 2024]. This misalignment reveals a persistent socio-technical gap: although IS are strategically positioned within institutions, their design practices frequently neglect systematic human-centered approaches [Silva et al. 2019]. Empirical evidence suggests that inadequate system interactions negatively affect users' trust, engagement, and emotional responses, with potential consequences for academic performance and institutional perception [Vlachogianni and Tselios 2023].

In the Brazilian context, educational quality is formally established as a foundational principle by Law No. 9.394/1996 [Brasil 1996], reinforcing institutional responsibility to ensure not only access to education but also equitable and effective conditions for the use of technology. From an IS perspective, this raises a broader governance question: how can

institutions align technological infrastructures with student-centered value creation? Human-Centered Design (HCD), as defined by ISO 9241-210 [ISO 9241-210 2019], provides a structured and iterative framework rooted in a comprehensive understanding of users, tasks, and contexts. However, while HCD is well established within Human-Computer Interaction research, its positioning as a strategic mechanism within IS governance remains underexplored in educational settings. In light of this gap, this study argues that human-centered redesign should not be understood merely as an interface improvement initiative, but rather as an emerging strategic mechanism for aligning technology, organizational objectives, and student experience in educational IS. Accordingly, the objective of this article is to analyze how a structured human-centered redesign process can contribute to strategic alignment and quality enhancement in academic IS.

To address this objective, we conducted the redesign of *Information System X*[1] at *Institution A* following HCD principles. The process included a problem-identification phase involving 101 students[2] , the development of a functional prototype and a usability evaluation using the System Usability Scale (SUS) [Brooke 1986], administered to six participants[3] The resulting prototype achieved a score classified as excellent. Beyond the quantitative results, a Thematic Analysis [Braun and Clarke 2006, ISO/IEC 38500 2024] was performed in accordance with established qualitative research procedures to capture participants' experiential insights. The findings indicated enhanced navigation clarity, improved mobile responsiveness, and the mitigation of previously identified usability constraints. These findings provide empirical support for the proposition that systematic human-centered redesign can generate impacts that extend beyond usability gains, contributing to strategic alignment, digital governance strengthening, and enhanced institutional value creation. By articulating empirical evidence with a conceptual repositioning of HCD within IS, this study advances an emerging perspective on redesign as a transformative mechanism in educational IS.

The remainder of this work is organized as follows. Section 2 discusses related work in the literature. Section 3 describes the methodology, presents the results of the study, and the evaluation of the proposed solution. Section 4 addresses reflections and challenges Human-Centered Design in Information Systems. Finally, Section 5 presents the final considerations and future research directions.

2. Related Work

The literature on usability in higher education information systems consistently demonstrates that interaction quality directly influences user satisfaction and system adoption [Gunesekera et al. 2019]. Despite this well-established relationship, most studies remain predominantly diagnostic, emphasizing the identification of interface-level issues rather than positioning redesign as a strategic, governance-oriented intervention aligned with institutional objectives. Empirical evidence reinforces this limitation: [Maslov et al. 2021] show that interaction barriers impair student engagement and efficiency but remain centered on performance assessment, while [Vlachogianni and Tselios 2023] highlight accessibility gaps

[1]The system and institution are anonymized as Information System X and Institution A.

[2]The study is part of the project "Accessibility and Usability of Applications on Multiple Devices", approved by the Ethics Committee (CAAE 02896318.2.0000.5390).

[3]The selection of this number of participants follows the recommendations of studies such as [Dumas and Redish 1999] and [Nielsen 2000].

from a digital inclusion perspective without proposing structured mechanisms to operationalize improvements within institutional governance.

At the intervention level, [Grilo et al. 2017] and [Kureerung et al. 2022] demonstrate that participatory and iterative redesign approaches can improve usability metrics such as content value, findability, efficiency, and user satisfaction. However, these contributions are largely operational, with limited connection to strategic and governance dimensions. Addressing this limitation, [Pedrosa and Freitas 2025] emphasize the integration of human-centered principles into digital governance, arguing that effective digital transformation requires the early incorporation of Human-Computer Interaction principles into Information Technology Master Plans.

Building on this perspective, the present study advances the field by reframing Human-Centered Design as a governance-aligned strategic mechanism for Educational Information Systems. Furthermore, it integrates quantitative (SUS) and qualitative (Thematic Analysis) methods to produce both measurable benchmarks and interpretative insights. By bridging the gap between usability diagnostics and strategic redesign, this approach positions human-centered intervention as a structured pathway for institutional alignment and the generation of public value.

3. Human-Centered Redesign as a Strategic Intervention in Information Systems

The redesign of Information System X was grounded in HCD principles [ISO 9241-210 2019], as illustrated in Figure 1. The process follows the stages of research and empathy, problem definition, ideation, prototyping, testing and iteration, with continuous prioritization of user needs. The process was iterative and incremental, allowing movement between stages as necessary. All activities were conducted collaboratively with the project team through brainstorming sessions and usability testing at each iteration. Additionally, the design process was multidisciplinary, involving researchers in software engineering, human-computer interaction (HCI), and Information Systems, as well as education professionals, teachers, administrators, and students from Institution A. The following sections detail each stage of the process and its respective results.

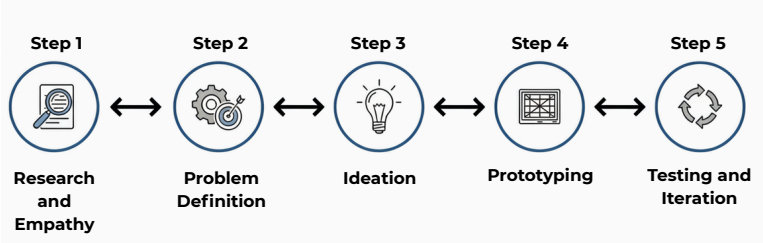


Figure 1. Human-Centered Redesign process for the Information System X.

3.1. Research and Empathy

The research and empathy stage sought to understand users' needs, challenges, behaviors, and expectations within their context. A questionnaire[4] was administered to 101 randomly selected users of Information System X at Institution A to identify frequently used features,

[4] https://osf.io/4nfe5/files/w843q

areas for improvement, and main usage barriers. Participants highlighted positive experiences, particularly the system's usefulness for accessing grades, study materials, exam schedules, and assignment organization, which were perceived as supporting learning and engagement, an aspect emphasized by users such as UserID17, UserID26, and UserID36. *The functionality of being able to compare my grades with those of the class and the course is very useful* (UserID17). *Having a general files menu makes things much easier* (UserID26). *I really liked the performance dashboard that presents the grade performance chart* (UserID36).

Conversely, users reported multiple difficulties with Information System X, particularly regarding navigation, performance, and stability, including frequent slowdowns and crashes. They also highlighted a lack of cross-platform responsiveness, challenges with the mobile application, and the absence of integrated communication tools for direct contact with professors. Additional issues involved limited access to learning materials, a lack of notifications about academic updates, and constraints in administrative and financial services, such as payment slip issuance. These concerns, emphasized by users such as UserID19 and UserID28, reveal significant usability and functional gaps in the system. *In general, the system is confusing to use, especially on mobile; it is poorly sized and does not adapt properly to mobile devices* (UserID19). *The system has a login session timeout that really annoys me, because I am searching for materials and, suddenly, the session ends, forcing me to log in again. In addition, the course information does not include the professor's email field, making communication difficult. There are also no notifications about changes made by the professor, forcing students to frequently log in and check* (UserID28).

3.2. Problem Definition

Based on the research and empathy findings, the problem definition translated user feedback into functional [ISO/IEC 25010 2023] and non-functional requirements [ISO/IEC 25019 2023], ensuring systematic alignment with user needs and information governance objectives. This structured approach supported the transformation of experiential data into actionable system improvements grounded in quality standards.

From a functional perspective, the analysis identified fragmented access to academic information, navigation difficulties, and limitations in information architecture. Frequently used features, such as grades and schedules, were distributed across different modules, reducing efficiency. Users also highlighted the need for additional functionalities, including an interactive calendar and the display of attendance percentages within course modules, revealing gaps in information integration and accessibility. From a non-functional and governance perspective, usability issues included high cognitive load caused by excessive information density, limited visual hierarchy, and lack of mobile responsiveness, resulting in layout distortions across devices. These findings point to opportunities to improve digital service quality, transparency, and strategic alignment by embedding user-centered requirements into the redesign process, thereby reinforcing evidence-based digital governance practices.

From an information governance perspective, these findings reveal opportunities to enhance digital service quality, transparency, and institutional information management. Integrating user-centered requirements into the redesign process enables governance mechanisms to better support decision-making, service reliability, and strategic alignment between technological infrastructure and institutional objectives. Thus, the problem definition advances not only usability improvements but also the strengthening of digital governance through evidence-based system evolution.

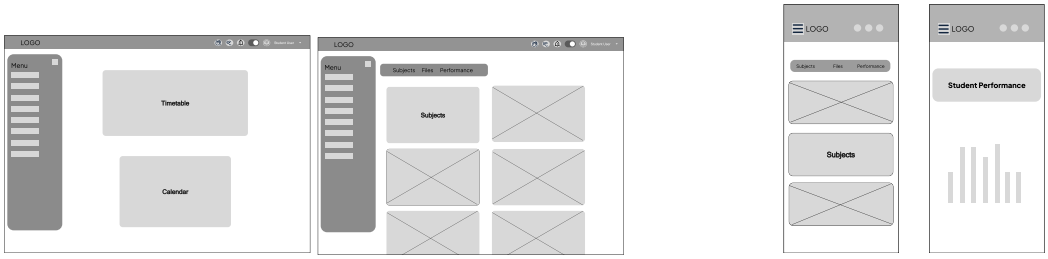
3.3. Ideation

This stage aimed to generate alternative design solutions to improve usability, information accessibility, and user satisfaction, while aligning with established requirements and information governance principles, such as stakeholder engagement and value delivery [ISO/IEC 38500 2024]. Ideation occurred through collaborative brainstorming sessions involving researchers in software engineering, HCI, and IS, together with education professionals from Institution A, resulting in proposals for improved information visualization, simplified navigation, and enhanced mobile usability.

All proposed ideas were assessed based on usability impact, technical feasibility, and contribution to user experience, while considering organizational constraints. This evaluation ensured that design decisions remained user-centered and aligned with governance objectives related to digital service quality and information management, guiding the selection of solutions for the prototyping stage.

3.4. Prototyping

Figma tool[5] was used to develop low and high-fidelity prototypes for the redesign of Information System X. The low-fidelity prototype explored alternative layouts and information structures, focusing on navigation flow and accessibility (see Figure 2), and was reviewed and validated with an interdisciplinary research team through collaborative brainstorming sessions. This stage focused on refining design alternatives to improve usability and reduce cognitive load. The prototyping process incorporated Nielsen's heuristics [Nielsen 2024], particularly visibility of system status and minimalist design, while also considering information governance principles by prioritizing accessibility, transparency of academic data, and usability to enhance digital service quality and institutional information management.



(a) Desktop version wireframe. **(b) Mobile version wireframe.**

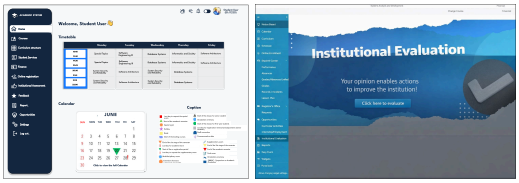
Figure 2. Low-fidelity wireframes of the redesign of Information System X: (a) desktop and (b) mobile versions.

Figure 2 presents responsive wireframes developed to address information fragmentation and high content density, which increased users' cognitive effort. The redesign adopted a human-centered approach to improve the organization of information and interaction efficiency. The desktop interface (Figure 2a) introduces a centralized academic dashboard integrating key functions, such as the timetable and academic calendar, alongside filterable card-based sections (Subjects, Files, Performance) to enhance visual hierarchy and navigation. To resolve mobile usability issues identified in Section 3.2, the mobile interface (Figure 2b) implements vertical tab-based navigation with progressive information disclosure, reducing cognitive overload and improving cross-device accessibility.

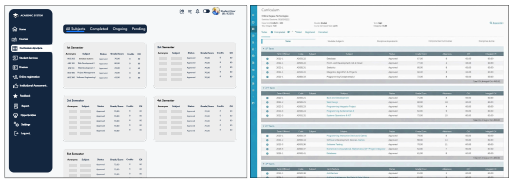
[5]https://www.figma.com

After incorporating feedback from the interdisciplinary team, a high-fidelity prototype was developed, integrating cognitive bias considerations [Tversky and Kahneman 1974] to enhance decision-making clarity, information presentation, and interaction quality. A sample of this prototype is shown in Figure 3.

Figures 3a and 3b present the redesigned post-login and curriculum screens, developed to reduce cognitive load and improve usability. The interface centralizes key academic information, offering quick access to the weekly timetable and an interactive calendar, while the curriculum view organizes courses by semester through filterable cards instead of dense tables. This structure clearly displays subject, status, grade, and credit hours, enhancing readability, mobile responsiveness, and visual hierarchy in alignment with HCD principles.



(a) Menu Interface: Prototype (left) and Original Information System X (right).



(b) Curriculum Grid: Prototype (left) and Original Information System X (right).

Figure 3. Comparative analysis between the proposed redesign (prototype) and the original graphical interfaces of Information System X.

Figure 4 presents the complete interaction mapping developed in Figma, detailing the system's information architecture and navigation paths across key modules. This interaction flow functioned as a structuring artifact for interface requirement specification, translating functional needs and business rules into clearer, implementable structures. Detailed modeling reduced design ambiguities, improved traceability between requirements and implementation, and enhanced software quality. Additionally, the prototype enabled early validation of usability and functional issues before coding, reducing rework and risks while supporting alignment between user expectations and organizational objectives.

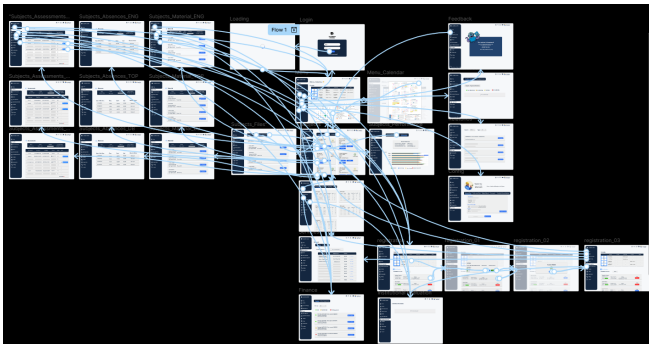


Figure 4. Mapping of interaction logic flow and screen transitions of the high-fidelity prototype for Information System X.

3.5. Testing and Iteration

The planning, execution, and analysis of the high-fidelity prototype were guided by the DECIDE framework [Preece et al. 2002], which provides a structured and iterative approach to

evaluation design[6]. In this study, the framework was operationalized to systematically assess the redesigned Information System X.

The evaluation combined quantitative and qualitative methods. A usability test with students required participants to perform representative academic tasks and complete the SUS questionnaire to measure perceived usability, while thematic analysis of their feedback provided deeper insights into user perceptions, interaction difficulties, and improvement opportunities. Detailed procedures and findings are presented in the following sections.

3.5.1. Usability Testing and SUS

The initial evaluation involved a usability test with end users to assess the prototype's functional consistency in supporting academic tasks, as well as interface clarity, usefulness, relevance, and ease of use within the institutional context. The study specifically examined whether the redesign mitigated previously identified issues (Section 3.2), including information fragmentation, lack of mobile responsiveness, high cognitive load due to poor visual hierarchy, and the absence of functionalities such as an interactive calendar and attendance indicators, aiming to improve interaction efficiency and information comprehension[7]. Beyond usability, the evaluation also addressed information governance objectives, such as accessibility, transparency, and reliability of institutional data. By analyzing users' ability to access, interpret, and use academic information effectively, the study assessed the redesign's contribution to both user experience and digital information management practices.

Participants were selected through convenience sampling [Etikan et al. 2016], and the evaluation was conducted as a case study in its real institutional context [Yin 2009, Cousin 2005]. Following case study principles, the aim was analytical rather than statistical generalization, generating contextually grounded insights despite the small sample size [Yin 2009, Flyvbjerg 2004]. A pilot study with 15 regular users was conducted to refine the data collection protocol and research instruments.

After adjustments, six students (P1-P6) participated in face-to-face evaluation sessions [Shephard and Färe 1974, Dumas and Redish 1999, Nielsen 2000]. After providing informed consent, they interacted with the high-fidelity prototype and completed an online questionnaire via Google Forms[8] , comprising demographic items, interface evaluation questions, and the SUS instrument [Brooke 1986]. Data were analyzed in a spreadsheet using the SUS scoring formula [Sauro and Lewis 2016]. Demographic results indicated that participants, identified by codes P1 to P6, were aged between 20 and 35 and were currently enrolled in higher education.

All participants (100%) reported that the redesigned prototype presented clear interface elements and objective information, with functionalities aligned to their academic needs. This indicates that users clearly understood system features and that the redesign enhanced usability while supporting digital information management within the institutional context. Subsequently, SUS responses were analyzed following the scoring guidelines of [Sauro and Lewis 2016]. The raw and final SUS scores of the six participants, calculated

[6]The DECIDE evaluation planning is available at the following link: `https://osf.io/4nfe5/files/pkx84`

[7]Other remaining issues will be addressed in future versions of Information System X.

[8]`https://osf.io/4nfe5/files/v9tq5`

from the ten questionnaire items using the standard formula, are presented in Table 1.

Table 1. Results obtained using the rating scale of [Sauro and Lewis 2016].

Participant	P1	P2	P3	P4	P5	P6	Final Average
SUS Raw Score	32	40	36	38	38	36	
SUS Final Score	80	100	90	95	95	90	**91.67**

The overall SUS score, calculated from the mean responses of the six participants, was 91.67 (Table 1)[9], indicating excellent perceived usability and substantially exceeding the benchmark average of 68 [Sauro and Lewis 2016]. This result suggests that the redesigned system was perceived as effective, efficient, and easy to use, successfully addressing previously identified usability and accessibility issues.

From an IS perspective, the findings underscore the strategic value of human-centered redesign in enhancing institutional digital services. High usability supports improved user experience, more effective interaction with organizational information, better decision-making, greater system adoption, and strengthened information governance, demonstrating measurable benefits for both user perception and institutional information management.

3.5.2. Thematic Analysis

The thematic analysis followed an inductive approach [Braun and Clarke 2006], deriving codes directly from participants' interaction data rather than predefined categories (Steps 1 and 2). The process involved repeated readings of transcripts for data familiarization, followed by segmentation into meaning units and generation of initial codes capturing recurrent or analytically significant aspects of user experience. Coding was guided by frequency across participants and relevance to usability and system functionality. Initial codes included suggestions to display attendance percentages within course cards, improve calendar interactivity, perceptions of ease of use, differences in technological familiarity, initial interaction uncertainty, comparisons with the institution's existing system, and preference for the mobile interface.

In Step 3, semantically related codes were grouped into broader themes based on recurring patterns and conceptual proximity, resulting in four categories: interaction quality (navigation fluency, clarity, usability), technological competence level (differences in digital familiarity), improvement suggestions (constructive refinement feedback), and user engagement and experience (perceptions and attitudes). During Step 4, themes were reviewed to ensure coherence and alignment with the dataset, with selected codes reassigned for conceptual precision (e.g., "ease of use" integrated into interaction quality) and terminology refined (e.g., "technological familiarity" reframed as technological competence level). In Step 5, themes were synthesized into an analytical narrative connecting user perceptions to design implications. The findings emphasized interaction quality, variation in digital competence, and mobile responsiveness, directly informing refinements such as adding attendance percentages and improving calendar interactivity.

Figure 5 illustrates the alignment between initial codes, thematic categories, and the analytical principles of relevance, richness, representativeness, and recurrence (Step 6). All

[9]Detailed individual scores and step-by-step SUS calculations are available at: `https://osf.io/4nfe5/files/7qzu2`

themes reinforced these principles, evidencing their structural importance for usability and overall user satisfaction. Interaction quality was linked to all four principles.

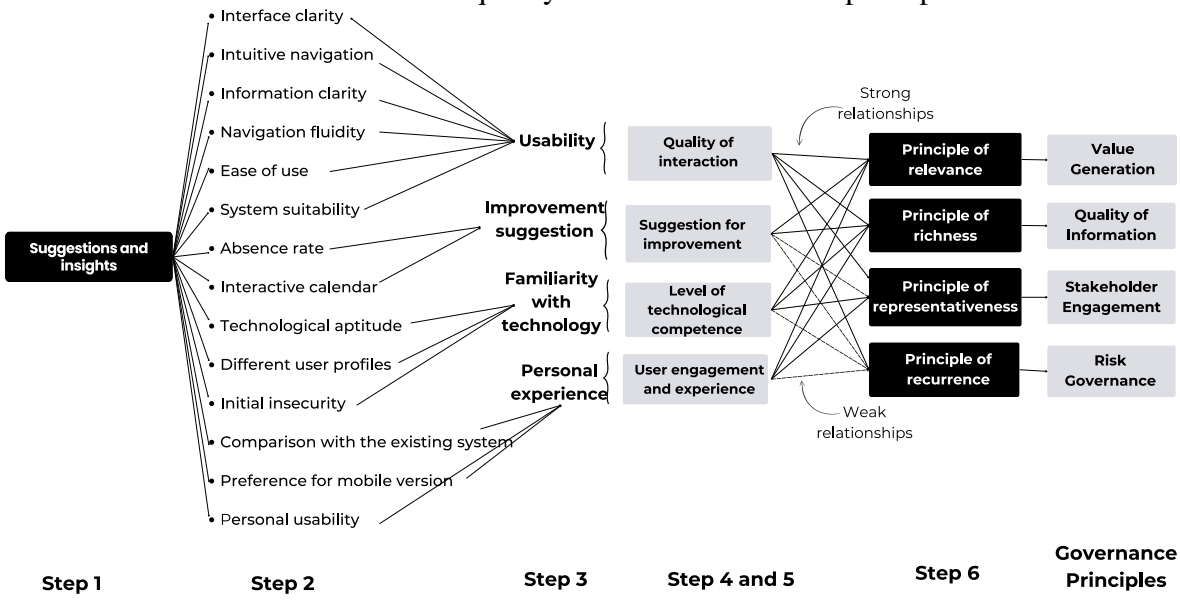


Figure 5. Correspondence between codes and themes across the different stages of the thematic analysis.

Under **recurrence**, consistent patterns such as usability issues and repetitive behaviors affecting user experience were identified. **Richness** enabled an in-depth analysis of technical, emotional, and contextual interaction dimensions. **Representativeness** ensured authentic incorporation of users' perceptions, while **relevance** prioritized critical factors impacting effectiveness, efficiency, and satisfaction, even when infrequent. Consequently, interaction quality emerged as central to the usability analysis.

Improvement suggestions were chiefly associated with relevance and richness, as they prioritized critical issues based on in-depth analysis, while representativeness ensured alignment with genuine user needs and recurrence supported recommendations grounded in repeated patterns. Technological competence level related to relevance (effective interaction), representativeness (diverse digital profiles), and richness (insights into challenges and behaviors), with recurrence emerging mainly in consistent difficulty patterns. User engagement and lived experience aligned primarily with relevance, representativeness, and richness due to their impact on acceptance, effectiveness, and legitimacy, whereas recurrence was secondary, appearing only in stable perceptual or behavioral trends.

4. Human-Centered Design in Information Systems: Reflections and Challenges

This study analyzes the role of HCD in IS evolution, arguing that user experience generates strategic evidence for governance, continuous improvement, and organizational value. By connecting thematic analysis to IT governance principles, it shows how qualitative data can support decision-making, risk management, and system evolution. Considering the sociotechnical nature of IS, the principles of relevance, richness, representativeness, and recurrence were reframed as mechanisms that transform qualitative insights into drivers of governance, planning, and digital transformation, reinforcing HCD as a strategic approach (Figure 5).

The link between **relevance** and **organizational value** aligns with IT governance literature, which stresses aligning digital assets with strategic objectives to maximize performance [Weill and Ross 2004, Zahiruddin and Wijaya 2024]. A key challenge, however, is translating qualitative insights into objective value metrics, particularly in contexts where human factors shape technology adoption. Likewise, the connection between **richness** and **information quality** reflects governance and data quality debates, highlighting that contextualized and reliable information supports decision-making and long-term effectiveness [Bernardo et al. 2024, Guillen-Aguinaga et al. 2025]. The main difficulty lies in sustaining information quality in dynamic environments requiring frequent data updates.

The principle of **representativeness**, linked to **stakeholder engagement**, emphasizes that involving diverse user groups in design and governance enhances legitimacy and system adoption. UX and governance studies show that active participation improves the relevance and effectiveness of information solutions [Norman 2013, Melo 2023]. The main challenge lies in reconciling diverse interests within shared governance structures through effective communication and negotiation. Moreover, the association of **recurrence** with risk governance highlights the importance of monitoring repeated patterns to detect vulnerabilities and enable preventive action [ISO/IEC 38500 2024, Zahiruddin and Wijaya 2024]. However, integrating qualitative evidence into risk management processes still dominated by quantitative metrics remains difficult. The remaining governance principles are still under analysis to further strengthen this integrative framework.

5. Conclusion and Final Considerations

This study redesigned Information System X at Institution A based on HCD principles. Usability issues were identified with 101 students, followed by prototype development and evaluation with six participants using the SUS [Brooke 1986], achieving an excellent mean score of 91.68. Thematic Analysis [Braun and Clarke 2006, ISO/IEC 38500 2024] indicated improvements in navigation, mobile responsiveness, and resolution of prior usability problems. The findings show that HCD-driven redesign extends beyond interface improvements, promoting strategic alignment, stronger digital governance, and greater institutional value, thereby confirming its transformative potential in educational information systems.

Future work will focus on expanding the evaluation to a larger and more diverse group of participants to enhance the generalizability of the findings. Longitudinal studies could be conducted to assess the sustained impact of HCD-driven redesigns on user behavior, satisfaction, and institutional processes. Additionally, integrating complementary usability and accessibility assessment methods, along with involving independent evaluators, would strengthen the robustness of the results. Exploring the application of HCD principles to other educational information systems and contexts could further validate the transformative potential of redesign and provide guidelines for broader institutional adoption.

Ethical Issues and Artificial Intelligence Use

This study complied with the ethical guidelines of the Sociedade Brasileira de Computação (SBC) for educational activities. ChatGPT was used exclusively to support writing and linguistic revision of the manuscript.

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