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Assessing the Usability of a Comprehensive Research Management System: A Mixed-Use Study in Iran

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Abstract

Usability is a key dimension of the quality of research information systems. This study aimed to examine the usability of the "Pazhuheshyar" research affairs management system and explore users' experiences and challenges when interacting with it across several medical universities in Iran. A convergent parallel mixed-methods design was employed. In the quantitative phase, 169 users (76 men and 93 women) completed a questionnaire evaluating the usability of web-based software, and independent t-tests were used to examine differences by gender and user role. In the qualitative phase, 16 semi-structured interviews were conducted using purposive sampling and analyzed through content analysis. The mean Relative Usability score was 33.19%, indicating a low to moderate level of usability. The lowest subscale score was related to Ease of Use (23.82%), while the highest score was observed for Content/Output Quality (42.40%). Women reported higher usability scores than men across most domains, although no significant differences were found for System Terminology and Information and System Capabilities. Similarly, officers and managers reported higher scores than researchers on most scales, with no significant differences in System Terminology and Information, Personalization, and Error Management. Qualitative analysis identified five main categories: complex navigation pathways and similar menu options; system errors and data storage problems; insufficient training and user support; strengths related to documentation and national system integration; and suggested improvements such as simplifying processes, redesigning search and reporting functions, providing personalized dashboards, and developing a mobile version. Despite strengths in documentation and integration, limitations in ease of use and learnability appear to hinder optimal efficiency and user satisfaction. Implementing user-centered workflow redesign, improving error handling and feedback mechanisms, providing structured training, and continuously monitoring user experience may enhance system adoption, user satisfaction, and productivity.

Keywords: Ergonomics; Research Management System; User-Computer Interface; Usability.

1- Introduction

Usability is widely recognized as a fundamental dimension of information system quality. According to ISO 9241-11, usability refers to the extent to which specified users can achieve defined goals within a particular context of use effectively, efficiently, and with satisfaction [1]. In university research management systems—designed to support the entire research lifecycle from proposal submission and review to funding, implementation, and project closure—usability plays a critical role in shaping researchers' productivity, system acceptance, and overall user satisfaction. From the perspective of human–computer interaction and cognitive ergonomics, systems designed according to user-centered principles can significantly enhance learnability, interaction efficiency, and perceived usefulness [2,3].

Existing research on research management and academic information systems has commonly relied on structured usability evaluation frameworks and mixed-methods approaches. Several studies combining heuristic evaluation based on Nielsen's ten heuristics with the System Usability Scale (SUS) have identified recurring usability issues

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related to interface clarity, feedback mechanisms, color usage, and command design. Although these studies often reported acceptable levels of user competence and general satisfaction, they consistently recommended improvements in visual clarity, feedback provision, and interface guidance [4]. In contrast, evaluations of other university systems have revealed substantially lower usability levels, with SUS scores as low as 47 accompanied by high levels of user dissatisfaction and perceived complexity [5]. Similarly, even systems reporting relatively high usability scores (e.g., 81.25) have demonstrated limitations in search functionality and information presentation, indicating the need for improved search visualization and clearer evaluation criteria [6].

Beyond system-level usability scores, previous research has also highlighted the broader relationship between usability and user outcomes. For instance, staff surveys have shown a positive association between perceived system usability and satisfaction with online communication environments [7,8]. Expert heuristic evaluations have further revealed numerous usability problems, particularly those related to the principle of "recognition rather than recall," which directly affects users' cognitive workload and task performance [8,9]. Likewise, student-based evaluations have documented large numbers of usability issues, most commonly associated with aesthetic and minimalist design principles as well as limitations in user control and navigation freedom [10]. Methodological research has also emphasized the effectiveness of hybrid usability evaluation approaches in higher-education management systems, with users generally reporting acceptance of these combined assessment frameworks [11,12].

Evidence from the Iranian context reflects similar patterns. Bahador et al., in an exploratory evaluation of a research management system, reported that although some fundamental functional requirements were addressed, major usability limitations remained, particularly in relation to user compatibility, interface simplicity, system guidance, and feedback mechanisms, highlighting the need for stronger user-centered design practices [10]. Likewise, usability evaluations of the Ministry of Health Examination System identified moderate usability scores together with notable challenges in navigation structure, access to key functions, and error feedback mechanisms [12,13].

Collectively, these findings emphasize that the success of research management systems depends not only on functional capabilities but also on the quality of user interaction, system learnability, and alignment with human-centered design principles.

Another study reported an inverse relationship between system usability and users' mental workload, measured using the NASA-TLX scale. In that evaluation, complex navigation structures and insufficient feedback mechanisms were associated with increased cognitive load, highlighting the importance of user-centered redesign in academic information systems [13,14]. Consistent evidence from both international and national studies indicates that recurring usability problems—such as complex navigation pathways, high memory demands, inadequate feedback, inconsistent terminology, and non-minimalist interface design—can reduce usability scores, increase mental workload, and ultimately weaken system acceptance among users [13–17]. Conversely, continuous monitoring of user experience combined with iterative design improvements based on quantitative and qualitative feedback has been associated with improved usability outcomes in academic information systems [16,17].

Despite the expanding body of research on usability evaluation in higher-education information systems, several important gaps remain. Many previous investigations have relied primarily on quantitative usability scales or expert-based heuristic evaluations, whereas fewer studies have adopted integrated approaches that combine standardized usability measurement with in-depth exploration of users' experiences. Furthermore, empirical evidence regarding the usability of research management systems in medical universities remains limited, particularly within the Iranian context. Addressing these gaps requires systematic evaluations that simultaneously assess usability performance and explore user experiences to generate actionable design improvements.

Hamadan University of Medical Sciences currently uses the "Pazhuheshyar" platform to manage research activities. Preliminary observations suggest that a systematic evaluation grounded in local user experiences could help identify both system strengths and usability limitations, clarify stakeholders' needs, and inform practical improvements. To date, many existing studies in similar contexts have been limited to purely quantitative assessments or exploratory analyses, and relatively few investigations within medical universities have employed a convergent mixed-methods design that simultaneously quantifies usability and examines users' lived experiences.

Accordingly, the present study evaluates the usability of the Pazhuheshyar research management system at Hamadan University of Medical Sciences using a convergent mixed-methods approach. By integrating quantitative usability measurement with qualitative exploration of user experiences, the study seeks to provide a comprehensive understanding of system usability and to identify practical opportunities for improving user interaction and system performance.

The study addresses the following research questions:

1) What is the overall usability level of the Pazhuheshyar research management system?
2) Are there differences in perceived usability across user roles and gender?
3) What usability challenges and barriers do users encounter while interacting with the system?

Through the integration of quantitative and qualitative findings, this study aims to provide a deeper understanding of the system's usability strengths and limitations and to offer evidence-based recommendations for improving user experience and system efficiency.

2- Materials and Methods

This study employed a cross-sectional convergent mixed-methods design, in which the quantitative and qualitative components were conducted in parallel and subsequently integrated during the discussion and interpretation phase. The target population consisted of users of the university's Pazhuheshyar research management system, including faculty members and system officers (administrators/support staff), who had registered or followed at least one research activity or project in the system within the previous 12 months. Participants were eligible for inclusion if they (1) had an active user account in the system, (2) had experience using the system during the past 12 months, and (3) provided informed and voluntary consent to participate. Exclusion criteria were (1) incomplete completion of the questionnaire in the quantitative phase and (2) withdrawal during the qualitative interviews.

In both study components, a stratified sampling approach was used based on user roles (faculty/researcher, research officer, or system manager). Based on a prior estimation [15] with a standard deviation of 15.55 for the usability index and a target population of approximately 521 users, the required sample size for the quantitative phase was calculated to be 162 participants (415 faculties/researchers and 106 officers/managers). To account for potential non-response, the questionnaire was distributed to the entire eligible population (n = 521). For the qualitative phase, purposeful sampling was applied with maximum variation in user roles, faculties, and levels of digital literacy, and the process continued until data saturation was reached.

2-1- Instrument

To evaluate usability, the Web-Based Application Usability Evaluation Questionnaire was used. This instrument includes 50 Likert-scale items covering the main dimensions of effectiveness, efficiency, safety/error management, features/capabilities, and learnability/memorability. The total and subscale scores were calculated and normalized on a 0–100 scale, where higher scores indicate better usability [15]. The validity and reliability of this instrument have been confirmed in previous similar studies [15, 18]. For data collection in the quantitative phase, the original questionnaire text was directly converted into an online format, which was distributed via SMS Center services to the mobile phones of all target population members for completion. The internal consistency of the usability questionnaire was evaluated using Cronbach's alpha. The overall reliability coefficient obtained for the present sample was 0.82, indicating satisfactory internal consistency of the instrument.

In the qualitative phase, semi-structured interviews were conducted with 16 participants, whose characteristics are presented in Table 1. The interviews explored three main areas: (1) user experience and satisfaction, (2) problems and barriers, and (3) suggestions for improvement. Data collection continued until theoretical/data saturation was achieved. With the participants' consent, interviews were audio-recorded and transcribed verbatim. The data were analyzed using MAXQDA qualitative analysis software, through which initial codes and categories were extracted. To enhance the trustworthiness of the qualitative findings, several strategies were employed. Credibility was supported through careful transcription and repeated review of interview data. Coding and categorization were conducted independently by two researchers, and discrepancies were resolved through discussion until consensus was achieved. Data saturation was considered reached when no new themes emerged from subsequent interviews. These procedures helped strengthen the credibility and dependability of the qualitative analysis.

The integration of quantitative and qualitative findings provided complementary insights into the usability of the Pazhuheshyar system. While quantitative results identified the dimensions with the lowest usability scores, the qualitative data helped explain the underlying reasons behind these findings. This triangulation of evidence improved the interpretability of results and allowed a deeper understanding of users' interaction difficulties with the system.

2-2- Data Analysis

Descriptive statistics (mean, standard deviation, frequency, and percentage) and inferential analyses (independent t-test, $\alpha = 0.05$) were used to analyze the quantitative data. Reliability of the usability questionnaire was assessed using Cronbach's alpha, indicating acceptable internal consistency for the overall scale and its subscales. Prior to conducting parametric tests, assumptions of normality and homogeneity of variance were examined, and effect size measures were calculated to support a more meaningful interpretation of group differences. Qualitative data were analyzed using conventional content analysis based on the approach proposed by Graneheim and Lundman. The analysis involved identifying meaning units, generating initial codes, organizing subcategories, and developing broader categories and themes. Coding was performed independently by two researchers, and disagreements were resolved through discussion and consensus [19].

3- Results

3-1- Quantitative Findings

The participants in this study included 169 people, 76 (45%) were male and 93 (55%) were female in the quantitative section and 16 (6 males and 10 females) in the qualitative section. The demographic characteristics of the participants are shown in Table 1.

Table 1. Demographic Characteristics of Participants (Quantitative and Qualitative)

	Group/ Level	Quantitative (n = 169)	%	Qualitative (n = 16)	%
Gender	Male	76	45	6	37.5
	Female	93	55	10	62.5
Age	—	41.24 ± 8.81	—	40.22 ± 6.50	—
Position	Researcher	141	83	11	68.8
	administrative user	28	17	5	31.2

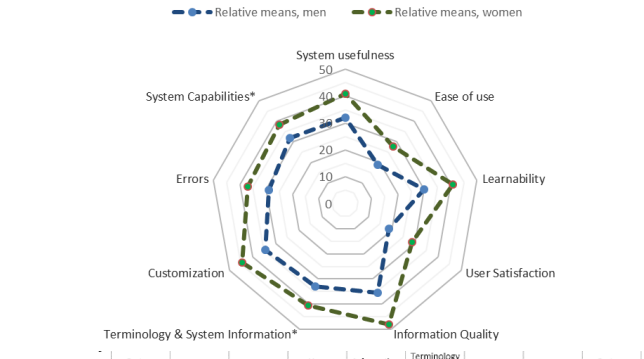
The preliminary results regarding the relative usability score are presented in Table 2. Considering the relative nature of each subscale, it was observed that most mean scores were approximately 34%, indicating a substantial deficiency in the level of usability reported by participants. The lowest mean score was related to ease of use (mean = 23.82), whereas the highest mean score (mean = 42.40) corresponded to content/output display on the screen.

Table. 2. Relative (0-100) usability scores and its subscales (n=169)

	Mean	SD
System usefulness	37.01	28.07
Ease of use	23.82	22.37
Learnability	35.97	24.89
User Satisfaction	24.47	24.93
Information (Content/Output) Quality	42.40	26.40
Terminology and System Information	37.20	25.61
Customization	39.94	26.28
Errors	33.28	23.96
System Capabilities	35.50	23.71
Relative Usability (overall)	33.19	22.59

Higher scores reflect better usability (0–100). Subscale and overall values are reported as corrected relative scores.

Figure 1 presents the differences in mean Relative Usability subscale scores between men and women. As shown, all subscales—except Terminology & System Information and System Capabilities—exhibit statistically significant differences, with women scoring higher on average than men.



	System usefulness	Ease of use	Learnability	User Satisfaction	Information Quality	Terminology & System Information*	Customization	Errors	System Capabilities*
Relative means, men	32.07	18.88	30.02	19.01	35.46	33.06	34.54	28.95	32.00
Relative means, women	41.04	27.85	40.83	28.92	48.06	40.59	44.35	36.83	38.36

Figure 1. Mean difference in relative usability and subscales between men and women. * Not significant difference (P>0.05)



	System usefulness	Ease of use	Learnability	User Satisfaction	Information Quality	Terminology & System Information*	Customization*	Errors*	System Capabilities
Relative means, reserchers	34.78	21.10	32.58	21.70	39.82	35.51	38.21	32.21	33.46
Relative means, admins	48.21	37.50	53.01	38.39	55.36	45.76	48.66	38.69	45.79

Figure 2. Mean difference in relative usability and subscales between researchers and admins. * Not significant difference (P>0.05)

Figure 2 shows the differences in mean scores across the nine usability subscales between researchers and system officers/managers. The results indicate statistically significant differences for all subscales except Terminology & System Information, Customization, and Errors. Across all subscales, the relative mean scores of officers/managers were higher than those of researchers.

3-2- Qualitative Findings

Based on sixteen interviews with system officers (administrators/support staff) and user researcher of the Pazhuheshyar system, Figure 3 summarizes five categories: (1) Interaction complexity; (2) technical/system issues; (3) support and training; (4) system strengths; and (5) Usability Improvements. Across interviews, usability difficulties were pervasive: cluttered menus, long and complex pathways for project registration, and highly similar options that led to user errors. For example, in the topic of Interaction complexity, interviewee number 5 stated, "Notification system: SMS, emails, and notifications that

are sometimes incomplete or unclickable". Confusion in the review workflow and lack of coordination across system modules were also repeatedly noted. Technically, participants reported login errors, unreliable saving of information, the need to clear the browser cache, and mismatches between research centers' processes and the system's forms—issues that consumed time and eroded trust. Reporting and search functions were frequently highlighted as especially problematic.

Regarding support and training, initial instruction was widely viewed as insufficient; many users learned the system through trial and error or frequent contact with support staff. While workshops and a ticketing system were said to alleviate some challenges, others emphasized weak support and reliance on individual experience. Users nonetheless identified strengths, notably documentation and archiving of research records (proposals, theses), notification/SMS features, and linkage to ministry-level macro systems. Suggested improvements converged on streamlining workflows and removing nonessential options, adding dashboard personalization, redesigning search, strengthening notifications/alerts, creating an integrated researcher database, and developing a dedicated version. Overall, while documentation and national integration are valued, persistent usability, technical, and training gaps indicate a need for user-centered redesign.

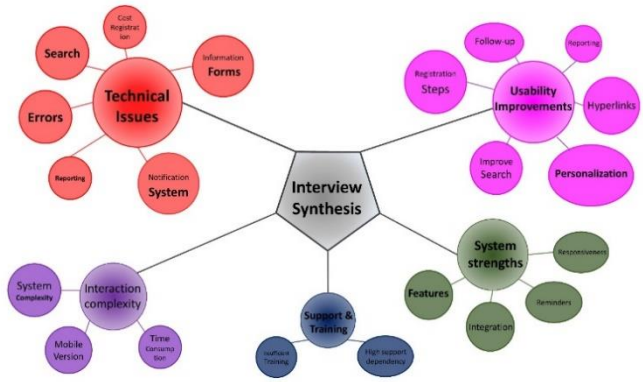


Figure 3. Challenges and solutions for improving system usability

3-3- Integration and Comparison of Quantitative and Qualitative Findings

A synthesis of the quantitative and qualitative results reveals a coherent pattern across both components. Both lines of evidence highlight major weaknesses in Ease of Use, Learnability, and Error Management, indicating that users' practical challenges—such as complex navigation and recurrent system errors—directly mirror the lowest-scoring dimensions identified in the quantitative data. At the same time, convergence was observed in the system's strengths: both datasets underscored positive perceptions of Content and Output Quality, particularly regarding documentation, data integration, and notification features. This consistency suggests that while the system provides valuable informational functions, its interface design and interaction flow remain key obstacles to efficient use. Group-level patterns were also aligned, with officers and managers—who had greater exposure and training—reporting higher usability than researchers, who expressed more difficulty and dependence on trial-and-error use.

In summary, the merged interpretation indicates that the system's usability limitations are primarily rooted in design and interaction issues rather than information content. Implementing user-centered redesign, enhanced feedback mechanisms, and structured training is therefore essential to improving overall usability and user satisfaction.

4- Conclusions

From a usability perspective, the low scores observed for ease of use and learnability suggest challenges related to interface complexity, workflow structure, and elevated cognitive load. Complex navigation paths, layered menus, and limited system feedback likely increase users' mental workload and reduce interaction efficiency—an interpretation consistent with human–computer interaction principles linking unclear navigation and insufficient feedback to lower perceived usability and higher cognitive demand.

In the quantitative phase, 169 users (76 men and 93 women) evaluated the Pazhuheshyar system on a 0–100 scale, yielding an overall mean of approximately 33, indicative of low-to-moderate usability. Ease of Use received the lowest score (23.82%), whereas Content/Output Quality scored highest (42.4%). Women generally reported higher usability scores than men, and officers/managers outperformed researchers across most dimensions. The qualitative analysis of 16 interviews further contextualized these findings, revealing five main categories: (1) complex navigation structures; (2) system and storage errors; (3) inadequate training and support; (4) strengths in documentation and data integration; and (5) suggested improvements, including workflow simplification, enhanced search functionality, and greater interface personalization.

Weaknesses in ease of use and learnability alongside comparatively better information output align with prior reports and a closely related study of research systems; many evaluations find stronger performance in documentation and data integration, but overall usability suffers due to complex navigation, inconsistent terminology, and high memory load [6]. Differences favoring system

administrators over researchers have been attributed in the literature to greater procedural familiarity, access to specific pathways, and more targeted training—an interpretation consistent with the present findings [11, 13]. Moreover, the documented link between lower usability and greater mental workload/time loss corresponds with our qualitative themes of navigational confusion and recurrent errors [4, 9]. Our results also accord with Kazemi et al. [14] on the research management system at Shiraz University of Medical Sciences, where usability scores for submission, review, and monitoring were below 50, with negative correlations between usability and "mental effort" and "errors"—i.e., as usability decreases, mental effort and errors increase.

The convergence of quantitative and qualitative evidence yields a coherent picture: low Ease of Use and Learnability in the metrics mirrors qualitative reports of long pathways, crowded menus, similar options, and reliance on trial-and-error to learn the system. Conversely, the relatively better Content/Output Quality aligns with reported strengths in documentation, archiving, notifications, and linkage to national platforms. Role differences favoring officers/managers can largely be explained by more targeted training/support and more frequent use patterns, while researchers' complaints about difficult search/reporting clarify their lower scores. Finally, gender differences favoring women (at least descriptively) may reflect usage patterns or sample composition and warrant controlled analyses in future research [5, 16, 20].

To improve Pazhuheshyar usability, we propose an integrated strategy starting with task-oriented redesign: reduce process steps, remove low-utility options, and organize workflows around frequent scenarios (registration, revision, review) to lower cognitive load. In parallel, strengthen error management and feedback so messages are informative/actionable and undo/cancel is available. Enhance information retrieval by redesigning the search page, adding filters, and offering predefined report templates [21, 22]. To accommodate diverse needs, provide useful, customizable dashboards for researchers and officers/managers, supported by structured training and support (in-system micro learning modules, step-by-step guides, and an integrated ticketing system). Ongoing UX (user experience) monitoring via remote measurement and behavioral indicators (task time, completion rate, error rate) with iterative improvement cycles should sustain quality; attention to accessibility and a mobile version for light tasks/follow-ups can broaden effective use. Key limitations include the cross-sectional design, reliance on self-report in the quantitative tool, and absence of behavioral measures alongside the questionnaire, which affect generalizability. Future phases should incorporate task-based usability testing, process data, and multivariable analyses to control for confounders.

This study indicates that although the Pazhuheshyar system provides important strengths in documentation and data integration, it faces persistent challenges in user experience, technical performance, and user training. Low scores in ease of use and learnability, recurring system and saving errors, and inconsistencies across forms and workflows appear to reduce efficiency and contribute to user dissatisfaction. The lack of structured training further exacerbates these issues, leaving many users dependent on trial-and-error or informal support. Addressing these challenges requires a user-centered redesign of the system. Key priorities include aligning the interaction architecture with user needs, simplifying workflows, improving search and reporting functions, and resolving technical errors. In parallel, clear guidelines, structured training programs, and an integrated support system are needed to strengthen user competence and system acceptance. Additional improvements—such as dashboard personalization and a mobile interface for lightweight tasks—could further accommodate diverse user roles and working contexts. Overall, the effectiveness of research management systems depends not only on technical functionality but also on their alignment with users' needs and interaction patterns. Accordingly, the proposed improvement roadmap emphasizes user-centered redesign, continuous monitoring of user experience, and phased implementation of usability enhancements to support sustainable improvements at institutional and national levels.

Competitive Interests

The authors declare no conflicts of interest related to the subject matter of this research or its findings.

Ethics Approval

The study protocol was approved by the Ethics Committee of Hamadan University of Medical Sciences (IR.UMSHA.REC.1404.348). Informed consent, confidentiality, and the right to withdraw at any time were observed. Data were reported in aggregate and without identifying information.

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