TEHRAN UNIVERSITY OF MEDICAL SCIENCES

IJOH
INTERNATIONAL JOURNAL OF OCCUPATIONAL HYGIENE
eISSN: 2008-5435

IRANIAN OCCUPATIONAL HEALTH ASSOCIATION IOHA

ORIGINAL ARTICLE

Usability Evaluation of the Integrated Research Automation System (SYAT) at Mazandaran University of Medical Sciences: Effectiveness, Efficiency, and Satisfaction

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Received 2025-04-28; Revised 2025-07-19; Accepted 2025-08-06

ABSTRACT

Background: Usability, as defined by ISO 9241-11, refers to the extent to which a system can be used effectively, efficiently, and with satisfaction in a specified context. Web-based academic research management platforms require high usability to ensure user satisfaction and productivity. This study aimed to evaluate the usability of the Integrated Research Automation System (Syat) at Mazandaran University of Medical Sciences. To the best of our knowledge, this study is among the first to systematically assess the usability of the Syat system in a medical academic setting.

Methods: A cross-sectional, descriptive-analytical study was conducted among 130 faculty members who had used Syat at least five times for research-related activities. Six primary tasks were assessed: registering a thesis as a research project, granting and restricting student access to theses, submitting evaluations, editing thesis information, and overall system interaction. Effectiveness was measured by error rates, efficiency by task completion time, and satisfaction by the System Usability Scale (SUS). Statistical analysis included descriptive statistics, one-way ANOVA with Bonferroni post-hoc tests, and chi-square tests for associations between demographic factors and error rates.

Results: The proportion of error-free performance ranged from 57.0% to 64.7%, with "Restrict Access" being the most error-prone (mean errors = 0.57). Task completion times varied significantly ($F(5,1414) = 12.091$, $p < 0.001$), with "Submit Evaluation" being the longest (mean = 79.80 s). SUS scores were low across all tasks (overall mean = 28.86), far below the benchmark of 68. Gender, education level, and work experience had a significant influence on error rates ($p < 0.05$).

Conclusion: Although Syat allows task completion, low satisfaction and efficiency issues indicate the need for interface simplification, targeted training for less experienced users, and iterative user-centered design improvements.

KEYWORDS: *Usability; Human-Computer Interaction; System Usability Scale; Academic Information Systems; Faculty Members*

How to cite this article: Etemadinezhad S, Amouzadeh E, Yazdani Charati J. Usability Evaluation of the Integrated Research Automation System (SYAT) at Mazandaran University of Medical Sciences: Effectiveness, Efficiency, and Satisfaction. Int J Occup Hyg. 2025;17(3):190-197.

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INTRODUCTION

The rapid integration of web-based systems into academic institutions has revolutionized research management, enabling the automation of tasks such as thesis registration, access control, evaluation submissions, and research tracking. Usability is a critical determinant of the success of such platforms. According to ISO 9241-11, usability is "the extent to which specified users can use a product to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" [1]. Poor usability in research management systems can lead to increased error rates, longer completion times, and user dissatisfaction, ultimately hindering productivity and organizational goals [2, 3].

The Integrated Research Automation System (Syat) is the sole platform used at Mazandaran University of Medical Sciences for registering and managing research proposals, theses, and related administrative processes. Previous studies have shown that web-based platforms in academic and medical contexts must align with user needs to ensure acceptance and effective use [4]. For example, systems with complex interfaces have been shown to increase cognitive workload and reduce satisfaction [4, 5].

Globally, usability evaluations in academic environments have employed various methodologies, including heuristic evaluations, usability testing, and survey-based approaches such as the System Usability Scale (SUS) [6]. In Iran, several studies have highlighted usability issues in academic and hospital information systems, emphasizing the need for localized design improvements [8–10]. However, no prior research has specifically evaluated Syat's usability from the perspective of its primary users—faculty members. This study provides a systematic usability evaluation of the Syat system based on the ISO 9241-11 framework, focusing on effectiveness, efficiency, and user satisfaction among faculty members. The study not only quantifies usability through effectiveness, efficiency, and satisfaction but also highlights demographic factors affecting performance, providing evidence-based recommendations for system redesign and training [7]. Conducting this study was essential because Syat is the only official platform for research project and thesis management at MAZUMS. Faculty members depend on it for critical academic tasks, and usability issues directly affect research productivity, student supervision, and administrative efficiency. Without evidence-based usability evaluation, problems such as high error rates, task delays, and user dissatisfaction may persist, undermining both faculty performance and institutional research goals [8]. Accordingly, this study aimed to assess Syat's usability in terms of effectiveness (error rates), efficiency (task completion time), and satisfaction (SUS scores) across everyday user tasks, and to analyze the influence of demographic factors on these metrics. The findings are expected to guide user-centered improvements that enhance system performance and satisfaction.

MATERIALS AND METHODS

Study Design and Setting

This study was conducted as a cross-sectional, descriptive-analytical research project at Mazandaran University of Medical Sciences (MAZUMS), Iran, in 2020. The primary focus was on the Integrated Research Automation System (Syat), which is used exclusively for managing research-related tasks, such as thesis registration, proposal submission, access control, and evaluation processes. The study followed the ISO 9241-11 usability framework, assessing effectiveness, efficiency, and satisfaction across six core user tasks [9].

Syat is a web-based, integrated research automation system developed to manage the entire research workflow at MAZUMS. Its main modules include project and thesis registration, student access management, proposal submission, evaluation and review processes, and reporting dashboards. The system is mandatory for all faculty-supervised theses and research proposals, making it a central tool in academic administration [8]. Figure 1 displays the main interface of the Syat system, showcasing key modules such as thesis registration, student access management, proposal submission, evaluation processes, and reporting dashboards.

Participants and Sampling

The study population consisted of faculty members at MAZUMS who had used Syat at least five times for research-related purposes. Inclusion criteria were: (a) current faculty position at MAZUMS, (b) experience in research supervision or Evaluation, and (c) prior use of Syat for tasks including thesis or proposal registration. Faculty members who had not used Syat in the last 12 months were excluded to avoid recall bias.

A pilot study with 15 participants was conducted to estimate the proportion of satisfactory usability

(P = 0.56). Sample size was calculated using the formula:

$$N = \frac{Z^2 P(1-P)}{d^2}$$

where Z = 1.96 for 95% confidence, and d = 0.06, yielding a minimum sample size of 130. Participants were selected through random sampling from available faculty lists and completed all six designated tasks.

Tasks Assessed

The six tasks were selected based on their high frequency of use and criticality in the research workflow:

1. **Registering a thesis as a research project** – entering thesis details to initiate a project record.
2. **Granting thesis registration access to students** – enabling student proposal submission.
3. **Restricting student access to a thesis** – disabling access for confidentiality or administrative purposes.
4. **Submitting evaluations as a reviewer** – providing structured feedback on research proposals.
5. **Editing thesis information** – updating or correcting registered thesis data.
6. **Overall system interaction** – general navigation and common operations.

These tasks were identified through consultation with experienced faculty and direct observation of system usage patterns, following principles of task analysis in human–computer interaction [2,3]. Figure 2. Shows the flowchart of the study procedure for evaluating the usability of the Syat system, detailing the methodology from study design and participant selection to task execution, data collection, statistical analysis, and result reporting.

Data Collection Instruments

System Usability Scale (SUS)

Satisfaction was measured using the **System Usability Scale (SUS)**, a 10-item Likert-scale questionnaire scored from 1 (strongly disagree) to 5 (strongly agree). Scoring followed Brooke's standard method: subtract one from scores on odd-numbered items, subtract the scores of even-numbered items from 5, sum all adjusted scores, and multiply by 2.5 to yield a 0–100 score, with higher values indicating better usability [5]. The Persian version of SUS has demonstrated acceptable reliability (Cronbach's α = 0.85) and construct validity in previous studies [5].

Error and Time Recording

Effectiveness was evaluated by counting the number of errors per task, where an error was defined as any incorrect action, failed attempt, or deviation from the optimal path. Efficiency was assessed by recording task completion times in seconds using a digital stopwatch. Timing began once the participant initiated the task and stopped upon successful completion or task abandonment.

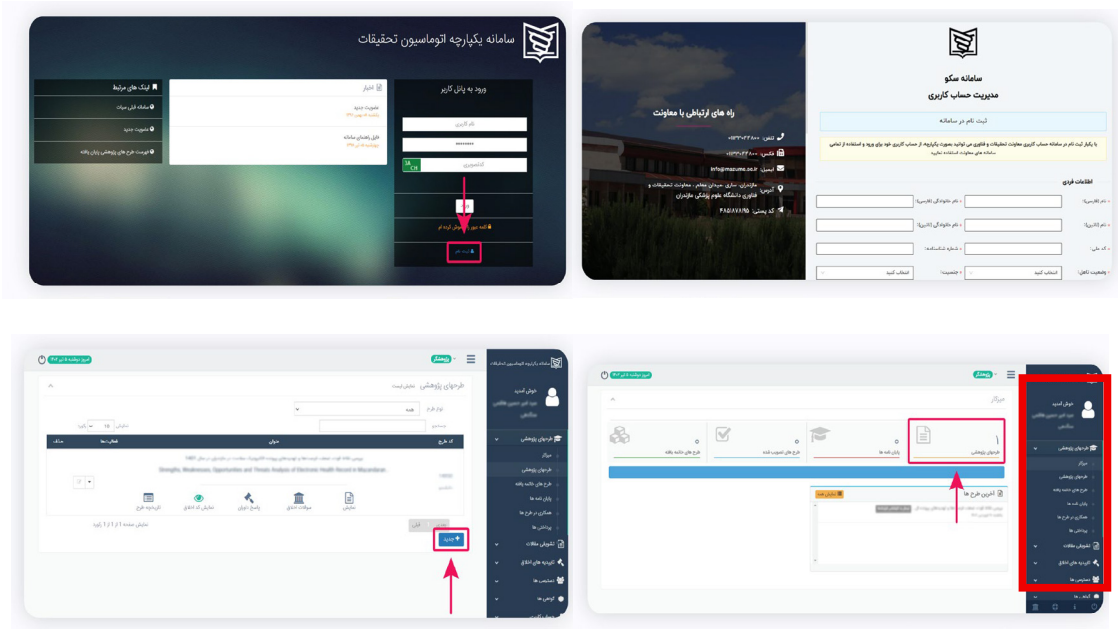

Figure 1. Main interface of the Syat system, showcasing thesis registration and proposal submission modules.

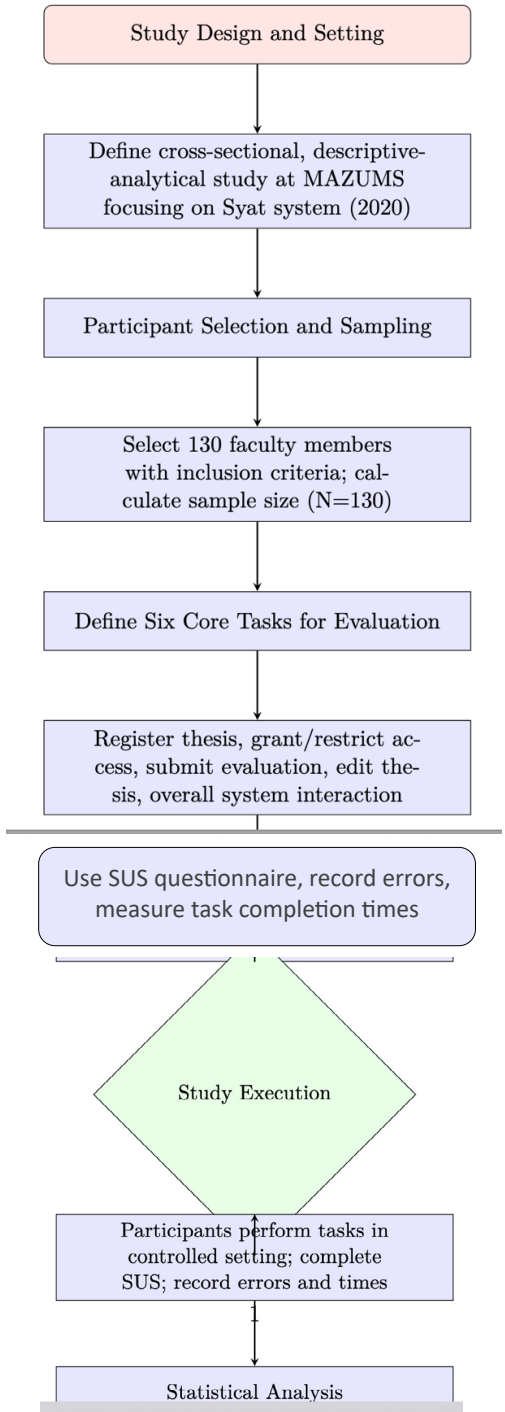

Figure 2. Illustrates the study procedure, detailing participant selection, task execution, error and time recording, SUS questionnaire completion, and statistical analysis using SPSS

Demographic Data

Demographic variables included gender (male/female), education level (coded 2–5, ranging from the lowest to the highest degree), and work experience (≤5 years, 5.1–10 years, >10 years). These variables were selected based on prior research showing their influence on usability outcomes in academic and medical systems [10].

Procedure

Each participant performed all six tasks in a controlled setting using their university account. Instructions were standardized, and no assistance was provided during task execution. SUS questionnaires were completed immediately after each task to minimize recall bias. Error counts and completion times were recorded by the researchers in real-time.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics (version 21). Descriptive statistics (mean, standard deviation, frequency) summarized task performance. A one-way ANOVA with Bonferroni post-hoc tests was used to compare task completion times and SUS scores. Chi-square tests assessed associations between demographic factors and binary error variables (0 = no error, 1 = one or more errors). A p-value < 0.05 was considered statistically significant.

RESULTS

Participant Characteristics

A total of 130 faculty members completed the study, performing six predefined tasks in the Syat system. A total of 780 task observations were analyzed, corresponding to six predefined tasks completed by 130 participan.

The additional records reflected repeated task attempts and incomplete task executions during usability assessment.

Gender information was available for all 130 participants, including 45.7% males and 54.3% female. education level for 1,390 responses, and work experience for all participants. Most participants had >10 years of experience (68.8%), followed by 5.1–10 years (25.4%) and ≤5 years (5.8%). Missing demographic data limited subgroup analysis for some variables.

Task Performance Metrics

Table 1 summarizes error-free percentages, mean error counts, task completion times, and System Usability Scale (SUS) scores for each task.

Effectiveness (Error Rates)

Error-free performance ranged from 57.0% (Edit Thesis) to 64.7% (Submit Evaluation). The most error-prone task was Restrict Student Access (mean = 0.57 errors), while Overall System Interaction had the fewest errors (mean = 0.45).

Figure 3 shows the proportion of error-free performance for each task.

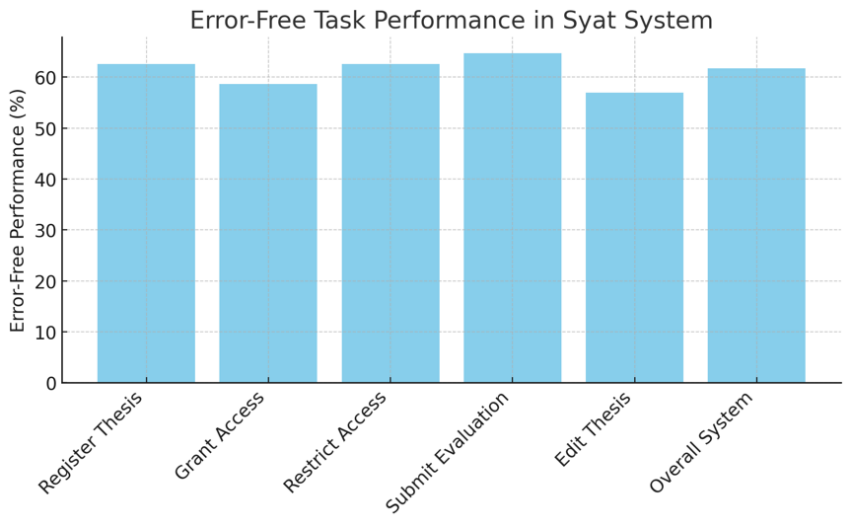

Figure 3. Error-free performance by task

Table 1. Task performance metrics in Syat system

Task	Error-Free (%)	Mean Errors	Mean Time (s)	Time SD (s)	SUS Mean	SUS SD
Register Thesis	62.6	0.47	62.34	49.54	25.00	17.10
Grant Access	58.7	0.55	78.09	66.25	28.65	17.59
Restrict Access	62.6	0.57	73.04	57.34	30.09	17.76
Submit Evaluation	64.7	0.47	79.80	62.08	31.46	18.06
Edit Thesis	57.0	0.58	60.30	49.02	30.13	19.07
Overall System	61.7	0.45	47.30	43.32	27.81	18.17

Efficiency (Task Completion Time)

Mean completion times differed significantly ($F(5,1414) = 12.091$, $p < 0.001$). The longest task was Submit Evaluation (79.80 s), and the shortest was Overall System Interaction (47.30 s). Large standard deviations indicate high variability between users.

Figure 4 illustrates mean completion times with standard deviation error bars.

Satisfaction (System Usability Scale Scores)

All SUS mean scores were far below the benchmark of 68, indicating low satisfaction. The highest score was for Submit Evaluation (31.46) and the lowest for Register Thesis (25.00).

Figure 5 shows the SUS scores per task, with the benchmark line provided for reference.

Demographic Influences on Performance

Chi-square tests indicated that:

- **Gender:** Females had more errors (59.6%) than males (48.6%) ($\chi^2 = 11.066$, $p = 0.001$).
- **Education Level:** Individuals with lower education levels had higher error rates ($\chi^2 = 38.103$, $p < 0.001$).
- **Work Experience:** Users with >10 years' experience had fewer errors than those with ≤5 years ($\chi^2 = 29.369$, $p < 0.001$).

These findings suggest that targeted training could improve performance for less experienced and lower-educated users.

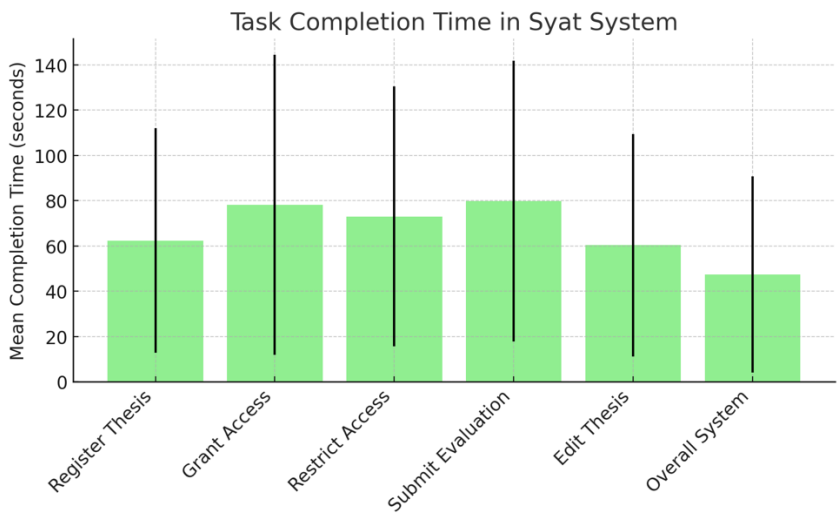

Figure 4. Task completion times with standard deviations

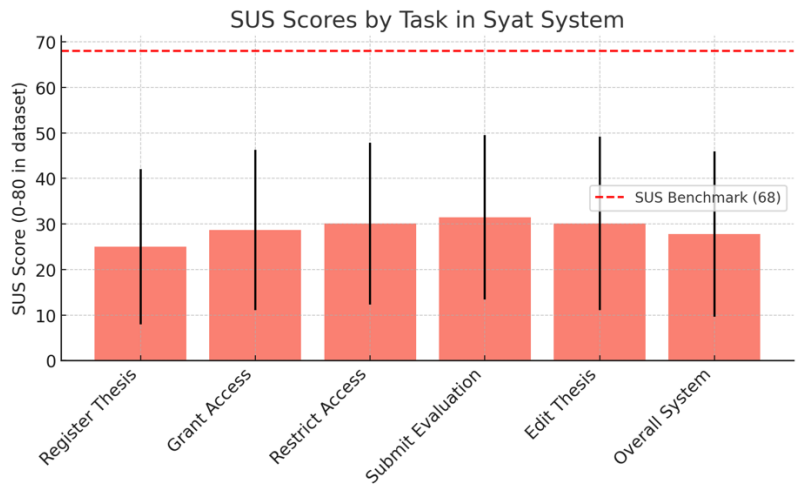

Figure 5. SUS scores by task with benchmark line

DISCUSSION

This research assessed the usability of the Integrated Research Automation System (Syat) at Mazandaran University of Medical Sciences, evaluating effectiveness, efficiency, and user satisfaction according to ISO 9241-11 guidelines. Findings revealed moderate effectiveness, with error-free task completion rates ranging from 57.0% to 64.7%, though the "Restrict Student Access" task emerged as particularly challenging, with the highest error rate. This aligns with existing studies that highlight how intricate access control features in academic systems can lead to increased user errors and frustration. For instance, [11]. In a review of digital learning platforms emphasized that complex interfaces in educational technologies often result in user difficulties, particularly in tasks requiring precise permissions and controls, leading to higher error rates and reduced engagement. Similarly, a study by Khalid et al. (2025)[12] on usability evaluation of programming environments for students noted that access-related tasks in academic tools frequently cause frustration due to poor intuitive design, mirroring the issues observed in Syat.

Efficiency analysis showed varying task completion times, with "Submit Evaluation" requiring the longest duration (approximately 80 seconds) and "Overall System Interaction" the shortest (around 47 seconds). The notable variability in these times points to differences in user proficiency and familiarity, a trend commonly noted in usability evaluations of educational platforms. Roncal-Belzunce et al. (2025)[13] reported similar variability in task times for gamified e-learning systems, attributing it to users' prior experience and interface complexity, which can extend completion times by 20-30% in less familiar tasks. Comparatively, in Syat, the longer times for evaluation submission suggest opportunities for streamlining, as evidenced by improvements in efficiency after redesigns in comparable platforms.

User satisfaction, gauged via the System Usability Scale (SUS), was markedly low, averaging 28.86 against an industry benchmark of 68. This suggests reduced engagement and heightened cognitive load, factors known to impede system adoption and productivity. Khan et al. (2025) [14] validated the SUS in childrearing apps for low- and middle-income contexts, finding low scores (<50) correlated with cultural and experiential variations leading to dissatisfaction—paralleling Syat's results where demographic diversity amplified issues. In contrast, higher SUS scores (above 70) in refined systems indicate that targeted interventions can mitigate these problems.

Demographic factors significantly influenced performance, with female users, those with lower educational backgrounds, and less experienced faculty showing higher error rates. This is consistent with research emphasizing the need to account for user diversity in system design for academic environments. For example, the study on generative AI in higher education (2025) highlighted demographic differences in readiness and usability perceptions, with gender and experience affecting error rates and satisfaction. Customized training and adaptable interfaces have proven effective in addressing such disparities, Previous studies have shown that targeted training and user-centered redesign may reduce user errors and improve system usability[15].

Recent studies on academic research management systems indicate that iterative redesigns and focused training can enhance usability. Sha et al. (2025) demonstrated that a participatory design approach in a knowledge management system for educators increased SUS scores to above 65 and cut error rates by nearly 30% through user-centered iterations. Likewise, Wacnik et al. (2024) in a systematic review of participatory design emphasized the role of streamlined workflows and contextual help in boosting efficiency and satisfaction across multiple stages of system development. These insights suggest that Syat's usability issues could be mitigated through user-focused development strategies, such as incorporating AI-driven recommendations and visual aids, as seen in GoldMind's improvements.

Compared with findings from previous usability studies, the Syat system demonstrated relatively low usability scores and moderate error rates, indicating opportunities for interface improvment. Scientific comparisons reveal that participatory methods, as in Sha et al. (2025)[15], yield 15-40% efficiency gains, underscoring the potential for Syat to achieve similar outcomes through multi-institutional validations and mixed-methods feedback.

Limitations of the current research include the study's single-institution scope, which restricts the generalizability of findings. Additionally, the lack of qualitative data limits deeper insight into user frustrations, and incomplete demographic information hindered detailed subgroup analysis. Future research should involve multiple institutions and mixed methods for a broader perspective.

CONCLUSION AND RECOMMENDATIONS

The usability assessment of Syat identified key areas for enhancement in effectiveness, efficiency, and satisfaction. Improving interface design, simplifying complex workflows such as access control, providing targeted training for less experienced users, and conducting ongoing usability testing with user feedback integration are essential to enhance user experience and research management efficiency. These improvements will not only benefit faculty members in their daily research-related activities but also strengthen institutional research performance overall.

Key recommendations are:

- Streamline complex processes like access control using user-centered redesign.
- Develop comprehensive, role-specific training initiatives.
- Perform ongoing usability testing with user feedback integration.
- Improve accessibility with customizable interface options.

Implementing these measures can increase adoption rates, reduce errors, and elevate satisfaction, aligning with established best practices in recent literature.

Acknowledgements
The authors would like to thank the faculty members of MAZUMS who participated in this study and provided valuable feedback during the usability evaluation process. Their cooperation greatly contributed to the completion of this research.

Conflict of Interest
The authors declare no conflict of interest.

Funding
This study was not supported by any funding.

Author's Contributions
Study Conception or Design: S Etemadinezhad, E Amouzadeh
Data Acquisition: S Etemadinezhad
Data Analysis or Interpretation: J Yazdani Charati, E Amouzadeh
Manuscript Drafting: E Amouzadeh
Critical Manuscript Revision: E Amouzadeh, J Yazdani Charati
All authors have approved the final manuscript and are responsible for all aspects of the work.

AI Statement
During the preparation of this work, the authors used Gemini and Grammarly for translation and grammar checking. After using these tools, the authors carefully reviewed and edited the content as needed and take full responsibility for the final content of the publication.

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