Perbanas International Conference on Economics, Business, Management, Accounting and IT (PROFICIENT) 2026
"Integrity-Driven Innovation: Reimagining Business, Finance, and Digital Transformation for Sustainable Impact"

Proceedings of the Perbanas International Seminar on Economics, Business, Management, Accounting and IT
[June 2026] [ISSN 3047-0951]

Academic Portal-Based Classroom Management System to Resolve Scheduling Conflicts and Optimize Campus Sustainability

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Abstract. *In higher education facility management, classroom scheduling conflicts remain a pervasive issue that significantly disrupts the learning process and causes unnecessary delays. This condition typically arises when two or more classes are inadvertently scheduled in the same room without adequate coordination and real-time validation. Currently, existing campus academic systems generally only display static individual schedules without live integration regarding the physical room's actual occupancy status. To address this operational gap, this study aims to design and develop a comprehensive Classroom Management System integrated directly with the campus academic portal. The novelty of this research lies in the implementation of an active, real-time digital First Come, First Served (FCFS) validation mechanism equipped with a direct alternative-room routing feature. This action automatically triggers instant conflict notifications (via a red pop-up UI) to all other affected parties and proactively provides available alternative room recommendations. This approach not only prevents double-booking but also promotes sustainable campus management by optimizing physical resource utilization and reducing wasted operational energy. An initial prototype was evaluated using a usability questionnaire distributed to target users. The empirical evaluation results, measured on a standard 1-5 Likert scale, revealed that users found the application "too complicated" (average score 3.33) and "less practical" (3.25). Furthermore, the system scored very low on the "easy to use" metric (1.75). The study concludes that while the system's backend architecture successfully handles conflict resolution autonomously and supports sustainable IT solutions, the user interface (UI) and user experience (UX) require a substantial redesign such as adding shortcut buttons within the conflict pop-up to lower the cognitive load and ensure practical usability for the academic community.*

Keywords: Classroom Management, Academic Portal, Schedule Conflict, Sustainable IT Solutions, Usability Testing.

INTRODUCTION

In the management of classroom facilities within a university environment, scheduling conflicts are a pervasive issue. This problem emerges when two or more courses are inadvertently scheduled to use the same room simultaneously without proper cross-departmental coordination (Simangunsong et al., 2025). Consequently, lecturers and students arrive at a designated classroom only to find it already occupied by another class, which leads to widespread confusion, significant time wastage, and major disruptions to the

educational process (Latifah et al., 2022). Furthermore, inefficient space management leads to poor utilization of campus resources, such as electricity and air conditioning in unmonitored empty rooms, which contradicts the principles of sustainable campus development.

The core of the problem lies in the limitations of current digital infrastructure. Existing academic portals typically only present static, individual course schedules without real-time integration regarding actual room usage (Putro et al., 2022). Students and lecturers receive no immediate notification if a room listed on their schedule is actively being used by another party. For instance, a common real-world scenario involves Student A having a scheduled class in Room 002 from 10:30 to 12:30, while Student B and their class arrive earlier and occupy the room, completely unaware of Student A's overlapping schedule (Simangunsong et al., 2025). Similar issues in corporate and academic environments have shown that manual records are highly prone to data duplication and lack real-time synchronization (Syahrial et al., 2022).

To overcome these challenges, it is necessary to develop a comprehensive Classroom Management System integrated directly into the academic application. **The novelty of this research** is the development of an active, real-time validation system utilizing a digital First Come, First Served (FCFS) mechanism that not only detects conflicts but actively prevents errors through immediate visual interventions (e.g., red warning pop-ups) and autonomous routing to alternative empty rooms. The primary objectives of this IT solution are to provide a platform for real-time digital validation, help users efficiently find available alternative rooms, and optimize the sustainable utilization of physical campus facilities (Latifah et al., 2022).

LITERATURE REVIEW

The transition from manual administrative tasks to digital management in educational institutions has been widely researched (Putro et al., 2022). Conventional scheduling often relies on manual confirmation from building staff or the usage of physical paper forms, causing delays and unstructured negotiations (Simangunsong et al., 2025). Modern software engineering practices advocate for integrated systems that define specific boundaries and access rights among different stakeholders (Latifah et al., 2022). Incorporating User-Centered Design (UCD) principles and Lean UX concepts ensures that the interface heavily considers the user's cognitive load, resulting in significantly better effectiveness, efficiency, and satisfaction levels across the system (Konda et al., 2022; Malik & Frimadani, 2022).

In designing this system, requirements engineering plays a critical role in modeling how the system responds to environmental triggers. The system operates on an automated conflict detection logic (Simangunsong et al., 2025). When the first user validates their entry into a room via the academic portal, the room's status immediately updates. The system then proactively scans the database; if it detects that the room was also scheduled for another class during that time frame, it automatically distributes a conflict notification to all affected users (Syahrial et al., 2022). The success of such a complex system heavily depends not only on its backend logic but also on its usability. If the interface is too complex, the intended efficiency gains are lost, making rigorous usability testing a crucial phase of the development lifecycle (Mambu et al., 2024).

METHODS

The research methodology is based on the analysis of system requirements and the subsequent evaluation of an initial prototype (Latifah et al., 2022), utilizing a User-Centered Design (UCD) framework

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structured around five primary parameters: (1) Literature Study **and Interaction Modeling using Use Case and Activity Diagrams**, (2) Usability Testing, (3) Analysis of Usability Testing Results, (4) Application Interface Redesign, and (5) Final Design Evaluation by the users (Konda et al., 2022). The system's context was analyzed using a 5W+1H approach to determine the exact needs of the users during active lecture days. We identified several key stakeholders with varying levels of involvement, including Students (primary users), Lecturers (primary users), Academic Admins (full access managers), Heads of Study Programs, and Facility Management Staff (Simangunsong et al., 2025). The complete stakeholder mapping is detailed in TABLE 1.

TABLE 1. Stakeholder Identification and Involvement Levels

Stakeholder	Role / Core Interest	Involvement
Students	Primary users: view schedules, receive conflict notifications, and search for alternative rooms.	High
Lecturers	Instructors who validate room usage and receive notifications if their room is double-booked.	High
Academic Admins	Manage schedule, room, and course data; possess full access to resolve scheduling conflicts.	High
Heads of Study Program	Monitor room usage to ensure no schedule overlaps between different study programs.	Medium
Facility Management	Provide and maintain physical rooms; receive information regarding room usage status.	Medium
E-Learning Dev Team	Build and maintain the classroom management module integration on the e-learning platform.	High

To ensure the system addresses real user problems, two primary personas were formulated (Simangsunsong et al., 2025):

1. Aldi Pratama (Student): Needs accurate room information and real-time notifications to avoid arriving at already occupied rooms.
2. Dr. Sari Wulandari, M.Kom. (Lecturer): Needs a system to quickly validate room usage to prevent losing teaching time due to manual room negotiations.

Following the initial system modeling, the interaction flow was mapped using Use Case and Activity Diagrams, defining critical functional requirements such as "Automated Conflict Detection" and "Search for Empty Classrooms" (Putro et al., 2022). Following the prototype development, a usability evaluation was conducted using a questionnaire tailored to assess Human-Computer Interaction (HCI) parameters. The responses were measured on a Likert scale ranging from 1 to 5 (Firjatullah, 2025), serving a similar function to the System Usability Scale (SUS) approach to identify specific usability pain points and user perceptions (Malik & Frimadani, 2022). The average scores were calculated using the standard mean formula:

$$\boldsymbol{P} = \frac{(\sum \boldsymbol{X_i})}{\boldsymbol{n}}$$

Where:

- P= average score
- $\sum X_i$= total score from all respondents for a specific indicator

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- n= total number of respondents

RESULTS AND DISCUSSION

Conflict Resolution Workflow and UI/UX Novelty The core computational logic of the proposed system is based on an automated conflict detection algorithm operating on a First Come, First Served (FCFS) principle (Simangunsong et al., 2025). In a simulated scenario where Class A and Class B are inadvertently scheduled in the same room, the system executes a resolution flow: When users from Class B arrive earlier and validate their room usage via the academic portal, the system updates the database and immediately detects the scheduling overlap with Class A (Simangunsong et al., 2025).

To enforce Error Prevention in the UI/UX design, if a user from Class A subsequently attempts to press the "Yes, Use Room" button, the system autonomously triggers a bold red warning pop-up. Psychologically, this red indicator acts as a strict visual interruption, providing real-time Visibility of System Status and making the user aware that the room has been claimed by another party. Subsequently, Class A users utilize the system's filtering feature to search the database for alternative classrooms that are not marked as 'in use', effectively mitigating the conflict without manual administrative intervention and optimizing sustainable space utilization (Syahrial et al., 2022).

System Usability Evaluation Following the prototype implementation, a comprehensive usability evaluation was conducted to measure user acceptance and interface effectiveness. To ensure a balanced evaluation, the 10-item questionnaire was designed using a mix of positive and negative usability indicators (Firjatullah, 2025). The categorization of these indicators is detailed in **TABLE 2**.

TABLE 2. Categorization of Usability Evaluation Metrics

Category	Evaluation Indicator (1-5 Scale)	Measurement Goal
Positive Metrics	Often used, Easy to use, Features work well, Quick to understand, Self-confidence.	Measures user satisfaction, system reliability, and general learnability (Firjatullah, 2025; Malik & Frimadani, 2022).
Negative Metrics	Too complicated, Need assistance, Lack of consistency, Less practical, Need to study first.	Measures interface complexity, cognitive load, and workflow inefficiency (Konda et al., 2022; Mambu et al., 2024).

The calculated average scores from this distributed questionnaire are visually represented in **FIGURE 1.**

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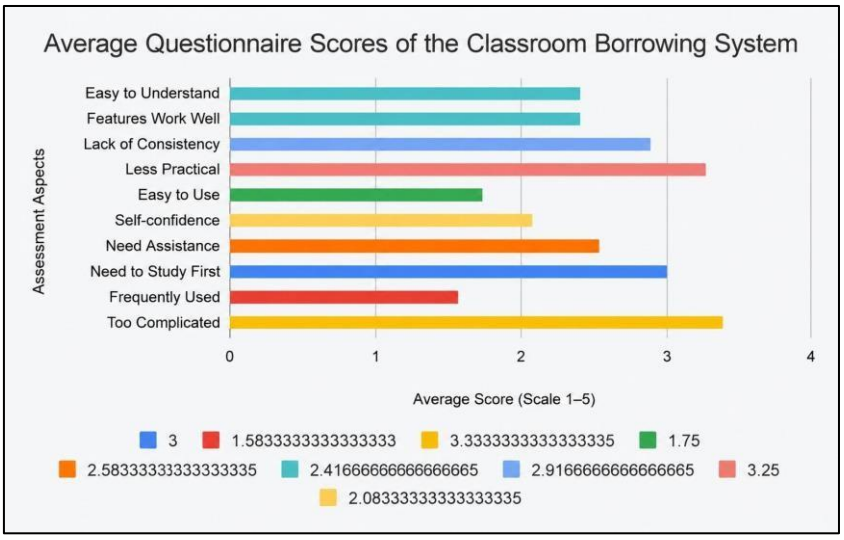

FIGURE 1. Average Questionnaire Scores of the Classroom Management System

As illustrated in **FIGURE 1**, the evaluation reveals critical insights into the system's current Human-Computer Interaction (HCI) design. Users reported high scores for the negative usability metrics, specifically rating the system as "Too complicated" with an average score of 3.33 and "Less practical" at 3.25 (Firjatullah, 2025). Conversely, positive operational metrics scored significantly lower, with "Easy to use" achieving only 1.75 and "Often used" at 1.58. Furthermore, the necessity for prior training is evident, as the "Need to study first" indicator scored 3.00.

These results strongly indicate that while the backend computational logic handles conflicts autonomously, the frontend interface creates friction (Firjatullah, 2025; Malik & Frimadani, 2022). The high cognitive load is likely caused by the user journey after the red pop-up appears; users must manually close the warning and navigate back through several menus to find an empty room. To guarantee long-term user acceptance, future iterations must streamline this flow for instance, by embedding a direct "Search Alternative Empty Room" shortcut button directly inside the red pop-up (Konda et al., 2022; Mambu et al., 2024). This redesign will significantly reduce the number of clicks and cognitive memory required, aligning the system with practical sustainability (Malik & Frimadani, 2022).

CONCLUSIONS

The proposed Academic Portal-Based Classroom Management System successfully defines a novel technical mechanism to resolve scheduling conflicts in university environments. By shifting from static schedules to a dynamic, real-time validation approach, the system is capable of detecting overlaps instantly, notifying affected students and lecturers via visual interruptions, and providing data to re-route them to empty classrooms. This solution strongly supports the concept of sustainable campus development by preventing wasted time and optimizing the utilization of physical classroom resources.

However, the empirical data gathered from the usability evaluation clearly demonstrates that functional completeness does not equate to user acceptance. The prototype is currently perceived as highly impractical (3.25) and overly complicated (3.33), resulting in a steep learning curve for its target demographic. For the system to be successfully deployed and embraced by the academic community, future iterations must prioritize a complete redesign of the Human-Computer Interaction framework. Streamlining the user

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journey such as integrating direct alternative room shortcuts within the error notifications will be critical steps in reducing system complexity, lowering cognitive load, and improving overall user satisfaction..

Acknowledgments

The authors would like to express their sincere gratitude to **Ms. Nani Tachjar**, the lecturer of the Human-Computer Interaction course at the Department of Informatics Engineering, Perbanas Institute. Her invaluable guidance, continuous support, and constructive feedback throughout the research and development of this system have been deeply appreciated.

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