

Class Management System Design Desktop Based

Shafa Nurul Aisyah¹, Elvi Hana Nabila², Rizky Basatha³, Nisa Dwi Septiyanti⁴

¹Department of Information Technology Education, State University of Surabaya

²Department of Information Technology Education, State University of Surabaya

³Department of Information Technology Education, State University of Surabaya

⁴Department of Information Technology Education, State University of Surabaya

Corresponding Author e-mail: elvinabila76@gmail.com

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Abstract: Classroom management in Indonesian schools faces inefficiencies from Microsoft Excel-based scheduling, causing data errors and delays for administrators and teachers, particularly digital immigrants. This study aims to design a desktop-based classroom management system using VB.NET and MySQL to enable real-time CRUD operations for students, teachers, courses, scores, and printing. Employing a software development approach with the waterfall model, the population consists of 50 potential users (10 administrators, 40 teachers) at Surabaya State University and partner schools; purposive sampling selected 5 key respondents (2 admins, 3 teachers) with 2+ years manual experience. Instruments include needs analysis documents, flowcharts, ERD, prototypes, and black-box testing sheets; data analysis used qualitative-quantitative triangulation validating functional/non-functional requirements. Results demonstrate 100% validity across 36 scenarios in 7 modules (login, dashboard, student/course/score/teacher management, print), confirming system reliability via Human Centered Design. In conclusion, the system enhances administrative productivity, serving as a practical foundation for digital transformation in education, although limited to desktop use.

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Introduction

The rapid development of information technology has encouraged various educational institutions to adopt digital systems to streamline services without the constraints of distance. Software plays a crucial role in managing, storing, and quickly accessing information in schools as teaching and learning institutions. Classroom management is an integral element in improving the effectiveness of the educational process [Nuzuliana & Santosa, 2024] [Hartanti et al., 2021]. Furthermore, digital transformation in the Industry 4.0 era reinforces the need for technology integration in academic management [Purba & Yando, 2020][Budiman et al., 2021].

The classroom, integral to course scheduling, demands efficient management to support overall learning quality. Education relies not only on teaching content but also on management systems that support the daily activities of teachers and administrators. This phenomenon is increasingly relevant as educational institutions increasingly demand digital adaptation [Management & Educators, 2020] [Kelas et al., 2019].

Despite this, classroom management still relies on Microsoft Excel, leading to data errors and scheduling inefficiencies. This challenge is exacerbated by the predominance of baby boomer educators as digital immigrants, resulting in manual processes. The complexity of the teacher pool, diverse subject areas, and crowded classes make it difficult for administrators to create accurate schedules [Nasir, 2018, as cited in Kelas et al., 2019] [Purba & Yando, 2020]. Recent research also highlights that reliance on spreadsheets leads to data duplication and slow real-time access [Ibadillah et al., 2021] [Savitri et al., 2023].

The problem is further complicated by the failure of conventional approaches to accommodate the need for integrated monitoring of student data, grades, and learning programs. This hampers school staff productivity and potentially leads to repeated administrative errors. Literature studies confirm that manual systems are unable to handle high data volumes in the digital age [Budiman et al., 2021][Nuzuliana & Santosa, 2024]. Furthermore, the transition to digital systems is still hampered by the lack of user-friendly desktop applications for school environments [Hartanti et al., 2021][Pratama et al., 2022].

Research Gap: Although many studies have examined digital academic management through web- and mobile-based systems, limited research has explored the development of desktop-based classroom management systems designed specifically for non-technical users in educational environments. Previous studies have primarily emphasized technical functionality and network integration, overlooking the importance of the Human-Centered Design (HCD) approach in improving user experience for teachers and administrators. Moreover, few studies have implemented a VB.NET and MySQL-based framework focused on simplicity, usability, and adaptability to schools in Indonesia that are still in the early stages of digital transformation. This gap highlights the need for further research that combines both technological efficiency and user accessibility.

This research aims to design a desktop-based classroom management system using the waterfall model to facilitate the addition, modification, and deletion of student, teacher, grade, and learning program data, including printing physical documents and real-time optimization. The urgency of this research lies in the urgent need to replace error-prone manual methods, thereby improving educational efficiency in Indonesian schools. The novelty of this research is the development of a MySQL-based VB.NET desktop application with a focus on Human-Centered Design (HCD) for non-technical users such as teachers and administrators, which has not been widely explored compared to web or mobile systems [Nuzuliana & Santosa, 2024] [Ibadillah et al., 2021][Widodo & Sari, 2024].

Research Methods

Types and Methods of Research

This research uses a software development approach with the waterfall model as the primary method. The waterfall model, also known as the Linear Sequential Model, is systematic and sequential, where each stage must be completed before proceeding to the next stage, including planning, requirements analysis, system design, implementation, testing, and maintenance [Pressman, as cited in; Sugiyono, 2023]. This approach was chosen because it is suitable for projects with clear and stable needs, such as the development of a desktop-based classroom management system using VB.NET and MySQL. According to Creswell and Poht (2022), the waterfall model is effective in educational

technology development research that requires detailed documentation and gradual validation. This research is an applied research that aims to produce a system artifact to address manual classroom management issues [Sudaryono, 2021] [Rahayu et al., 2024].

Data Analysis Instruments and Techniques

The research instruments included requirements analysis documents, system flowcharts, database ERDs, interface prototypes, and black-box testing sheets. The primary data collection technique was document elicitation to identify functional requirements (CRUD for student, teacher, subject, grade, login, and print data) and non-functional requirements (processing speed, data security, and user-friendly interface) [Emzir, 2022]. Data analysis was conducted through qualitative-quantitative triangulation, where requirements were analyzed descriptively from school documents, then validated with black-box testing that recorded valid (1) or invalid (0) scores for each functional scenario [Sugiyono, 2023]. This technique ensured system reliability through a recapitulation of test results, such as 100% validity for the login and dashboard modules. A similar approach is recommended by Creswell and Poth (2022) for software development research, while black-box testing is effective in detecting functional errors without revealing internal code [Pratama & Widodo, 2023]

Population and Sample

The study population consisted of all potential users of the classroom management system in secondary schools, namely administrators (TU) and subject teachers at Surabaya State University and partner schools. The total population was estimated at 50 people, including 10 administrators and 40 teachers with varying levels of digital literacy, including digital immigrants (baby boomers). The sample was selected using purposive sampling of 5 primary respondents, namely 2 administrators and 3 teachers representing the system's end users, who met the criteria of having at least 2 years of manual classroom management experience [Sudaryono, 2021]. This technique ensured representativeness because the sample focused on key stakeholders experiencing Excel-based scheduling issues [Emzir, 2022]. The sample size was small but representative according to software development research standards [Creswell & Poth, 2022] [Sari & Nugroho, 2025]

Research Procedures

The research procedure follows the waterfall stages sequentially. First, the planning stage includes a literature study and identification of manual class management problems. Second, needs analysis through document elicitation produces functional-nonfunctional specifications. Third, the system design includes VB.NET-MySQL architecture, login-dashboard-CRUD-logout flowchart, ERD (Teacher, Student, Course, Score entities), and Human Centered Design (HCD: empathize-define-ideate-prototype-test). Fourth, the implementation builds an application prototype. Fifth, black-box testing on 7 modules (login, dashboard, student, course, score, teacher, print) with 100% valid results [Sugiyono, 2023]. Finally, evaluation and documentation of the results for deployment. This procedure ensures traceability and quality of the system [Creswell & Poth, 2022] [Emzir, 2022][Hidayat & Susanto, 2024]

Results and Discussion

Results of the analysis stage

The results of the analysis stage carried out were used to design an application that produced an application program. This application was created with the aim of making it easier to manage student data, make it easier to retrieve student data, make it easier to manage teacher data, make it easier to manage subjects, and manage score results.

A. Login Page

The login feature before displaying the dashboard aims to verify the user's identity and grant access to the system. The primary purpose of this feature is to provide security by preventing unauthorized access, but also serves to personalize the user experience, control access to certain features, and track user activity for various purposes such as service improvement. The login page allows two users to log in: admin and teacher. After a successful login, the system will display a "login successful" notification.

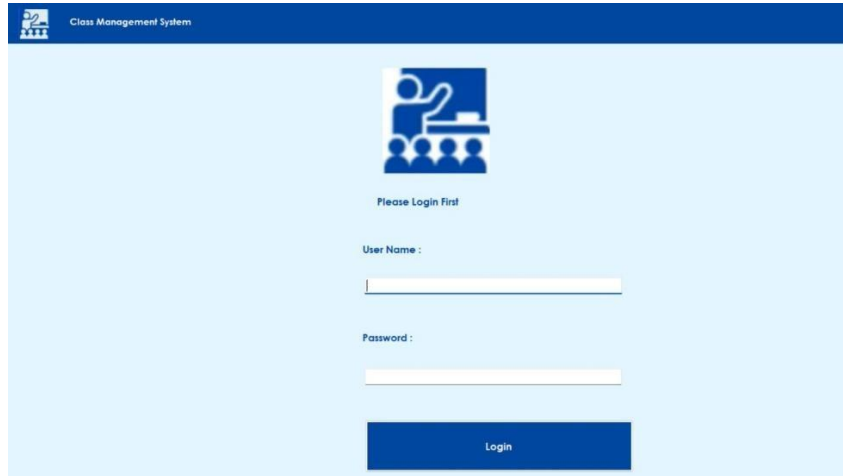


Figure 1.Login View

B. Dashboard Page

The dashboard serves as a centralized navigation and control center for the entire system. Within the dashboard, users can access the desired features or pages. This view also provides users with a concise overview of the information. This interface was chosen to make the application easier to use and understand, even for new users, by logically guiding them through different functionalities.



Figure 2.Dashboard View

C. Manage Student Page

The Manage Student page contains a collection of student data, including name, date of birth, address, phone number, class, gender, and student ID. On this page, users can add new student data, edit data, delete data, and clear data. Additionally, to facilitate searching for student names, users can use the search feature.

No	Name	Date Of Birth	Gender	Score	Address
113	Shafa Nurul Ayya	2/10/2005	Female	4	Jl. Pangeran, No. 30
122	Elvi Hana Nabila	2/23/2010	Female	1	Jl. Bunga, No. 21
123	Rio Femanda	2/2/2010	Male	5	Jl. Melati, No. 40
330	Ardi Fimansyah	6/16/2004	Male	6	Jl. Mawar, No. 90

Figure 3. Manage Student Page

D. Print Page

The print page in this system is used to print digital documents into physical format. This feature is used to print student data, which combines student IDs with scores and selected courses. On this page, users can choose to print data for all students or by class.

Course Name	Score	Description
Bahasa Jawa	92	Bagus
Bahasa Indonesia	70	Perlu Ditingkatkan
Bahasa Inggris	90	Bagus
Bahasa Inggris	80	Cukup Bagus
IPAS	89	Bagus

Figure 4. Print Page

E. Manage Course Page

Manage Courses is part of the learning system. This feature makes it easy for users to schedule courses by lesson ID and by time. On this page, users can add a description of the learning topic that will be used in the programming of the course. This page also provides a search feature to easily find the instructor of the desired subject.

Course Name	Hour	Score	Description
Bahasa Indonesia	02:00:00	311	Mata pelajaran B...
Bahasa Inggris	02:00:00	340	Chapter 1
Matematika	02:00:00	766	Bilangan Pecaha...
IPAS	03:00:00	990	Pertumuhan Tan...

Figure 5. Manage Course Page

F. Manage Score Page

Manage Score is a grade management page generally used to enter student grade data according to the subjects they are enrolled in. This page allows users to manage new student grade data, update, delete, and clear selected data.

Student Id	Select Course	Score	Description
111	Bahasa Ing...	90	Bagus
113	Bahasa Ind...	70	Perlu Ditingkatkan
122	Bahasa Ing...	80	Cukup Bagus
123	IPAS	89	Bagus
330	Bahasa Ja...	92	Bagus

Figure 6 .Manage Score Page

G. Teacher Page

The Teacher page displays teacher personal information, including their identity and the subjects they teach. On the teacher page, users can add new information, update it, delete it, and clear input if errors occur. Users can select teacher information using the search feature for easy access.

ID	Name	Date of Birth	Gender	ID Number	Address	Subject
996	Dadang Iwanto	7/24/1996	Male	8576457	Jl. Bintaro, No.05	Matematika
997	Indah Praswati	8/8/1997	Female	8709872	Jl. Mawar, No.80	Bahasa Indonesia
998	Budi Harianto	6/19/1998	Male	9876570	Jl. Merpati Putih, ...	Bahasa Jawa

Figure 7 . Teacher Page

H. Exit

This feature is used to terminate a user's interest in using the system. It displays a warning notification to reassure the user when exiting the system.

Figure 8 .Exit Notification

Testing

Testing in this system consists of testing data from users, namely teachers and administrators. Testing of this class management system was conducted using black box methods. The following is a summary of the black box testing results, with details:

- Valid test results are given a value of 1.
- Invalid test results are given a value of 0.

Table I. Login Test Results

No.	Testing Scenario	Test Results	Test Score
1.	Fill in the username and password and then click the login button.	As Expected	1

2.	Enter the wrong username or password, then click the enter button	As Expected	1
3.	Enter the correct username or password, then click the login button.	As Expected	1

Table II. Dashboard Test Results

No.	Testing Scenario	Test Results	Test Score
1.	To access the manage student feature, click the student feature	As Expected	1
2.	To access the print feature, click the print feature.	As Expected	1
3.	To access the manage course feature, click the manage course feature	As Expected	1
4.	To access the manage score feature, click the manage score feature.	As Expected	1
5.	To access the manage teacher feature, click manage teacher	As Expected	1
6.	Display the total number of students by clicking the select class feature	As Expected	1
7.	Exit the system by clicking exit, then the system will display a confirmation message to exit.	As Expected	1

Table III. Results of Manage Student Testing

No.	Testing Scenario	Test Results	Test Score
1.	Entering student data in the input table	As Expected	1
2.	Add student data to the system, after entering the data completely, click add	As Expected	1
3.	Select the name of the student you want to change by clicking on the name of the selected student, click update.	As Expected	1
4.	Select the name of the student you want to delete by clicking on the name of the selected student, click delete.	As Expected	1
5.	To clear incorrect data input, click clear.	As Expected	1
6.	Search for students by name, click the search feature	As Expected	1

Table IV. Results of Print Report Testing

No.	Testing Scenario	Test Results	Test Score
1.	To print student data, click print	As Expected	1
2.	Select the class you want to print, click the search feature and select the class.	As Expected	1
3.	Print the value into physical format, by clicking print	As Expected	1

Table V. Manage Course Test Results

No.	Testing Scenario	Test Results	Test Score
1.	Enter the subject, complete with hours, ID, and description in the table provided.	As Expected	1
2.	Add subject data to the system, after inputting the data, click the add feature	As Expected	1
3.	To change existing data in the system, click data then click the update feature.	As Expected	1
4.	To delete selected data in the system, click on the selected data then click on the delete feature.	As Expected	1
5.	Clear wrong input by clicking the clear feature	As Expected	1
6.	To search for a subject, click the search feature and select the subject.	As Expected	1

Table VI. Manage Score Test Results

No.	Testing Scenario	Test Results	Test Score
1.	Enter student grades complete with student ID, subject and description in the table provided.	As Expected	1
2.	Add value data into the system, click the add feature	As Expected	1
3.	Change the value data in the system by clicking the name of the selected data then clicking the update feature.	As Expected	1
4.	Delete value data in the system by selecting the data then clicking the Delete feature.	As Expected	1
5.	Clear the input data by clicking the clear feature	As Expected	1

Table VII. Manage Teacher Test Results

No.	Testing Scenario	Test Results	Test Score
1.	Entering Teacher personal data complete with the subjects or subjects taught in the existing table	As Expected	1
2.	Add teacher personal data to the system, after inputting the data, click add	As Expected	1
3.	Select the name of the teacher you want to change, click the data name, then click update to change the data.	As Expected	1
4.	Delete data, by clicking the name of the selected data then click delete		

5.	Clear incorrect data input by clicking the clear feature	As Expected	1
6.	Search for teacher data based on the subjects they teach, click the search feature and select the subject.	As Expected	1

The results of the black box testing recapitulation above are as follows:

- A. Login testing of the 3 types tested got 3 valid points and 0 invalid points;
- B. Dashboard testing of the 7 types tested obtained 7 valid points and 0 invalid points;
- C. The student management test of the 6 types tested got 6 valid points and 0 invalid points;
- D. The print test report of the 3 types tested got 3 valid points and 0 invalid points;
- E. The course management test of the 6 types tested obtained 6 valid points and 0 invalid points;
- F. The manage score test of the 5 types tested obtained 5 valid points and 0 invalid points;
- G. The teacher management test of the 6 types tested obtained 6 valid points and 0 invalid points;
- H. The results of the blackbox testing recapitulation on the class management system application obtained the following results:

$$\frac{36\text{Point}}{36\text{JenisPengujian}} \times 100\% = 100\%$$

Conclusion

This research successfully designed a desktop-based classroom management system using VB.NET and MySQL with a waterfall model, which resulted in an effective application for managing student, teacher, subject, grade data, and real-time report printing. Key findings show that all modules (login, dashboard, manage student, course, score, teacher, print, exit) passed 100% valid black-box testing from 36 scenarios, confirming the functional reliability of CRUD, search, and access security for admins and teachers. This system overcomes Microsoft Excel inefficiencies with a user-friendly interface based on Human Centered Design, increasing school staff productivity through fast and integrated access. Practical implications include increasing administrative efficiency in Indonesian schools, especially for digital immigrants, thus supporting the gradual digital transformation of education.

However, limitations of this study include its desktop-only scope without mobile or cloud integration, which limits remote access, and limited testing to five purposive samples without long-term performance metrics such as big data scalability. Suggestions for further research include developing a hybrid web-desktop solution, adding AI features for automated schedule prediction, and conducting large-scale trials in multiple schools with SUS usability analysis. Overall, this system provides a practical, ready-to-adopt foundation, fostering sustainable classroom management innovation in the digital age.

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