**P-ISSN: 2656-1743 | E-ISSN: 2656-1735** **JURNAL RISET INFORMATIKA**
DOI: https://doi.org/10.34288/jri.v8i1.459 Vol. 8, No. 1. December 2025
**Accredited rank 4 (SINTA 4), excerpts from the decision of the DITJEN DIKTIRISTEK No. 230/E/KPT/2023**

# DEVELOPMENT OF AN INFORMATION SYSTEM FOR ATTENDANCE AND STUDENT PROGRESS AT PAUD TUNAS MUDA

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**Abstract**

The Tunas Muda Early Childhood Education Student Attendance and Progress Recording Information System application is a digital platform designed to help teachers record student attendance and progress in a modern and efficient manner. Currently, the recording process is still done manually, causing various obstacles such as late reporting, data inaccuracy, and difficulties in comprehensively monitoring student progress. This research uses the Research and Development (R&D) method. The purpose of this research is to develop a system that can facilitate teachers in taking attendance and recording student progress and enable school principals to monitor attendance and progress data through graphical displays and statistical analysis. Data collection was conducted through direct interviews with teachers as the main users. The system was developed using Flutter SDK for the interface and Firebase Firestore as the database. The results of the study show that the application is capable of recording student attendance and progress in real time, generating reports in PDF format, and displaying attendance and progress analysis in an informative graphical form.

Keywords: Flutter; Student attendance; Student Progress; Firebase; Application; Information system

***Abstrak***

*Aplikasi Sistem Informasi Kehadiran dan Pencatatan Kemajuan Siswa PAUD Tunas Muda merupakan platform digital yang dirancang untuk membantu guru dalam mencatat kehadiran dan kemajuan siswa secara modern dan efisien. Saat ini, proses pencatatan masih dilakukan secara manual, sehingga menimbulkan berbagai kendala seperti pelaporan yang terlambat, ketidakakuratan data, dan kesulitan dalam memantau kemajuan siswa secara komprehensif. Penelitian ini menggunakan metode Research and Development (R&D). Penelitian ini bertujuan untuk mengembangkan sistem yang dapat memudahkan guru dalam melakukan absensi dan pencatatan kemajuan siswa serta memungkinkan kepala sekolah untuk memantau data kehadiran dan kemajuan melalui tampilan grafis dan analisis statistik. Pengumpulan data dilakukan melalui wawancara langsung dengan guru sebagai pengguna utama. Pengembangan sistem dilakukan menggunakan Flutter SDK untuk antarmuka dan Firebase Firestore sebagai basis data. Hasil penelitian menunjukkan bahwa aplikasi mampu mencatat kehadiran dan kemajuan siswa secara real time, menghasilkan laporan dalam format PDF, dan menampilkan analisis kehadiran dan kemajuan dalam bentuk grafis yang informatif.*

*Kata kunci: Presensi siswa; Perkembangan siswa; Firebase; Aplikasi; Sistem informasi*

## INTRODUCTION

Pendidikan Anak Usia Dini (PAUD) is an important stage in a child's development, where recording student attendance and learning progress is essential to monitor their overall development. However, at PAUD Tunas Muda, this recording process is still done manually using books or report sheets, which often results in delays in reporting, recording errors, and the risk of data loss. This condition makes it difficult for teachers and principals to monitor student development accurately and continuously.

With the advancement of information technology, the implementation of a digital-based information system has become an effective solution to improve efficiency and accuracy in education data management. Therefore, this study aims to develop an information system application for recording student attendance and progress at Tunas Muda PAUD. This application is designed to help teachers record student attendance and

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progress in real-time, provide automatic reports in PDF format, and display attendance and progress analysis results through interactive graphics.

This research uses the Research and Development (R&D) method with a system development approach using Flutter SDK for the interface and Firebase Firestore as a cloud-based database. With this application, it is hoped that the administrative process at PAUD Tunas Muda will become more efficient, accurate, and support the improvement of early childhood learning quality.

With advances in information technology, the application of a digital-based information system is a strategic solution in improving the effectiveness of educational administration. This application can integrate real-time recording of student attendance and development, so that data can be accessed anytime and anywhere by teachers and principals. In addition to speeding up the recording and reporting process, this system is also capable of increasing transparency, data accuracy, and supporting data-driven decision making in early childhood education.

A number of previous studies have developed similar systems in various educational contexts. Research by (Fu'adi et al., 2022) developed a Web-based Early Childhood Monitoring Information System that makes it easier for teachers to monitor children's activities and development efficiently. (Rodiyah & Mulyati, 2021) research shows that a website-based child growth and development monitoring system can reduce manual recording errors and increase parental involvement . Meanwhile, (Hikmah et al., 2021) developed a web-based student attendance information system that has been proven to improve the efficiency of attendance data management compared to manual methods.

In addition, research by (Sarwindah et al., 2023) also designed an early childhood development checklist information system to make it easier for teachers to document children's development indicators digitally. Then, (Maarif, Karim, and Yuliawati, 2025) developed a web-based PAUD management information system that emphasizes the importance of digitizing early childhood education data. Meanwhile, research by a team from (Suwarno et al., 2025) developed a web-based PAUD report card score processing information system using the Naïve Bayes method, which facilitates teachers in digitally recording and analyzing students learning progress efficiently. Meanwhile, research conducted by (Fu'adi et al., 2022) shows that a web-based early childhood development monitoring information system can help teachers monitor student development and facilitate efficient and accurate data processing.

Although previous studies have shown positive results, most still have limitations in terms of integrating features between attendance and student progress records, graphical analysis, and multi-user access for teachers and principals. Most systems are also still conventional web-based, not yet optimized for mobile platforms that are more practical to use in early childhood education environments.

Based on this, this study presents the Tunas Muda PAUD Student Attendance and Progress Recording Information System Application as an innovation in student data management. This application was developed using Flutter SDK for a responsive and attractive user interface (UI), as well as Firebase Firestore as a database that supports real-time cloud storage. The research methods used included direct interviews with teachers as the main users, as well as a system development approach that focused on user needs.

Testing results show that this application is capable of recording student attendance and progress in real-time, generating automatic reports in PDF format, and displaying attendance and student progress analysis in the form of interactive graphics. Thus, this application not only improves the efficiency and accuracy of recording, but also supports transparency and professionalism in the management of early childhood education institutions.

## RESEARCH METHODS

This study uses the Research and Development (R&D) method, which aims to produce software products—in this case, the Attendance and Student Development Recording Information System Application for Early Childhood Education. The R&D method was chosen because it is specifically designed for product development-oriented research while also testing its effectiveness (Auliya & Akhriza, 2025). In other words, R&D is a structured methodology for identifying needs, designing, developing, and validating educational products (information systems) before implementation. The research approach is descriptive(Okpatrioka, 2023). which means that researchers describe the stages of system development and the results of application function testing. Descriptive analysis was conducted to ensure that each application feature was able to overcome manual recording problems

in the field, such as delays in reporting and the risk of data loss.

**A. Data Collection Techniques**

Some of the main data collection techniques used include:

1. Observation

   Direct observation was conducted on the process of recording attendance and student development in early childhood education. This observation provided an overview of the manual workflow and the obstacles encountered (Sinaga et al. 2021).

2. Interview

   Conducted with early childhood education teachers to explore system requirements, desired features, and issues experienced with the manual system. In-depth semi-structured interviews were used to obtain detailed insights into teachers' experiences, perceptions, and needs related to system development. This approach aligns with the study by (Jusni et al., 2023), who conducted online interviews with early childhood education practitioners in Yogyakarta to explore inclusive practices and identify essential elements for system improvement

3. Literature Review

   Researchers conducted a literature review of books, journals, and previous studies related to educational information systems, Flutter application development, Firebase Firestore, and R&D methods. This literature review became the theoretical basis for designing an effective information system (Rosikhin and Ahmad'i 2024).

**B. Development Stages**

The stages of application development describe the process of developing the Tunas Muda Early Childhood Education Student Attendance and Development Recording Information System Application from start to implementation. The model used refers to the Research and Development (R&D) approach as described by (Rahayu 2025), which emphasizes a systematic product development process through the stages of needs analysis, design, testing, and refinement.

1. Identification of Potential and Problems

   The first step is to identify problems in the attendance recording process and manual development, such as late reporting, data loss, and lack of synchronization between teachers and administrators. Similar problems were identified by Fu'adi, (Fu'adi et al., 2022), where manual data entry in early childhood education institutions resulted in inefficiency and inaccurate reporting.

2. Data Collection

   Data was collected through observation, interviews, and literature review to gain a comprehensive understanding of user needs. This approach is consistent with the R&D data collection phase described by (Arifin et al., 2023), which emphasizes that user-based data collection ensures that products are aligned with actual operational requirements.

3. System Design and Development

   At this stage, the prototype system was designed and developed using the Flutter framework for the front end and Firebase Firestore as a real-time cloud database. The system is divided into four main modules, namely login and authentication, attendance management, student progress tracking, and reporting. Each module is designed to support the needs of early childhood educators in managing attendance and documenting student progress efficiently. The use of Flutter and Firebase is based on their proven effectiveness in mobile-based education systems. Adi et al. 2025) shows that Flutter enables the development of cross-platform responsive applications with a single code base, while (Wairooy et al., 2024) highlights the scalability and real-time data synchronization capabilities of Firebase Firestore. This combination of technologies enables the system to operate efficiently, ensuring data accuracy, accessibility, and smooth performance across multiple devices.

4. Product Testing and Improvement

   After development was complete, the system was tested using the Black-box testing method to ensure that the main functions ran according to specifications, including: attendance input, data storage, and report generation. For example, (Saman and Ratnasari 2022) in the Intech Scientific Journal: Information Technology Journal of UMUS conducted Black-box testing 34 nan Android-based learning application and found that follow-up on failed test cases was necessary for the system to be more efficient. Based on the test results, the main functions of the system are working well. However, there are some minor improvements that have been made: the user interface has been simplified and data synchronization between modules has been strengthened so that data updates can run more smoothly. This iterative refinement process is in line with the results of research by (Fitriana et al., 2021) on Android storage applications that utilize Black-box testing and Boundary Value Analysis techniques – achieving a success rate of 83.33%.

5. Final Implementation

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At this stage, the system has been developed and functionally tested to ensure that all features are working properly. However, implementation at Tunas Muda Early Childhood Education Center has not yet been carried out. Therefore, the Final Implementation stage is planned as a follow-up stage that will involve teachers as the main users to assess the ease of use, effectiveness, and efficiency of the system in supporting teacher administrative activities.

Future implementation is expected to show improvements in data accuracy, ease of monitoring, and time efficiency compared to the previous manual recording system, as stated by (Ilham & Yuniarti, 2022) that the application of an education information system can improve data accuracy and support more effective communication and decision-making in the school environment.


Figure 1. Development Stages

## RESULTS AND DISCUSSION

### A. Design

In this study, an attendance and student progress recording information system application was designed to suit the needs of teachers and principals at Tunas Muda Early Childhood Education Center. The application design was kept simple for ease of use. The design process began with the creation of use case diagrams that included login features, attendance recording, student progress recording, and report generation. The interface design was created with a simple and easy-to-understand display to support ease of access and efficiency of use by teachers.

1. Use Case Diagram


Figure 2. Use Case Diagram

Figure 1 illustrates the Use Case Diagram of the Attendance and Student Progress Information System at PAUD Tunas Muda. The diagram depicts the relationships among three main actors—Admin, Teacher, and Principal—and the primary functions available within the system.

The Admin is responsible for managing user accounts, including creating new accounts, deleting accounts, and updating passwords. The Teacher, as the main user of the system, can log in, record student attendance, track student progress, input student data, monitor attendance and progress, and generate learning reports. Meanwhile, the Principal is tasked with analyzing attendance and student progress data provided by teachers to support learning evaluation.

All system interactions begin with a login process that determines each actor's access rights. This design ensures clear role distribution, minimizes recording errors, and enhances administrative efficiency within PAUD Tunas Muda. A use case diagram is one of the diagrams in the Unified Modeling Language (UML) used to describe the relationship between actors and systems (Fadhli & Syahirah, 2022). This diagram helps clarify the main functions of the system to be developed and shows how users interact with the system. Through use case diagrams, developers can easily identify system requirements and explain the initial design to users or related parties.

### B. Implementation User Interface

A good user interface (UI) improves user satisfaction and system efficiency. According to (Tasya & Setyantoro, 2024), an effective user interface is crucial for creating an optimal user experience and facilitating access to information.

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Furthermore, consistency and ease of use should be top priorities in user interface design. According to the (Fathurrahman & Sumarsono, 2024), consistency is the application of uniform interface patterns to similar situations. This includes the use of consistent colors, typography, and terminology.

1. Splash Screen Page

Figure 2 shows the splash screen for the Tunas Muda Early Childhood Education (PAUD) application. In the center is the logo with the motto "SEHAT, CERDAS, CERIA" and the title "PAUD TUNAS MUDA" in dark gray. Light green accents on a white background. The screen that activates the application.


Figure 3. Splash Screen Page

2. Login Page

Figure 3 shows the login interface where users access the Tunas Muda PAUD mobile application by entering their ID and password. This page serves as the main entry point for teachers to securely log into the system. It includes input fields for user credentials and a Login button that verifies the data with the system's database. Once authenticated, users are directed to the main dashboard. An illustration of the login interface is shown below.

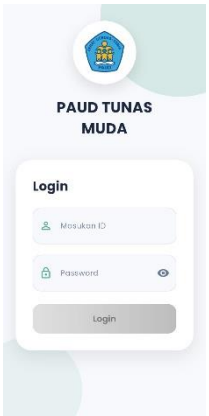


Figure 4. Login Page

3. Teacher Dashboard Page

The initial appearance of the teacher dashboard page is shown in Figure 4. This page displays important information such as the user's name, role, and a short motivational greeting. The daily activity menu below provides reminders to track student attendance. The main menu contains important features such as Attendance, Progress, Student Data, Supervision, Reports, and Analysis.

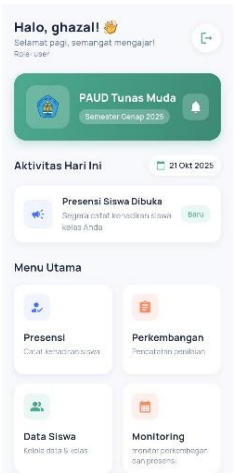


Figure 5. Teacher Dashboard Page

4. Presensi page

Figure 5 shows the Student Attendance page, where teachers can record student attendance every day. At the top is the attendance date information, which can be changed as needed. Teachers can also filter data by class. Each student is displayed in a list with an attendance status that is still Not Filled and can be updated via the edit button on the right.

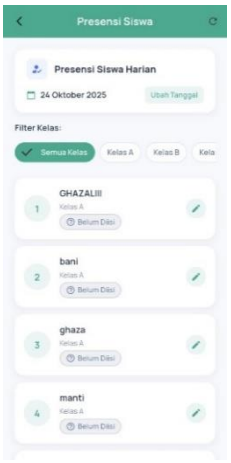


Figure 6. Presensi Page

**JURNAL RISET INFORMATIKA**
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5. Student Progress Page

Figure 6 shows the Student Development Record page, which teachers use to assess student development based on various aspects such as religious and moral values, physical, motor, cognitive, language, social, emotional, and artistic development. Teachers can select the assessment date and students to be assessed. Each aspect of development has several assessment categories, such as BB (Belum Berkembang), MB (Mulai Berkembang), BSH (Berkembang Sesuai Harapan), dan BSB (Berkembang Sangat Baik). This display is designed so that teachers can conduct assessments systematically and provide special notes as needed.

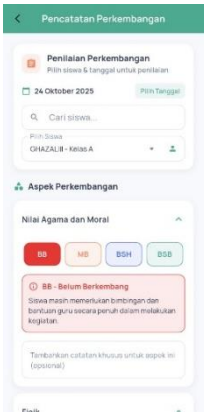


Figure 7. Student Progress Page

6. Student Data Page

Figure 7 shows the Student Data page used by teachers to manage student and class information. At the top, there is a class selection tab that facilitates data grouping based on class. Each student data is equipped with an edit button to update information and a delete button to delete student data. In addition, there are add student and add class buttons at the bottom to add new data as needed.


Figure 8. Student Data Page

7. Monitoring Page

Figure 8 shows the Advanced Monitoring page, which is used to monitor student progress and attendance based on specific categories. There are four main tabs: Good Progress, Poor Progress, Poor Attendance, and Good Attendance. Each tab displays student data according to the selected category. This display helps teachers identify students who need more attention or who are showing positive progress.

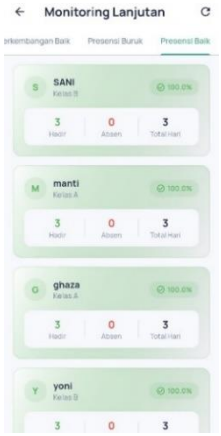


Figure 9. Monitoring Page

8. Report Page

Figure 9 shows the Report page, which is used to generate student data summaries in PDF format. In the Report Type section, users can choose between Attendance Report or Progress Report. Next, users can specify the report period manually or through quick options such as Today, 7 Days, and 30 Days. Once all settings are complete, users can press the Generate Report button to create a report document according to the selected criteria.

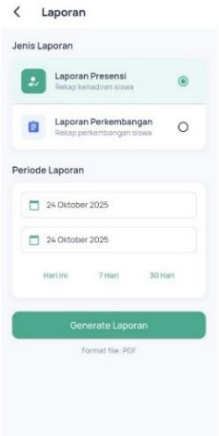


Figure 10. Report Page

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9. Attendance Analysis Page

Figure 10 shows the Attendance Analysis page, which displays student attendance data for a selected period. Users can filter by date range, class, and time, then view summaries such as total attendance, percentage, and status Present, Permission, Sick, Alpha. At the bottom, attendance data are visualized through Bar, Pie, or Line charts to make the analysis easier to understand.


Figure 11 Attendance Analysis Page

10. Progress Analysis Page

Figure 11 shows the Student Development Analysis page, which displays student progress based on selected aspects and time periods. Users can filter data by Class, Aspect, and Date Range. The Development Statistics section shows totals and achievement categories BSB, BSH, MB, and BB with their percentages. A graph below presents these results in a clear visual format.


Figure 12. Progress Analysis

11. Admin Dashboard Page

Figure 12 shows the Administrator Home page. The Administrator Menu section has only one main feature, namely Manage Users, which is used to manage teacher and administrator accounts. Through this menu, administrators can add, change, or delete user accounts registered in the system and access various system functions efficiently.

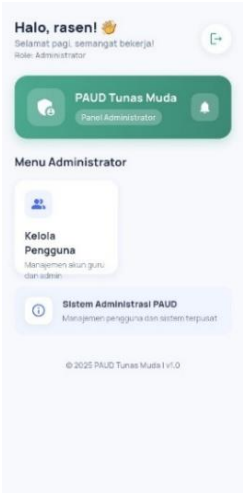


Figure 13. Admin Dashboard Page

12. User Management Page

Figure 13 shows the Manage Users page, where administrators manage teacher accounts. At the top, there is a Create New Account form with fields for User ID, Full Name, Password, and Role with options for Teacher and Admin. After entering the data, the administrator can click Create Account to add a new user. A Search User feature below helps find specific accounts by name or ID. All registered accounts are listed with their name, ID, and role, and administrators can edit or delete accounts as needed.

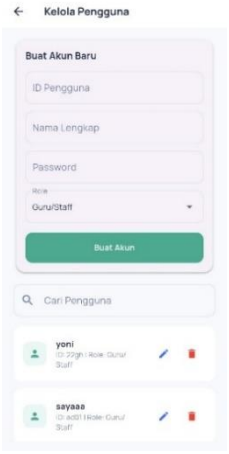


Figure 14. User Management Page

13. Principal Dashboard Page

Figure 14 shows the initial view of the principal's dashboard, which contains statistical information about the total number of students and teachers. In addition, at the bottom there is a main menu consisting of several features, namely Dashboard, Reports, and Monitoring. This display helps principals monitor school data and activities efficiently.


Figure 15. Principal Dashboard Page

## C. Testing

Software testing plays a vital role in the development cycle, aiming to verify the quality, efficiency, and reliability of a software product (Suwarno et al., 2025). The black box testing technique used in this study ensures that all features in the Tunas Muda PAUD application including login, attendance recording, student progress assessment, data management, reporting, and user management operate accurately as intended. This method is conducted by providing various input data to the system and then evaluating whether the resulting output aligns with predetermined specifications. The testing process confirms that each feature performs its function correctly according to the design requirements.

Tabel 1. Testing

| No | Feature | Test Case (short) | Expected Result | Status |
|---|---|---|---|---|
| 1 | Splash Screen | App launches to splash screen | Logo and motto display; app proceeds to Login | Passed |
| 2 | Login | Login with valid ID & password | User directed to dashboard | Passed |
| 3 | Login (invalid) | Login with wrong credentials | Error message shown; access denied | Passed |
| 4 | Teacher Dashboard | Load dashboard after login | Name, role, greeting, main menu visible | Passed |
| 5 | Attendance | Record daily attendance / change date / filter class | Attendance saved and updated per student | Passed |
| 6 | Student Progress | Input assessment for selected student & date | Assessment saved with category (BB/MB/BSH/BSB) and notes | Passed |
| 7 | Student Data | Add / edit / delete student; add class | Data changes stored and reflected in list | Passed |
| 8 | Monitoring | View Good/Poor Progress and Attendance tabs | Correct students appear per category | Passed |
| 9 | Report | Select report type and period, generate | PDF report generated according to criteria | Passed |
| 10 | Attendance Analysis | Filter date/class/time and view summary | Totals, percentages, and chart visualization shown | Passed |
| 11 | Progress Analysis | Filter by class/aspect /date and view stats | Category percentages (BSB/BSH/MB/BB) and graph shown | Passed |
| 12 | Admin Dashboard | Access admin menu after admin login | Manage Users option available | Passed |
| 13 | User Management | Create, search, edit, delete accounts | Accounts added/updated/removed correctly | Passed |
| 14 | Principal Dashboard | Load principal view | Student/teacher statistics and menus visible | Passed |

## CONCLUSIONS AND SUGGESTIONS

### CONCLUSIONS.

Based on the testing results conducted using the black box method, it can be concluded that all features in the Tunas Muda PAUD application including login, attendance management, student progress assessment, data management, reporting, and user management function properly according to the design specifications. The system has proven to be reliable in supporting early childhood education activities by providing accurate data recording, systematic progress evaluation, and

efficient reporting processes. This application improves the effectiveness of teacher performance and simplifies the monitoring process for both administrators and principals.

The application was developed using Flutter integrated with Firebase Firestore, offering a modern and efficient cross-platform solution with real-time data synchronization. This technological approach enhances scalability, accessibility, and maintenance efficiency, distinguishing the system from conventional PAUD management applications. Therefore, the system is feasible to be implemented as a digital support tool for PAUD institutions.

**SUGGESTIONS**

For future development, there are several things that can be considered to improve the functionality and scope of the Tunas Muda PAUD application, namely:

1) Additional Access for Parents: The application can be developed so that parents can also access information about their children's attendance and development directly through a special account.

2) Two-Way Communication Feature: A messaging or notification feature should be added so that teachers and parents can interact effectively regarding their children's activities and progress.

3) Integration with Other Education Systems: Further development could be directed towards connecting the application with other education systems or databases to facilitate reporting and data management.

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