MiniClass: A Gamified Homework Reminder Management System for Primary School Students

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DOI: https://doi.org/ 10.47772/IJRISS.2026.101000337

Received: 22 October 2026; Accepted: 27 October 2026; Published: 02 November 2026

ABSTRACT

Homework management remains a challenge for primary school students due to poor time management, limited motivation, and ineffective communication among teachers, students, and parents. Existing learning management systems provide homework management features but often lack child-friendly interfaces and motivational elements suitable for younger learners. This study presents MiniClass, a gamified homework reminder management system designed to improve homework completion and student engagement. The system was developed using the Scrum software development methodology, with Flutter as the mobile application framework and Firebase Authentication and Cloud Firestore for user authentication and cloud-based data management. MiniClass supports three user roles: teachers, students, and parents. Teachers can create classes and assign homework, students receive reminders and earn gamification rewards such as experience points (XP) and achievement badges upon completing tasks, while parents can monitor their children's homework progress. Functional testing confirmed that the implemented features operated as intended and satisfied the defined system requirements. The proposed system demonstrates that integrating homework reminders, parental monitoring, and gamification into a

single mobile application provides a practical solution for supporting homework management among primary school students. Future work may include file attachment support, multi-child parent management, and enhanced gamification features.

Keywords: Gamification, Homework Management, Mobile Learning, Flutter, Firebase, Primary Education

INTRODUCTION

Homework plays a significant role in reinforcing classroom learning by allowing students to practice concepts independently and develop essential skills such as responsibility, self-discipline, and time management. For primary school students, however, completing homework consistently can be challenging due to limited self-regulation skills, forgetfulness, and dependence on teachers and parents for guidance. Studies have shown that digital support systems and reminder tools can improve homework management and encourage students to complete academic tasks more effectively (Aul et al., 2001; Lai et al., 2020; Trautwein, 2007).

The increasing adoption of mobile learning technologies has transformed the way educational activities are managed. Learning Management Systems (LMS) such as Google Classroom provide convenient platforms for distributing assignments and facilitating communication between teachers and students (Heggart & Yoo, 2018). Nevertheless, most existing systems are designed for secondary or higher education and do not adequately address the motivational and usability needs of younger learners. Furthermore, while applications such as ClassDojo and Duolingo successfully incorporate gamification or parental engagement, they do not provide an integrated solution that combines homework management, automated reminders, parental monitoring, and child-friendly motivational features within a single platform (Kapp, 2012; Sailer & Homner, 2020).

To address these limitations, this study proposes MiniClass, a gamified homework reminder management system designed specifically for primary school students aged 8 to 12 years. The mobile application integrates

homework management, automated reminder notifications, parental monitoring, and gamification features such as experience points (XP) and achievement badges to encourage consistent homework completion and improve communication among teachers, students, and parents. The system was developed using the Scrum software development methodology with Flutter as the mobile application framework and Firebase services for authentication and cloud-based data management.

The objectives of this study are to identify the functional and non-functional requirements of a homework reminder management system, design and develop the proposed MiniClass application, and validate the developed system through functional testing and requirement traceability. By integrating educational management and motivational game elements into a single mobile application, this work contributes a practical solution that supports homework management while enhancing engagement for primary school learners.

Related Work

Homework is an essential component of the learning process as it reinforces classroom instruction, encourages independent learning, and develops students' responsibility and time management skills (Cooper et al., 2006; Trautwein & Köller, 2003). However, primary school students often experience difficulties in managing homework because they rely heavily on teachers and parents for guidance and frequently struggle with remembering assignment deadlines. Research has shown that effective homework management, combined with parental involvement, can positively influence students' academic performance and homework completion (Patall et al., 2008; Gonida & Cortina, 2014; Dumont et al., 2012). Despite these benefits, conventional homework management methods and many existing digital platforms provide limited support for maintaining students' motivation and engagement, particularly among younger learners.

The rapid growth of mobile learning technologies has significantly improved access to educational resources and communication between teachers, students, and parents. Mobile-based learning systems enable teachers to distribute assignments, monitor submissions, and provide learning materials through a centralized platform while allowing students to access homework information anytime and anywhere (Crompton & Burke, 2018; Sung et al., 2016). Technologies such as Flutter and Firebase further support the development of cloud-based educational applications by providing secure user authentication and real-time data synchronization across multiple devices. These capabilities have made mobile applications an effective platform for supporting homework management and improving communication within educational environments (Aul et al., 2001; Lai et al., 2020; Hwang & Wu, 2014).

Gamification has emerged as an effective strategy for increasing learner motivation and engagement by incorporating game design elements into educational activities. Common gamification features include experience points (XP), achievement badges, progress tracking, and immediate rewards that encourage students to complete learning tasks consistently (Dicheva et al., 2015; Hamari et al., 2014; Landers, 2014). Previous studies have reported that these elements improve motivation, participation, and self-regulated learning, especially among younger learners who respond positively to interactive and visually engaging environments (Sailer et al., 2017; Domínguez et al., 2013; Buckley & Doyle, 2016). Consequently, integrating gamification into homework management systems offers the potential to transform routine homework activities into more enjoyable and rewarding experiences (Metwally et al., 2021; Metwally et al., 2020; Huang & Soman, 2013).

Several educational applications demonstrate different strengths in supporting teaching and learning. Google Classroom provides comprehensive homework distribution and assignment management but offers limited gamification features (Heggart & Yoo, 2018). ClassDojo emphasizes classroom behaviour management and communication between teachers and parents through reward-based mechanisms but lacks comprehensive homework reminder and submission management (Chiarelli et al., 2015). Duolingo effectively applies gamification techniques such as XP, achievement badges, and progress tracking to sustain learner motivation; however, it is designed primarily for language learning rather than homework management (Vesselinov & Grego, 2012; Shortt et al., 2023). Although these applications contribute valuable educational features, none integrates homework reminders, parental monitoring, and gamification into a single mobile platform specifically designed for primary school students.

Parental involvement has been consistently identified as a critical factor in supporting children's homework completion and academic success. Digital tools that enable parents to monitor progress and receive timely notifications have been shown to strengthen home-school collaboration and reduce the likelihood of missed assignments (Gonzalez-DeHass et al., 2022; Li et al., 2025; Haelermans & Ghysels, 2017). Technology-mediated parental engagement through mobile applications can improve homework completion rates and foster more positive attitudes toward learning when communication is two-way, personalised, and supportive (See et al., 2021; Epstein, 2018).

Based on the reviewed literature, there remains a need for an integrated homework management solution that combines automated reminders, parental involvement, and motivational gamification features within a child-friendly mobile application. To address this gap, this study proposes MiniClass, a gamified homework reminder management system that supports teachers, students, and parents through homework management, real-time notifications, progress monitoring, and gamification features designed to encourage consistent homework completion among primary school students.

Table 1: Comparison of Existing Homework Management Systems

Feature	Google Classroom	ClassDojo	Duolingo	Proposed MiniClass
Homework Management	✓	Limited	✗	✓
Homework Reminder	Limited	✗	✗	✓
Parent Monitoring	Limited	✓	✗	✓
Gamification	✗	Limited	✓	✓
Target User	General	Primary	Individual	Primary

METHODOLOGY

This study adopted the Scrum software development methodology to design and develop the proposed MiniClass mobile application. Scrum was selected because it supports iterative and incremental development, enabling system features to be implemented, tested, and refined through multiple development cycles (Schwaber & Sutherland, 2020). This approach was suitable for the project as it allowed continuous evaluation of system functionalities and facilitated improvements throughout the development process.

The development process consisted of five main sprints. The initial sprint focused on establishing the application's core structure by configuring the Flutter development environment, Firebase Authentication, and Cloud Firestore database while developing the user interface and application navigation. The second sprint implemented the Teacher Module, which provides functionalities for class management, homework creation, editing, deletion, and monitoring student submissions. The third sprint focused on the Student Module, allowing students to join classes, view assigned homework, submit completed tasks, and monitor their learning progress. The fourth sprint introduced the Parent Module and a real-time notification system, enabling parents to monitor their children's homework activities and receive updates whenever homework was assigned or submitted. The final sprint integrated gamification features, including experience points (XP), achievement badges, reward animations, and system testing to improve user engagement and verify system functionality.

The MiniClass application was developed using Flutter, an open-source framework that supports cross-platform mobile application development from a single codebase. Firebase Authentication was integrated to provide secure user registration and login, while Cloud Firestore served as the cloud-based NoSQL database for storing user accounts, homework records, class information, notifications, and student submissions. These technologies enabled real-time synchronization of data among teachers, students, and parents, ensuring that updates were immediately reflected across all user devices (Flutter Team, 2023; Firebase Documentation, 2023).

The system supports three user roles: Teacher, Student, and Parent. Teachers are responsible for creating classes, assigning homework, and monitoring student submissions. Students can join classes using a class code, receive homework reminders, submit completed assignments, and earn gamification rewards upon task completion. Parents are able to link their accounts with their children's profiles, monitor homework progress, and receive notification updates regarding homework activities. This role-based design ensures that each user has access only to functionalities relevant to their responsibilities while improving communication among all stakeholders.

To evaluate the developed application, functional testing was conducted to verify that each module operated according to the specified system requirements. A requirement traceability matrix was also used to confirm that all identified functional requirements were successfully implemented. This validation process ensured that the developed MiniClass application satisfied its intended objectives and performed reliably before completion of the project.

RESULTS AND DISCUSSION

The MiniClass application was successfully developed based on the identified system requirements using Flutter and Firebase technologies. The completed system integrates homework management, automated reminder notifications, parental monitoring, and gamification features within a single mobile application. Functional testing confirmed that all major modules operated according to the specified requirements and successfully supported the intended activities of teachers, students, and parents.

The Teacher Module enables teachers to create classes, assign homework, edit or delete assignments, and monitor student submissions through a centralized dashboard. These features simplify classroom management by allowing teachers to organize homework efficiently while monitoring students' submission status in real time. The integration with Cloud Firestore ensures that homework information is synchronized immediately across all connected users.

The Student Module allows students to join classes using a class code, view assigned homework, submit completed assignments, and monitor homework progress through a child-friendly interface. Automated reminder notifications help students remember upcoming homework deadlines, while the gamification features provide additional motivation by rewarding completed tasks with experience points (XP) and achievement badges. These elements encourage students to complete homework consistently and make routine learning activities more engaging, consistent with findings from prior gamification research (Sailer & Homner, 2020; Metwally et al., 2021).

The Parent Module improves communication between home and school by allowing parents to monitor their children's homework progress through a dedicated dashboard. Parents receive notifications whenever new homework is assigned or completed, enabling them to remain actively involved in supporting their children's learning activities. This functionality strengthens collaboration among teachers, students, and parents while reducing the likelihood of missed assignments (Gonzalez-DeHass et al., 2022; See et al., 2021).

To verify system quality, functional testing and requirement traceability were performed. The testing results demonstrated that all implemented functions operated as expected and satisfied the predefined functional requirements. The successful completion of these tests indicates that the MiniClass application achieved the project objectives by providing an integrated homework reminder management system supported by gamification and real-time communication features.

Table 2: Functional Testing Summary

No	Functional Requirement	Description	Status
1.	User Registration	Users can create an account based on their role (Teacher, Student, Parent).	✓

2.	User Login	Registered users can log into the system securely.	✓
3.	Teacher Dashboard	Teachers can access their dashboard after successful login.	✓
4.	Class Management	Teachers can create and manage classroom information.	✓
5.	Student Enrolment	Students can join classes using a unique class code generated by teacher.	✓
6.	Homework Management	Teachers can create, edit and delete homework.	✓
7.	Homework Submission	Students can submit completed homework through the application.	✓
8.	Submission Monitoring	Teachers can review homework submissions from students.	✓
9.	Parent Monitoring	Parents can monitor their child's homework progress and status.	✓
10.	Notification System	Students and parents receive notifications when new homework is assigned.	✓
11.	Gamification	Students earn XP, levels and achievement badges after completing homework.	✓
12.	Reward Tracking	Students can view rewards and learning progress.	✓
13.	Homework Status Tracking	Homework status is displayed as Active, Pending, Completed or Overdue.	✓
14.	User Profile	Every user can view their profile information.	✓

The identified requirements were translated into system modules that support role-based access, homework management, homework submission, notification services, parental monitoring, and gamification. These requirements formed the foundation for the design and implementation of the MiniClass application.

CONCLUSION

This paper presented MiniClass, a gamified homework reminder management system developed to support homework management among primary school students. The system integrates homework assignment, automated reminders, parental monitoring, and gamification features within a single mobile application. By combining these functionalities, MiniClass aims to improve communication between teachers, students, and parents while encouraging students to complete homework through an engaging and user-friendly learning environment.

The application was successfully designed and implemented using the Scrum software development methodology, Flutter framework, Firebase Authentication, and Cloud Firestore. Functional testing demonstrated that the developed modules operated according to the specified system requirements and supported the intended activities of all three user roles. The findings indicate that the proposed system provides a practical solution for digital homework management while integrating motivational game elements suitable for primary school learners.

Although the developed system achieved its functional objectives, several limitations remain. The project focused primarily on system development and functional validation; therefore, a large-scale usability evaluation involving teachers, students, and parents was not conducted. In addition, the current implementation provides a limited set of gamification features and does not support advanced functions such as file attachment submission, offline access, or management of multiple children under a single parent account.

Future work may focus on conducting comprehensive usability studies with actual users to evaluate the effectiveness of the system in improving homework completion, user engagement, and learning outcomes.

Additional enhancements may include richer gamification mechanisms, personalized learning analytics, support for multimedia homework submissions, and expanded parental management features. These improvements have the potential to increase the educational value and practical adoption of the MiniClass application in primary school environments.

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