

Original article

Parent-Teacher Interaction System: Development of Parent-Teacher Communication and Collaboration System

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ABSTRACT

This study seeks to enhance communication and collaboration between parents and teachers in primary schools. The research delves into the myriad challenges parents and teachers encounter when attempting to communicate and collaborate effectively, particularly in the context of busy schedules and the absence of a dedicated platform. To address these issues, the aim of this study is to propose a "Parent-Teacher Interaction System (PTIS)," a comprehensive web-based platform designed to bridge the communication gap and support collaborative efforts between parents and teachers. The development of PTIS follows an agile software development methodology, ensuring that the platform is both adaptable and user-centric. The system offers a suite of features such as real-time tracking of student performance across academics and activities, a structured feedback mechanism for parents, multilingual support, a PTIS chatbot for instant queries, daily attendance monitoring, and detailed attendance reports. Beyond serving its immediate users, the PTIS is envisioned as a model for future research and development initiatives aimed at creating educational tools that enhance parent-teacher engagement and ultimately contribute to the betterment of student outcomes.

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INTRODUCTION

Parent-teacher communication and collaboration have grown in this age of connectedness and technology. New technologies like emails, messaging apps, online platforms, and virtual meetings enable more frequent and easy connections. These advancements have made communication easier and revealed a child's progress, needs, and obstacles. In this introduction, this study will discuss parent-teacher communication and collaboration, its role in improving educational outcomes, and the tools and practices have arisen to support it. Education shapes society, just as it shapes our youth's intellectual, social, and emotional development. Effective parent-teacher communication and teamwork help students succeed. To enable their participation in inclusion, parents must communicate and collaborate with school staff, especially teachers involved in their children's education [1]. These relationships are crucial to parent-teacher collaboration. Communication and teamwork are the foundations of a successful educational environment.

Every organisation, school, and home needs it [2]. Modern communication relies on technology, especially IT. Through this integration, it resulted in the development new communication services methods, protocols, and devices to enhance the efficiency and efficacy of human contact. Innovative teaching methods, digital breakthroughs, and a focus on involving students, parents and teachers in a full learning experience are replacing traditional educational paradigms in our fast-changing world. The majority of school behaviour issues and their remedies involve communication [3,4,5]. Monitoring children's academic and extracurricular growth is crucial to achieving educational goals [6]. Parents and teachers collaborate to monitor a student's academic achievement and extracurricular activity. Even worse, parental involvement in school achievement is at an all-time low. Because many schools and parents do not value this function, parents are not aware of their children's school activities and performances [7]. This emphasises how important it is to have a complete solution in a website like Parent-Teacher Interaction System (PTIS).

This project aims to develop a web application that meets the requirements of parents and teachers in primary school as a response to being more concerned about the child's or student's development. The website system is designed to make it easier to track academic, co-curricular and extracurricular performance results; general feedback for parents to address their concerns about the school; language support; and a PTIS chatbot for parents and teachers to easily ask it to navigate the features in the system. In addition, the system offers daily attendance tracking and reporting, a school announcement page, and an event calendar for tracking school activities. The purpose of adding these unique features is to make this website more relevant and useful in educational settings. [8,9,10]

Related System

This section discusses about the review of the technologies applied in similar applications or system within the studied research demonstrates an emphasis on communication and collaboration systems needed in education to ensure easy and constant contact between parents and teachers. On the other hand, this article seeks to analyze and assess four websites or applications, namely ClassDojo, Bloomz, ParentSquare, and Seesaw.

Sam Chaudhary and Liam Don established ClassDojo in 2011 to connect teachers, students, and parents. It supports React and Node.js web and mobile apps with real-time data updates, cloud storage, and secure communication protocols. Instant comments and over 35 language translations help ClassDojo foster a healthy classroom culture. Its behavior tracking may emphasize extrinsic rewards, and it lacks advanced instructional material management features like Google Classroom. It improves parent-teacher relations and learning [11].



Figure 1. ClassDojo logo

Chaks Appalabattula established Bloomz in 2013 to improve educator-parent-student interactions. It facilitates communication using real-time messaging, cloud storage, and secure protocols. Behaviour tracking, calendar sharing, and volunteer coordination are available via Bloomz's web and mobile apps. Bloomz creates a comprehensive communication centre, however some users find the feature set overwhelming and highlight photo/video storage limitations in the free edition. Bloomz strengthens school-home bonds and encourages family involvement in education [12].



Figure 2. Bloomz logo

ParentSquare is a K-12 school communication network that engages educators, students, and parents. In 2011, Anupama Vaid and Sohit Wadhwa started it. The platform uses secure messaging, real-time data updates, cloud storage, and strong data privacy. It supports app notifications, emails, texts, and voice communications and translates over 100 languages. Some consumers complain about its drawbacks. New users may find ParentSquare's feature set daunting, and it lacks advanced educational material management tools like Google Classroom. ParentSquare improves school-home communication and creates a supportive learning environment [13].



Figure 3. ParentSquare logo

Adrian Graham, Carl Sjogreen, and Alvin Yuhas founded Seesaw in 2013. New IT solutions including real-time data updates, cloud storage, and secure communication protocols let teachers, students, and parents communicate. It uses React for front-end and Node.js for back-end services for web and mobile apps. Seesaw makes learning fun by letting students share photographs, videos, and drawings with teachers and parents. It also supports non-English-speaking families by automatically translating communications into 55 languages.



Figure 4. Seesaw logo

Compare the proposed system to four similar applications. Bloomz and ClassDojo serve teachers, students, and parents. ParentSquare and Seesaw are only available to parents and teachers. The table shows that other similar apps don't have co-curricular and extra-co-curricular activities, chatbots, or donation collection monitoring, except ParentSquare's donation collection tracking features. These four apps emphasise academic success and behaviour tracking. This proves the proposed system is necessary and valuable for parents and teachers. The website integrates with the proposed system, while the remaining four applications leverage both the website and mobile platforms. The suggested system tracks academics, co-curricular, and extra-co-curricular activities to assess students' progress and club engagement in the form of results. A chatbot on the website will improve the user experience by making system navigation easier. The suggested system's donation collection tracking table records parent donations. The portfolio then lists students' addresses, allergies, emergency contacts, and teacher feedback. The proposed system may employ a user-friendly interface website design and other elements like the four system functionalities.

Table 1. Comparison Between Existing System and Proposed System

Features Available	Class Dojo	Bloomz	ParentSquare	Seesaw	Proposed System
Academics tracking	X	√	√	√	√
Co-curricular and extra-curricular Tracking	X	X	X	X	√
ChatBot	X	X	X	X	√
Donation collection tracking	X	X	X	X	√
General feedback for parents	√	√	√	√	√
Language Support	√	X	√	√	√

* ✓ Function Available, ✗ Unavailable*

METHODS

Questionnaire Design

The research technique utilised a quantitative approach by employing the System Usability Scale (SUS) method through a structured questionnaire. The questionnaire consists of four sections: Section A is dedicated to collecting demographic data from the parents and teachers, Section B investigates their interactions with the system, Section C examines their preferences for the development of the proposed system and Section D analyses the user opinions and recommendations about developing the proposed system.

Data Collection

The researcher has distributed 20 questionnaires using Google Form to parents and teachers in primary school in Putrajaya. The justification for employing this strategy lies in its extensive scope and capacity to methodically gather a

wide range of comments. The sample size of 49 respondents is considered sufficient to yield useful insights into the communication and collaboration requirements of the target audience, thus informing the system's development.

Analysis

The collected data from the questionnaires was systematically analyzed to gain insights into the current communication practices between parents and teachers, their satisfaction levels, and the specific needs that should be addressed by the Parent-Teacher Interaction System (PTIS). The analysis was segmented into several key areas: the demographic profile of the respondents, the communication channels currently in use, the familiarity with existing systems or mobile applications that facilitate parent-teacher interactions, and the challenges encountered in communication. A summary of key findings is illustrated in Table 2

Demographic Profile

The demographic data revealed a balanced representation of both parents and teachers, ensuring that the feedback reflects the perspectives of all primary stakeholders. The responses indicated that most parents and teachers are accustomed to using popular communication tools like WhatsApp, with a smaller proportion relying on email or Telegram for their interactions.

Communication Channels and Satisfaction

A significant portion of respondents indicated a preference for WhatsApp as their primary communication channel, citing its ease of use and instant messaging capabilities. However, despite the widespread use of WhatsApp, there was a notable dissatisfaction with the effectiveness of these communication methods, particularly concerning the lack of structured feedback and the challenges in tracking student progress in a streamlined manner. This dissatisfaction highlights the need for a dedicated platform like PTIS that can provide more comprehensive and organized communication.

Familiarity with Existing Systems

When asked about their familiarity with any systems or mobile applications designed specifically for parent-teacher communication, a substantial number of respondents indicated a lack of awareness. This finding underscores the potential impact of PTIS, as it addresses a clear gap in the current market by offering a system that is tailored to the needs of both parents and teachers in primary schools.

Challenges in Communication

The analysis also revealed several challenges faced by parents and teachers in their communication efforts. Issues such as miscommunication, lack of a proper method to communicate, and time constraints were frequently mentioned. These challenges highlight the importance of developing a system like PTIS that can facilitate clearer, more effective communication while accommodating the busy schedules of both parents and teachers.

Overall, the analysis of the questionnaire responses confirms the necessity and relevance of the PTIS. The insights gained from this analysis will inform the further development of the system, ensuring that it meets the specific needs and preferences of its users.

Table 2. Summary of key findings from the questionnaire responses

Category	Sub-category	Frequency
Respondent Type	Parents	29
	Teacher	20
Preferred Communication Channels	WhatsApp	42
	Email	2
	Telegram	5
Familiarity with Existing Communication Systems	Yes	19
	No	30
Familiarity with Existing Communication Systems	Miscommunication between parents and teachers	7
	Lack of a proper method to communicate	21
	Time constraints between parents and teachers	9
Challenges in Communication	No communication challenges	19

Requirements

A requirement is a comprehensive specification that defines the objectives and anticipated behaviour that the system should strive to accomplish [8]. It serves as the foundation for the system's planning, design, and development procedures. Requirements can be classified into three distinct categories: functionality, non-functionality, and usability. Based on the questionnaire replies, the respondents have identified and confirmed specific system needs that they want to be included in the system.

Table 3. Proposed System Requirements Gathered from Stakeholders

Requirement Description	Type	Stakeholder
The system allows users to register and login using a valid email, username, and password.	Functional	Parents, Teachers, and School Admin
The system allows users to update their profile.	Functional	Parents and Teachers
The system allows users to input and update the data of the academic, co-curricular and extra- co-curricular activities.	Functional	Teachers
The system allows users to view the academic, co-curricular and extra-co-curricular activities report.	Functional	Parents and Teachers
The system allows users to input the attendance and student portfolio of the student's data according to the user classes.	Functional	Teachers
The system allows users to view the attendance report and student portfolio.	Functional	Parents and Teachers
The system displays the calendar and view the school events to the users. The authorized users only can mark the school events in the calendar at the system.	Functional	Parents and Teachers
The users can send email to the other users or click the users telephone number at the contact form in the system.	Functional	Parents and Teachers
The users can ask chatbot in the system to navigate any features that cannot be find in the system.	Functional	Parents and Teachers
The authorized users can send any school announcement in the system and view the school announcement post.	Functional	Parents and Teachers
The system provides general feedback to give feedback about the school and system.	Functional	Parents
The system provides an admin interface to manage academic, co-curricular and extracurricular results, classes, subjects, teachers, parents, students and donation collection tracking databases.	Functional	School Admin
The system allows users to view the donation collection amount that the school has been collected.	Functional	Parents and Teachers
The system implements caching mechanisms, optimize database queries, and consider load balancing for better performance.	Non- Functional	Parents, Teachers and School Admin
The system should be able to perform in any type of web browser such as Google, Windows Explorer, Mozilla Firefox and etc.	Non- Functional	System
The system should comply with relevant data privacy regulations to protect customer data and maintain confidentiality.	Non- Functional	System
The system should regularly backup data to prevent data loss and ensure a reliable and secure backup storage solution.	Non- Functional	System
The system should have scalability to accommodate all the reports such as academics, attendance, student portfolio and co- curricular and extra-co-curricular.	Non- Functional	System
The users should be able to add, edit, delete, print and view all the reports such as academics, attendance, student portfolio and co- curricular and extra- co-curricular.	Usability	Parents and Teachers
The system will create an intuitive and visually appealing dashboard for parents, teachers and school admin.	Usability	System
The system should be able to send and receive messages between parents and teachers	Usability	System
The system needs to conduct user testing for interface usability. Ensure a clean and organized layout for easy navigation.	Usability	System

UML Design

The use case diagram above states a few of the features on the PTIS website. The teacher has the ability to update co-curricular and extra-co-curricular activities, attendance records and student profile. In addition to that, the use case “mark the calendar for a school event” involves the teacher selecting a date and entering the school event on the chosen day. Parents and teachers have access to view co-curricular and extra-co-curricular activities, attendance records and student profile. Both users have the ability to access the updated calendar.

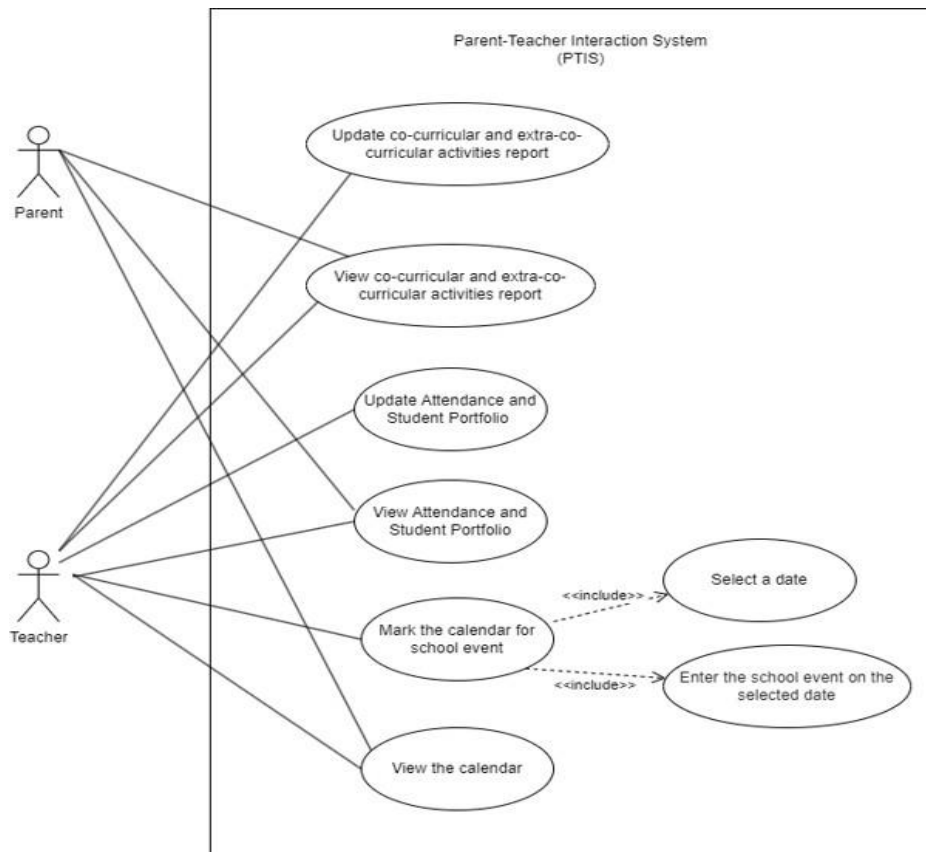


Figure 5. Use Case Diagram

RESULTS

Agile software development is ideal for this project due to its phases. Agile software development anticipates the need for flexibility and incorporates practicality into product delivery, according to the agile thought process.

Programming Language

Selecting programming languages is vital for Visual Studio Code website development success and speed. HTML, CSS, JavaScript, and PHP are used. HTML, created in 1991 by Tim Berners-Lee, is vital for web content organization but has stylistic and semantics constraints. CSS styles, modularizes, and responsively designs HTML, but browser compatibility and complexity are issues. Interactivity and asynchronous programming with a broad framework ecosystem are available in JavaScript. Server-side scripting language PHP makes dynamic content production and database interaction easy and integrated. Use of these languages improves website creation.

Technology Used

Visual Studio Code is a versatile source code editor that works on multiple platforms. It is renowned for its extensions, advanced code editing features such as IntelliSense, and its ability to handle debugging, version control integration, and job automation. The software provides a streamlined structure that accommodates various programming duties, making it a favoured option among developers. phpMyAdmin is a freely available web-based administration tool specifically created for efficiently managing MySQL and MariaDB databases using a graphical user interface. It streamlines database administration activities such as establishing, removing, and altering databases, tables, and rows, as well as executing SQL queries and controlling user permissions. XAMPP, developed by Apache Friends, is a cost-free and open-source bundle of web server software that comprises the Apache HTTP Server, MySQL database server, PHP

interpreter, and Perl interpreter. The software offers a user-friendly installation package that allows for the establishment of a comprehensive web-server environment on personal computers, enabling convenient local web development and testing on Windows, Linux, and MacOS operating systems.

Finding and Discussion

Below is a comprehensive depiction of the user interface, along with a thorough examination of its features. This visual image serves as navigational assistance, assisting users in understanding the structure and features of the interface accurately. The following explanation explores the specifics of each element, providing useful insights into how users interact with the website and how to best utilize its various features.

Figure 6 shows the login page that registered users use to securely access the system by entering their email and password. The input fields accept user data, and validation checks verify it before submission. The server receives the credentials and verifies them against phpMyAdmin's user database after pressing "Login Now". The system gives access to valid users and displays error messages for authentication failures. Successful authentication generates a session that allows website navigation without re-entering login information. Users automatically access dashboard pages after logging in. Logging out deletes session data and redirects users to the login page. A login page is a safe and easy mechanism for users to verify their identity and access restricted content or services.



Figure 6. Interface of Login Page

Figure 7 shows the registration page. Users should enter their information securely and easily on the registration page to store it properly in the programme. Users must provide their full name, email, and strong password to register. To confirm the password, decide whether the user is a parent or teacher, input the school administrator's code, and choose a profile image, meeting the registration conditions stated in the figure above. The registration process is user-friendly for convenience. Already registered users can quickly access the login page by selecting the text underneath the "Register Here" button. This design simplifies registration for returning customers, making service access quicker. This user-centric method prioritizes registration security and system accessibility and efficiency.

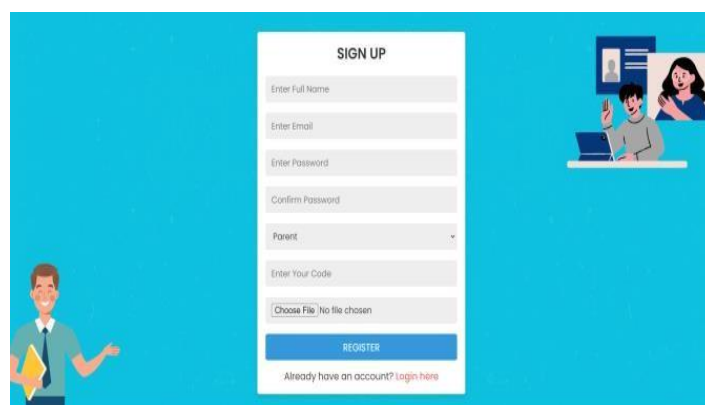
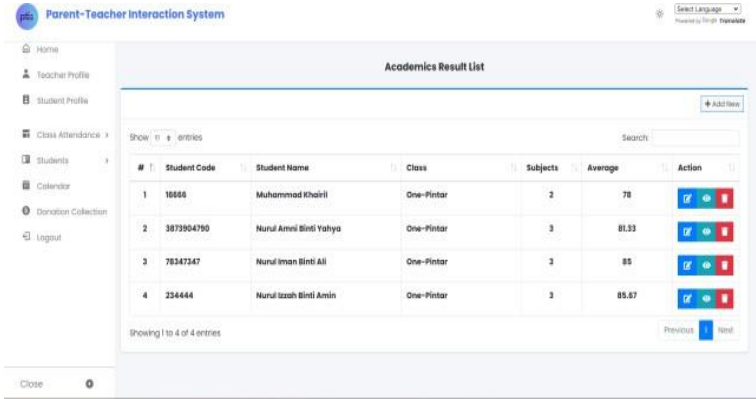


Figure 7. Interface of Register Page

This functionality allows users, such as teachers and school administrators, to conveniently manage students' academic results by adding, editing, deleting, and viewing them. The view option enables the user to generate a printout of the results, facilitating convenient reference and documentation. By integrating these crucial elements into the PTIS website system, the project immediately tackles the stated problem statement of the insufficient provision of information on academic achievement for parents and teachers. This implementation provides parents and teachers with immediate access to up-to-date academic data, which improves decision-making and facilitates communication about student achievement.

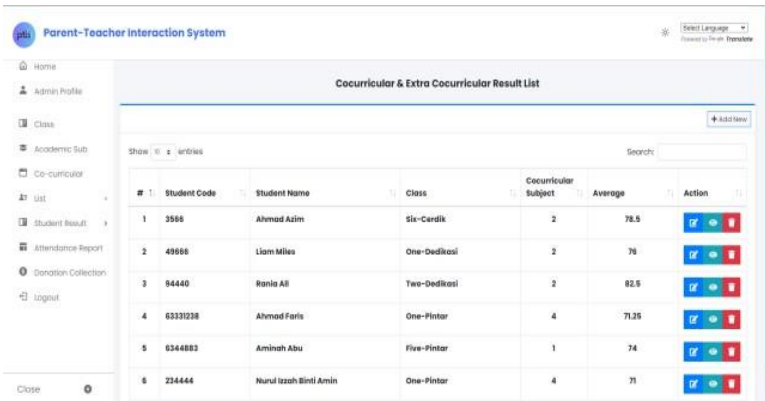


The screenshot shows the PTIS interface with a sidebar menu on the left and a main content area titled 'Academics Result List'. The table displays the following data:

#	Student Code	Student Name	Class	Subjects	Average	Action
1	10006	Muhammad Khairil	One-Pintar	2	78	[View] [Edit] [Delete]
2	3873904790	Nurul Anni Binti Yahya	One-Pintar	3	81.33	[View] [Edit] [Delete]
3	78347247	Nurul Iman Binti Ali	One-Pintar	3	85	[View] [Edit] [Delete]
4	234444	Nurul Izzah Binti Amin	One-Pintar	3	85.67	[View] [Edit] [Delete]

Figure 8. Interface of Academics Result List

Figure 9 is a feature that allows instructors and administrators to easily add, modify, delete, and view students' co-curricular and extracurricular achievements. These results can be printed using the view button for reference and documentation. The project solves the problem statement of parents and teachers not having enough information regarding co-curricular and extra-curricular performance by adding these crucial functions to the PTIS internet system. This implementation helps parents and educators understand students' holistic development beyond academics and promote their different interests and abilities. This project promotes a collaborative, well-rounded educational environment by increasing transparency and communication about students' non-academic activities.



The screenshot shows the PTIS interface with a sidebar menu on the left and a main content area titled 'Cocurricular & Extra Cocurricular Result List'. The table displays the following data:

#	Student Code	Student Name	Class	Cocurricular Subject	Average	Action
1	2566	Ahmad Azim	Six-Cendik	2	78.5	[View] [Edit] [Delete]
2	49668	Liam Miles	One-Dedikasi	2	76	[View] [Edit] [Delete]
3	94440	Rania Ali	Two-Dedikasi	2	82.5	[View] [Edit] [Delete]
4	6333038	Ahmad Faris	One-Pintar	4	71.25	[View] [Edit] [Delete]
5	6344883	Aminah Abu	Five-Pintar	1	74	[View] [Edit] [Delete]
6	234444	Nurul Izzah Binti Amin	One-Pintar	4	71	[View] [Edit] [Delete]

Figure 9. Interface of Co-curricular and Extra-curricular Result List

In figure 10, Parents can voice their opinions, complaints, and suggestions regarding the school in general using this option. The stated problem statement concerning parents not being able to provide general input about the school is immediately addressed by this project by adding this feedback option to the PTIS website system. By using this function, parents can participate in school activities, provide their thoughts on the classroom, and help with efforts to make the school better. Students' educational experiences and the relationship between home and school will both benefit from this initiative's stated goal of encouraging open lines of communication between the two parties.

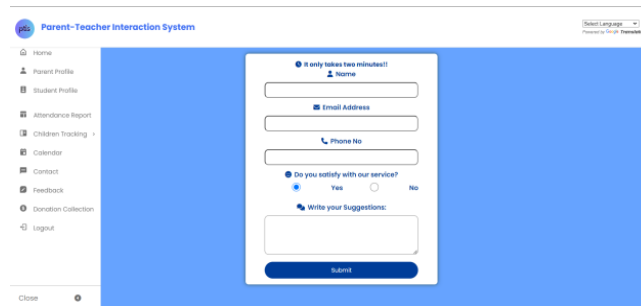


Figure 10. Interface of General Feedback for Parents

Figure 11 shows an interface of a function that helps parents who do not speak Malay language, the primary language of education. By adding language support to the PTIS website, the project addresses the language barrier issue. This function lets parents and teachers of different languages read school updates, announcements, and academic progress reports in their preferred language. This effort promotes inclusivity, accessibility, and effective engagement for all parents, regardless of language competency, creating a more supportive school community where all parents may actively participate in their child's education.

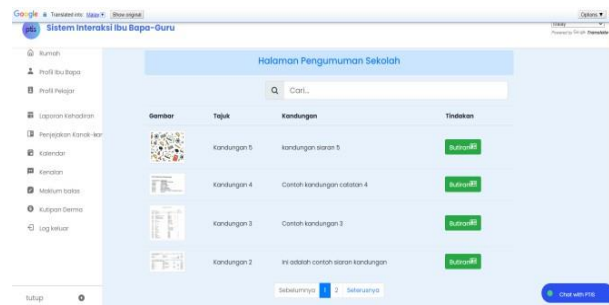


Figure 11. The interface of the School Announcement Page incorporates language support features

CONCLUSION

In conclusion, the development of the Parent-Teacher Interaction System (PTIS) marks a significant step forward in enhancing the communication and collaboration between parents and teachers in primary schools. By addressing critical challenges such as insufficient information on student academic and extracurricular activities, limited feedback mechanisms, and language barriers, the PTIS provides a comprehensive solution that fosters a supportive and transparent educational environment. The system's features, including real-time tracking of student performance, language support, and a user-friendly interface, empower parents to play a more active role in their child's education. Ultimately, the PTIS not only bridges the communication gap between home and school but also sets a benchmark for future educational tools aimed at improving student outcomes. Through continued use and refinement, the PTIS has the potential to significantly contribute to the academic success and holistic development of students, reinforcing the vital partnership between parents and educators. This article contributes to the field of educational technology by introducing and developing the Parent-Teacher Interaction System (PTIS), a web-based platform designed to enhance communication and collaboration between parents and teachers in primary schools. The first contribution of this study is to highlight significant communication barriers between parents and teachers, such as insufficient access to student performance data, limited feedback mechanisms, and language barriers. By systematically analyzing these challenges, the study provides a clear understanding of the gaps in current communication practices. Also, the study presents the design and implementation of the PTIS, a platform that addresses identified challenges. The system includes features such as real-time academic and extracurricular tracking, a feedback system for parents, language support, a chatbot for ease of navigation, and an attendance tracking system. These features are tailored to meet the specific needs of primary school stakeholders, making the PTIS a valuable tool for improving parent-teacher interactions. Besides, the PTIS serves as a model for future educational tools aimed at enhancing communication and collaboration in educational settings. The system's design and implementation can be used as a reference for further research and development in the field of educational technology and lastly, the study employs a quantitative approach to gather and analyze user feedback from parents and teachers, ensuring that the development of PTIS is grounded in actual user needs and preferences. This empirical validation strengthens the relevance and effectiveness of the proposed system.

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Conflicts of Interest

The authors declare no conflicts of interest.

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نظام التفاعل بين الوالدين والمعلمين : تطوير نظام التواصل والتعاون بين الوالدين والمعلمين

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المستخلص

تسعى هذه الدراسة إلى تعزيز التواصل والتعاون بين الآباء والمعلمين في المدارس الابتدائية. ويتناول البحث التحديات العديدة التي يواجهها الآباء والمعلمون عند محاولة التواصل والتعاون بشكل فعال، وخاصة في سياق الجداول الزمنية المزدحمة وغياب منصة مخصصة. ولمعالجة هذه القضايا، يهدف هذا البحث إلى اقتراح "نظام تفاعل الآباء والمعلمين"، وهو عبارة عن منصة شاملة تعتمد على الويب ومصممة لسد فجوة الاتصال ودعم الجهود التعاونية بين الآباء والمعلمين. ويتبع تطوير نظام تفاعل الآباء والمعلمين منهجية تطوير برمجيات مرنة، مما يضمن أن تكون المنصة قابلة للتكيف وتركز على المستخدم. ويقدم النظام مجموعة من الميزات مثل التتبع الفوري لأداء الطلاب عبر الأنشطة والدراسات الأكاديمية، وآلية ردود الفعل المنظمة للآباء، والدعم متعدد اللغات، وبرنامج محادثة تفاعلي للاستفسارات الفورية، ومراقبة الحضور اليومي، وتقارير الحضور التفصيلية. وبعيداً عن خدمة مستخدميه المباشرين، يُنظر إلى نظام تفاعل الآباء والمعلمين باعتباره نموذجاً لمبادرات البحث والتطوير المستقبلية التي تهدف إلى إنشاء أدوات تعليمية تعزز مشاركة الآباء والمعلمين وتساهم في نهاية المطاف في تحسين نتائج الطلاب.

الكلمات المفتاحية: التواصل بين أولياء الأمور والمعلمين، التكنولوجيا التعليمية، أنظمة الاتصالات عبر الإنترنت، نظام ردود الفعل للآباء، متابعة أداء الطلاب.