Learn Together: A Web-Based Integrated Study Space for Real-Time Collaborative Learning

[1]Engr. Allen Levin DC. Bautista., [3]Engr. Arvin C. Cabrera., [2]Dr. Ma. Magdalena V. Gatdula., [4]Abel M. Lugtu Jr., [1]Engr. Amado T. Valencia Jr., PECE

[1]Master of Science in Electronics Engineering, Graduate School Bulacan State University, Malolos City, 3000

[2]Professor, Graduate School; University Registrar Bulacan State University, Malolos City, 3000

[3]Master of Engineering in Computer Engineering, Graduate School Bulacan State University, Malolos City, 3000

[4]Master of Science in Computer Engineering, Graduate School Bulacan State University, Malolos City, 3000

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ABSTRACT

The increasing reliance on digital learning has introduced challenges in maintaining effective communication and collaboration among students. Many learners struggle when studying independently due to limited access to immediate academic support, while rising transportation costs reduce opportunities for face to face group study. Although online platforms are available, many do not provide a structured and integrated environment specifically designed for collaborative learning.

This study presents Learn Together, a web-based platform that integrates real-time chat and video conferencing into a centralized study space. The system was developed using modern web technologies to ensure accessibility, usability, and smooth interaction.

The platform includes features such as user profiles, study space creation, messaging, and a community ranking system to support engagement. Initial testing suggests that Learn Together improves communication, supports collaboration, and provides a more accessible approach to group learning. These findings suggest that integrated platforms can help address common challenges in collaborative learning and improve the overall learning experience.

Keywords: Collaborative Learning, Web-Based Application, Online Study Space, Real-Time Communication, Video Conferencing.

INTRODUCTION

Digital platforms have become an important part of how students communicate and learn. Activities such as group discussions and online classes are now commonly conducted through web-based systems that support both real-time and asynchronous interaction. These platforms allow students to collaborate even when they are not in the same location.

However, many students still experience difficulty when studying independently. One of the main challenges is the lack of immediate academic support when encountering difficult topics. In addition, transportation costs make it harder for students to meet for in-person study sessions, which reduces opportunities for collaboration.

Existing platforms such as Zoom, Microsoft Teams, and Discord provide communication tools, but they are not specifically designed for structured academic collaboration. Users often switch between applications, which can interrupt communication and reduce efficiency.

Learn Together was developed to address these limitations by providing an integrated web-based platform that combines real-time chat and video conferencing within a dedicated study space. The system supports continuous interaction and offers a more organized and accessible environment for collaborative learning.

Background of the Problem

The increasing reliance on digital platforms has changed how students approach learning. While online resources are more accessible, many students still experience challenges, especially when studying on their own. One of the main concerns is the lack of immediate academic support. When students encounter difficult topics, they often have no one to consult, which can slow down their understanding.

Economic factors also limit collaboration. The rising cost of transportation makes it more difficult for students to meet for face to face group study sessions. As a result, opportunities for discussion and peer support are reduced.

At the same time, existing platforms do not fully address these challenges. While many tools offer messaging or video conferencing, they are often not integrated into a single environment. Students need to switch between applications, which can interrupt communication. In addition, most platforms are not designed specifically as study spaces.

Because of these issues, there is a need for a system that supports real-time communication and structured collaboration. This study introduces Learn Together as a centralized platform designed to improve how students interact and learn together.

Specifically, this study aims to answer the following questions:

1. What challenges do students face when studying independently?
2. How does the lack of immediate guidance and interaction affect their learning process?
3. How do rising transportation costs influence students' participation in face-to-face collaborative learning?
4. What are the limitations of existing online learning platforms in supporting collaboration?
5. How can an integrated online study space improve communication, collaboration, and overall learning experience?

Project Rationale

The development of Learn Together is driven by the need to address the challenges faced by students in both independent and collaborative learning. The lack of immediate support, inaccessibility of group study opportunities, and inefficiency of existing platforms are some of the key challenges that drive the development of Learn Together.

With the integration of communication tools in a single platform, Learn Together offers a structured and interactive environment for studying, which can help in making the process more efficient and independent.

Objectives

General Objectives:

To develop an integrated web-based platform that improves communication and collaboration among students.

Specific Objectives:

1. Identify challenges in independent and collaborative learning
2. Develop a platform with real-time chat and video conferencing
3. Improve accessibility to collaborative learning despite physical and economic limitations
4. Enhance student engagement through interactive system features

Significance of the Study

This study provides a practical solution to the challenges faced by students in modern learning environments. It benefits:

- **Students**, by offering a platform for accessible and collaborative learning
- **Educators**, by improving communication and interaction
- **Institutions**, by providing a scalable and cost-efficient digital solution

The study also contributes to the advancement of educational technology by promoting integrated and student-centered learning platforms

Sustainability Perspective

Learn Together supports sustainable learning by reducing the need for physical meetings and transportation. This minimizes costs and environmental impact while promoting accessible education through digital means.

LITERATURE REVIEW

Studies show that collaborative learning improves student engagement and understanding, especially when students are able to interact and share ideas in a group setting (Chim et al., 2024; Bach & Thiel, 2024). In online environments, real-time communication also plays an important role in maintaining active participation and allowing students to receive immediate feedback during discussions (Learning, Culture and Social Interaction, 2024). Research further suggests that technology-enhanced collaborative systems improve participation, engagement, and overall learning experience when properly integrated into a structured environment (International Journal of Educational Research, 2024; Smart Learning Environments, 2025).

Digital platforms support this process by allowing users to communicate and collaborate in real-time. Systems that integrate messaging and video conferencing provide a more effective experience compared to platforms where these features are separate (Systems and Soft Computing, 2025).

However, many existing platforms such as Zoom and Microsoft Teams are designed for general communication rather than structured academic collaboration. While they offer reliable features, they do not provide a dedicated study environment where students can organize sessions and maintain focused group interaction.

Similarly, platforms like Discord offer flexible communication but are not specifically designed for academic use, which may affect how structured and productive study sessions are managed.

These limitations show the need for a platform focused on collaborative learning. Learn Together addresses this gap by providing an integrated environment where students can communicate and study more effectively.

METHODOLOGY

Project Design

The Learn Together system utilizes a client-server system, whereby the frontend is responsible for user interaction, and the backend handles all data and communication processes. The frontend is responsible for presenting the interface and enabling users to interact with the system, while the backend facilitates real-time updates and system operation.

The system was developed using React JS for the user interface, Firebase Realtime Database for data management, and PeerJS for video communication. React JS was selected for its ability to create responsive and interactive interfaces. Firebase was used to handle real time data synchronization without requiring complex server setup. PeerJS was implemented to support direct peer-to-peer video communication between users.

By combining these technologies, the system was able to provide both chat and video conferencing features within a single platform, ensuring a smooth and consistent user experience.

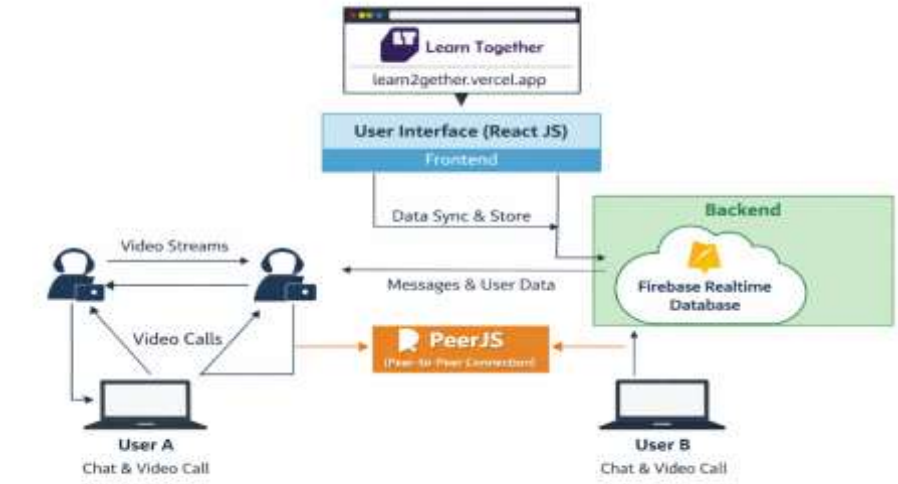

Figure 1. Learn Together System Schematic Diagram

Figure 2. Learn Together System Block Diagram and System Flowchart of User Interaction

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Testing

System testing focused on functionality, usability, and performance. Features such as login, messaging, and video conferencing were tested under normal usage conditions. The system was observed to ensure that real-time communication remained stable and responsive.

Basic usability testing was also conducted to evaluate how easily users could navigate the platform and perform common tasks. Results showed that users were able to interact with the system without difficulty, indicating that the interface is clear and user-friendly.

Scope

The study focuses on the development of a web-based platform that supports collaborative learning through real-time communication. The system includes features such as user account management, study space creation, messaging, and video conferencing.

The platform is designed for small group use, where students can interact, exchange ideas, and participate in discussions within a shared virtual environment. It provides an accessible alternative to traditional group study by allowing users to connect and collaborate without the need for physical meetings. The design of the system centers on creating a simple and organized space that supports continuous interaction during study sessions.

Major Breakdown Structure (MBS)

The project was divided into six main phases:

1. **Project Planning**

- Requirement Gathering
- Timeline & Resource Planning

2. **System Design**

- UI/UX Design
- Architecture Design

3. **Development**

- Frontend Development (Chat Interface, Video Layout)
- Backend Development (Server, Database, API Integration)

4. **Feature Integration**

- Chat Feature Integration
- Video Conferencing Integration

5. **Testing**

- System Testing
- Bug Fixing & Improvements

6. **Final Presentation**

- Present the completed system to the Professor

Scheduling Strategy

The Critical Path Approach (CPA) was used in the scheduling of the tasks. This ensured that the development and testing of the project were given priority. This helped in the efficient completion of the project.

To assist in the scheduling of the project, the project management tool ProjectLibre was used. This tool helped the project management team schedule the project. With the tool, it was possible to generate a Gantt chart. This helped the project management team in the efficient completion of the project. With the Gantt chart, it was possible to monitor the project's progress. Additionally, it helped in the identification of the overlapping of the tasks. A screenshot of the Gantt chart generated is presented in the document.

Table 1. List of project activities, durations, and predecessors.

Activity ID	**Activity Description**	**Duration (days)**	**Predecessor(s)**
A	Project Planning	3	—
B	System Design	7	A
C	Frontend Development	6	B
D	Backend Development	7	B
E	Chat Feature Integration	5	C, D
F	Video Conferencing Integration	7	C, D
G	System Testing	4	E, F
H	Final Presentation	1	G

The entire list of tasks involved in creating the Learn Together platform is displayed in Table 1. The tasks are organized according to the sequence in which they must be finished, beginning with system design and project planning. Following the planning phase, the frontend and backend development process begins. Since the chat and video features rely on the earlier development tasks, they can be integrated once both are completed. System testing and the final presentation are the final two tasks. It is simpler to comprehend how the work progresses from one step to the next and which tasks depend on the completion of others when the activities are arranged in this manner.

Table 2. Manual Slack (Float) Computation

Formula: Slack = Late Start – Early Start

Activity ID	**Early Start**	**Late Start**	**Slack**	**Critical? YES OR NO**
A	0	0	0	Yes
B	3	3	0	Yes
C	10	11	1	No

D	10	10	0	Yes
E	17	19	2	No
F	17	17	0	Yes
G	24	24	0	Yes
H	28	28	0	Yes

For each task in the project schedule, Table 2 displays the slack, or "float." Slack shows the amount of time that a task can be postponed without impacting the project's final completion date. Several tasks in this project have zero slack, which means they cannot be postponed at all. The following tasks make up the critical path:

- A – Project Planning
- B – System Design
- D – Backend Development
- F – Video Conferencing Integration
- G – System Testing
- H – Final Presentation

Since these activities feed directly into one another, a delay in any of them will automatically push the entire project timeline out.

On the other hand, there are activities with a small amount of slack:

- C – Frontend Development has 1 day of slack
- E – Chat Feature Integration has 2 days of slack

This means Activities C and E can be delayed slightly without affecting the final completion date. Knowing which activities are critical helps the team focus their attention on tasks that must be prioritized, while also giving some flexibility for tasks that have limited slack.

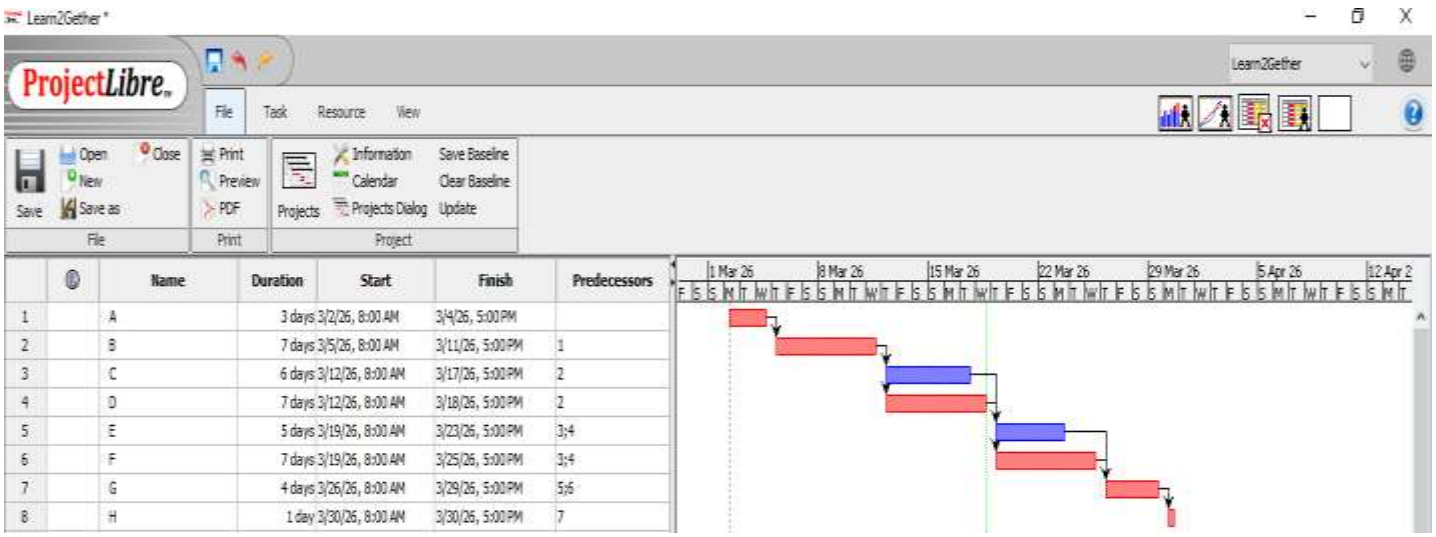

Figure 3. The ProjectLibre simulation shows the Gantt Chart for the Learn Together project, and the focus is on the duration of the tasks, their sequence, and the dependencies used in the scheduling process.

Execution Strategy

The project was carried out in phases, beginning with planning and design, followed by system development, testing, and final deployment. Each stage was completed step by step to ensure that the system was stable before moving to the next phase.

Regular monitoring and progress evaluation were conducted throughout the development process. This allowed the team to identify issues early and make necessary adjustments. By maintaining consistent communication and tracking progress, the team was able to complete the project within the planned schedule.

Table 3. Project phases with corresponding key activities and expected outputs.

Phase	Key Activities	Expected Outputs
Phase 1 - Planning	Define project scope, objectives, and overall plan	Clear project direction and defined goals
Phase 2 - System Design	Create system architecture and design components	Structured system design and technical blueprint
Phase 3 - Development	Develop frontend and backend features	Functional system with integrated chat and video features
Phase 4 - Testing	Perform system testing and fix identified issues	Improved system performance and reduced errors
Phase 5 - Presentation	Prepare and present the final system	Completed and ready-to-use platform

Resource Management

Table 4. Resource Type, Description, and Allocation Rationale

Resource Type	**Description**	**Allocation Rationale**
Human Resources	Project manager, developers, and testers involved in the system development	Each role was assigned to ensure proper task distribution, quality control, and smooth project coordination
Technical Resources	Computers, stable internet connection, and development tools	These were necessary to support coding, testing, and real-time communication during development
Software Resources	React JS, Firebase Database, and PeerJS	Selected to efficiently build a real-time web application, support scalability, and simplify video and chat integration

Team and Communication Structure

The project followed a collaborative team structure:

- **Project Manager:** Oversees overall project execution
- **Developers:** Responsible for coding and system integration
- **Testers:** Ensure quality and functionality of the platform

Communication was maintained through regular meetings, online messaging platforms, and task management tools to support coordination and efficiency throughout the project.

Risk Analysis

Several risks were considered during the development of the platform. Technical risks included possible issues in integrating chat and video features, as well as performance limitations during real time communication. These risks were managed through continuous testing and gradual integration of system components.

Schedule related risks were also identified, particularly delays in backend development and feature integration. To address this, the team monitored task dependencies closely and adjusted workloads when needed.

The project also faced resource related challenges due to the limited size of the development team. Clear role assignment and regular communication helped reduce the impact of this limitation.

External factors such as unstable internet connectivity were also considered, as they directly affect system performance. The platform was tested under different network conditions to ensure acceptable functionality.

Table 5. Risk, Potential Impact, and Mitigation Strategy.

Risk	Potential Impact	Mitigation Strategy
Integration issues between chat and video features	May cause system errors or failure in real-time communication	Conduct continuous testing and integrate features gradually to identify issues early
Backend development delays	Can affect overall project timeline and delay completion	Monitor task progress closely and adjust workload or priorities when needed
Limited development team	May lead to slower progress due to multiple responsibilities	Assign clear roles and maintain regular communication among team members
Unstable internet connection	Can disrupt system performance, especially during video conferencing	Test the system under different network conditions and optimize performance

RESULTS

The platform successfully integrates chat and video conferencing into a single environment, allowing users to communicate and collaborate without switching between applications.

Basic user testing showed that the system performs well under small group conditions. Users were able to create study spaces, send messages, and join video calls without major issues. The system maintained stable performance within the current limit of five users per study space.

Feedback from users indicated that the platform is easy to use and helpful for group study. Many users found the integration of chat and video conferencing convenient, as it reduced the need to use multiple applications.

These results suggest that the platform is effective for its intended purpose, although further testing with a larger number of users is recommended.

Project Outputs / Deliverables

The Learn Together platform successfully delivered a functional web-based system that integrates communication and collaboration tools into a single environment. The platform includes key features such as a User Profile System, Study Spaces (Virtual Rooms), Messaging System, and a Community and Ranking System.

The User Profile System allows personalization through profile pictures, bios, and tracking of focus time and activity status. Study Spaces enable users to create and join virtual rooms for video conferencing and group study, with moderation and access control features. The Messaging System supports real-time communication through organized chats and inbox management. Meanwhile, the Community and Ranking System promotes engagement by highlighting active users and encouraging participation.

Schedule Performance

The project was completed within the planned schedule using the Critical Path Approach (CPA). Key tasks such as system design, backend development, and video conferencing integration were completed on time. Minor delays occurred in non-critical activities like frontend development and chat feature integration; however, these did not affect the overall project timeline due to available slack.

Sustainability Outcomes

The platform promotes sustainability by reducing the need for physical meetings and transportation. By enabling online collaboration, it minimizes costs and environmental impact while improving accessibility to learning. The digital nature of the platform supports efficient resource use and aligns with sustainable education practices.

Observed Issues

During system testing and development, several issues were observed. Occasional delays in video communication and performance slowdowns occurred when multiple users were active simultaneously.

As new features were added, additional system issues were identified, requiring continuous debugging and adjustments. This shows the complexity of integrating multiple real-time functionalities into a single platform.

In addition, the limited number of developers led to a higher workload per member, which extended the development time. These challenges suggest the need for improved resource allocation and more efficient development processes in future work.

DISCUSSION

Interpretation of Results

The results show that integrating communication tools into a single platform improves collaboration and interaction among students. Features such as study spaces and messaging support real-time engagement, while the overall structure provides a more organized learning environment.

The platform addressed the lack of structured collaborative environments by providing a centralized space where students can communicate and interact in real time. These findings suggest that integrated platforms offer a more effective approach compared to using separate tools.

While the results are based on initial testing, they provide a clear indication of the platform’s potential. Further evaluation involving a larger number of users may provide additional insights into its long-term effectiveness.

Project Management Insights

The use of structured project management techniques, particularly CPA and Gantt chart scheduling, contributed to the project’s success. Identifying critical tasks allowed the team to prioritize essential activities and avoid delays. Continuous monitoring and phased execution ensured smooth progress and efficient task completion.

Decision-Making Reflections

Decision-making played a crucial role in the success of the project, particularly in choosing the right tools and technologies for web development. Selecting React JS, Firebase, and PeerJS enabled efficient implementation of real-time features such as chat and video conferencing.

Choosing appropriate tools simplified system integration, reduced development complexity, and improved overall performance. This emphasizes that selecting the right technology stack is a critical factor in building a functional and scalable web platform, as poor tool selection could lead to inefficiencies, delays, and technical limitations.

This demonstrates that proper technology selection directly influences system performance, development speed, and scalability.

Communication Dynamics

Effective communication among team members was a critical factor in the project's success. Regular meetings, updates, and use of messaging tools ensured coordination and clarity of tasks. This collaborative approach minimized misunderstandings and helped maintain alignment with project goals.

Limitations

The results show that the platform is effective in supporting collaborative learning, several limitations should be considered. Screen recording is not included in the video conferencing feature, as the system is primarily designed to support real-time interaction rather than recording or storing sessions.

In addition, the number of users who can join a study space is currently limited to five participants. This was set during development to maintain stable performance and ensure a smooth user experience during real-time communication.

These limitations suggest areas for future improvement, particularly in expanding system capacity and adding optional features that enhance functionality without affecting performance.

Strategic & Sustainability Implications

The project highlights the importance of integrated digital platforms in modern education. By combining communication and collaboration features, Learn Together supports more efficient and accessible learning. Its ability to reduce physical resource use aligns with sustainability goals, while its design supports future expansion and improvement. The platform demonstrates how user-centered and technology-driven solutions can address current educational challenges.

CONCLUSION

The study shows that an integrated web-based platform can improve how students communicate, collaborate, and access academic support, particularly in situations where traditional face to face interaction is limited. Learn Together provides a centralized environment that supports real-time communication, enhances engagement, and makes collaborative learning more accessible.

By combining chat and video conferencing into a single system, the platform reduces the need for physical meetings and supports more efficient interaction. While the system has some limitations, it provides a strong foundation for future development. Further improvements may focus on scalability, security, and performance optimization.

Overall, Learn Together demonstrates how integrated digital platforms can support more effective collaboration and contribute to the continued development of online learning.

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