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DESIGN AND DEVELOPMENT OF GROUP4U MOBILE APPLICATION FOR ACADEMIC COLLABORATION AMONG UNIVERSITY STUDENTS

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ABSTRACT

Collaborative group work is widely implemented in higher education to develop teamwork, communication, and project-based learning competencies. However, students often encounter challenges related to fragmented communication, poor task coordination, unequal workload distribution, and limited progress monitoring during group assignments. Although general-purpose communication and document-sharing platforms are commonly used, these tools often provide fragmented support and are not specifically designed around the workflow of academic group assignments. This study presents the design, development, and usability evaluation of Group4U, a mobile academic collaboration application developed to support university students in managing collaborative group assignments. The study employed a User-Centered Design (UCD) methodology comprising requirement analysis, iterative prototyping, implementation, and evaluation. A formative evaluation involving six participants, comprising three academic experts and three university students, was conducted to identify interface and usability improvement opportunities. This was followed by a summative usability evaluation involving 32 university students using an adapted USE (Usefulness, Satisfaction, and Ease of Use) questionnaire. The findings indicate favourable user perceptions across usefulness, ease of use, and satisfaction, with positive responses ranging from 71.8% to 81.3% across the evaluated items. The originality of Group4U lies in its domain-specific integration of communication, task management, progress monitoring, and document sharing within a unified mobile environment designed specifically for academic group-work workflows, rather than introducing individual collaboration functions that are already available in existing platforms. The study further demonstrates the practical application of UCD in aligning system functionality and interface design with the needs of university students. Practically, Group4U provides a centralized mobile environment that supports

academic group communication, task coordination, progress visibility, and shared resource management. The findings provide practical design insights for the development of user-centered, domain-specific mobile collaboration applications in higher education.

Keywords: Academic collaboration, Collaborative learning system, Mobile application development, Usability evaluation, User-centered design

INTRODUCTION

Collaborative group work has become a fundamental pedagogical strategy in higher education, widely adopted to cultivate essential competencies such as teamwork, communication, problem-solving, critical thinking, and project management skills (Donelan & Kear, 2024). In many academic disciplines, students are expected to work collaboratively to complete assignments, design projects, and produce shared deliverables. Despite its educational benefits, collaborative group work remains a persistent challenge for many students (Al Rahmi et al., 2022). Prior research has consistently identified common barriers including ineffective communication, inconsistent participation, unclear task ownership, poor coordination, and difficulty monitoring individual contributions within group projects (Hadwin et al., 2018). These challenges often lead to unequal workload distribution, delays in task completion, interpersonal conflict, reduced accountability, and overall dissatisfaction with the group work experience (Kovari, 2025). In academic settings where deadlines, structured deliverables, and coordinated effort are critical, inefficient collaboration may negatively affect both learning outcomes and project performance (Kovari, 2025).

The rapid advancement of mobile technologies has transformed how students communicate, interact, and coordinate academic activities. Smartphones have become indispensable tools in higher education due to their portability, accessibility, and continuous connectivity, enabling students to engage in academic collaboration regardless of location or time constraints (Qashou, 2021). The increasing reliance on mobile communication has encouraged students to adopt digital platforms such as WhatsApp, Telegram, Google Drive, and email for group discussions, file exchange, and task coordination. These platforms offer convenience and familiarity, making them widely accepted among student communities. However, although such applications facilitate communication and content sharing, they are primarily designed as general-purpose communication or productivity tools rather than structured academic collaboration systems (Valencia-Arias et al., 2024). As a result, important functionalities required for effective academic group management, including centralized task assignment, progress monitoring, deadline tracking, collaborative documentation, and structured discussion management, are either absent or fragmented across multiple applications (Chowdhury et al., 2021). Students often need to switch between several tools to complete a single collaborative workflow, creating inefficiencies, fragmented information exchange, and communication breakdowns. This fragmented ecosystem increases cognitive burden and reduces the effectiveness of academic teamwork. Recent research has highlighted the potential of mobile-supported collaborative learning systems in improving communication quality, social interaction, and academic engagement. Wang et al. (2022) reported that mobile social applications can positively influence collaborative learning satisfaction through

improved communication and information sharing. Similarly, Treethong et al. (2021) found that mobile group communication platforms support team interaction and social cohesion during collaborative task execution. These findings suggest that mobile technologies can play a meaningful role in facilitating collaborative learning experiences.

From a multimedia and mobile application development perspective, designing an effective collaborative academic platform requires more than merely integrating communication tools. It demands careful consideration of user experience, interaction design, usability, accessibility, and workflow efficiency (Chandran et al., 2022). Applications intended for repeated academic use must present intuitive navigation, minimize cognitive overload, and align closely with actual user needs (Rivera et at., 2021). Poor usability design may reduce adoption, regardless of functional completeness. Consequently, a user-centered development approach becomes essential in ensuring that collaborative mobile systems remain both functional and usable. User-Centered Design (UCD) provides an established framework for designing digital systems that prioritize user requirements, behaviors, and interaction expectations throughout the development lifecycle (Endsley & Jones, 2025). By involving users in iterative requirement gathering, prototyping, and evaluation, UCD helps ensure that the final system aligns with real-world usage scenarios rather than developer assumptions. In mobile application development, this approach is particularly important due to interface limitations, screen constraints, and interaction sensitivity that directly affect usability and user engagement (Quezada et al., 2021).

In response to these challenges, this study presents the design, development, and usability evaluation of Group4U, a mobile academic collaboration application specifically developed to support university students in managing collaborative group assignments. Unlike general-purpose communication tools, Group4U integrates essential academic collaboration functions within a unified Android-based environment, including group communication, task management, progress tracking, and document sharing. The system was developed using a User-Centered Design (UCD) methodology to ensure that its functionality and interface were aligned with the needs and requirements of university students engaged in academic group work. Accordingly, this study aims to achieve two objectives: (1) to design and develop the Group4U mobile application based on the identified needs and requirements of university students engaged in academic group work; and (2) to evaluate the usability of the Group4U mobile application in terms of usefulness, ease of use, and user satisfaction. This research contributes to multimedia and mobile application development by introducing a dedicated mobile collaboration platform tailored to academic group project management, demonstrating the practical application of UCD principles in developing a domain-specific collaborative system, and providing empirical usability findings that offer practical design insights for future academic collaboration applications. By integrating communication, task management, progress monitoring, and document sharing within a unified environment, Group4U aims to provide a more structured and user-centered approach to supporting academic collaboration among university students.

BACKGROUND

Collaborative group work has long been recognized as an essential instructional strategy in higher education, particularly in disciplines that emphasize project-based learning, problem-solving, and

peer interaction (Herrera, 2021). Through collaborative assignments, students are encouraged to develop critical soft skills including communication, teamwork, negotiation, leadership, and shared decision-making. Beyond academic content mastery, group work also prepares students for professional environments where collaboration and collective responsibility are fundamental competencies (Qureshi et al., 2023). As a result, group-based academic activities have become a common pedagogical practice across universities. Despite its educational significance, managing collaborative group work remains challenging for many students. Previous studies have identified persistent issues such as ineffective communication, unclear division of responsibilities, unequal contribution among group members, weak accountability, and difficulties in monitoring overall task progress (Hadwin et al., 2018; Donelan & Kear, 2023; Qureshi et al., 2023). These challenges often create inefficiencies in task execution, interpersonal conflicts, delayed deliverables, and reduced satisfaction with collaborative learning experiences. In many cases, the absence of structured coordination mechanisms causes students to rely heavily on informal communication habits, making academic collaboration inconsistent and difficult to manage.

On the other hand, mobile technologies have significantly influenced how collaborative activities are conducted in educational settings. Smartphones have become highly accessible tools that support continuous communication, immediate information exchange, and flexible access to academic resources regardless of time or location (Goundar & Kumar, 2022). Mobile-supported collaborative learning (MCL) has gained increasing attention due to its ability to facilitate communication, social interaction, and collaborative engagement among students (Wang et al., 2022; Sergeeva et al., 2025). The portability and convenience of mobile devices make them particularly suitable for supporting collaborative academic activities outside traditional classroom boundaries. However, while students frequently adopt mobile applications such as messaging platforms, email services, and cloud-based document sharing tools to support group work, these solutions are often fragmented and not specifically designed for structured academic collaboration (Sophonhiranrak, 2021). Communication may occur through one platform, file sharing through another, and task coordination through separate productivity tools. This fragmented workflow may increase cognitive burden, reduce efficiency, and complicate collaboration management. Consequently, there is a growing need for purpose-built mobile applications that integrate essential collaborative functionalities within a unified academic workflow environment.

Multimedia Principles or Theories

From a theoretical perspective, the design of an academic collaboration mobile application should be grounded in established learning and usability frameworks to ensure that the system supports both effective interaction and meaningful collaborative engagement. One important theoretical foundation is Constructivist Learning Theory, which emphasizes that knowledge is actively constructed through social interaction, collaboration, and shared problem-solving (Zajda, 2021). Since academic group work naturally involves collective discussion, task negotiation, and peer engagement, collaborative mobile platforms should facilitate these interactions in structured and accessible ways (Zajda, 2024). Group4U aligns with this principle by enabling integrated communication, collaborative task management, and shared academic coordination among users. In addition, Cognitive Load Theory (CLT) provides important justification for interface design in collaborative mobile systems. CLT suggests that users have limited working memory capacity,

and excessive interface complexity or fragmented workflows may negatively affect performance and efficiency (Ouwehand, 2025). In academic collaboration contexts, students often need to manage communication, deadlines, files, and progress updates simultaneously. When these functions are distributed across multiple disconnected tools, unnecessary extraneous cognitive load is introduced. By integrating essential collaborative functions into a single environment, Group4U aims to reduce cognitive fragmentation and improve task efficiency. The Cognitive Theory of Multimedia Learning (CTML) further strengthens the multimedia design rationale of the application. According to Mayer's theory, users process visual and verbal information through separate but limited cognitive channels, making efficient information presentation critical for effective interaction (Mayer, 2024). Although Group4U is not a direct instructional content delivery application, multimedia design principles remain relevant in structuring user interaction. Principles such as coherence, signaling, and spatial contiguity support the design of clean interfaces, meaningful visual cues, and logically grouped interface components, helping users navigate collaborative tasks with reduced confusion and improved usability (Mayer & Moreno, 1998). From a system development perspective, usability and interaction quality are equally important to technical functionality. User-Centered Design (UCD) provides a practical framework for ensuring that application development remains aligned with actual user needs, behaviors, and expectations (Baxter et al., 2015; Still & Crane, 2017; Quezada et al., 2021). In mobile application environments, where screen limitations and interaction constraints directly affect user experience, iterative user involvement becomes particularly important.

Collectively, these theoretical and design foundations establish a strong academic basis for the development of Group4U as a structured academic collaboration platform. Rather than functioning merely as a communication application, the proposed system is grounded in collaborative learning theory, multimedia interaction principles, cognitive efficiency considerations, and usability-centered mobile application design practices.

RELATED WORK

A review of existing literature indicates growing research interest in mobile-supported collaborative learning, educational communication platforms, and usability-oriented mobile application design. Previous studies have demonstrated the potential of mobile technologies in enhancing communication, collaborative engagement, and learning interaction across educational contexts. Nevertheless, many existing solutions differ significantly in terms of design focus, system functionality, and alignment with academic group workflow requirements. Some studies emphasize communication enhancement, while others focus on conceptual frameworks or usability evaluation without providing fully integrated collaborative systems. To further position the contribution of the present study, Table 1 compares selected previous studies according to their platform or system, main contribution, strengths, and limitation.

Table 1

Comparative Analysis of Existing Mobile Collaborative Learning Studies and Group4U

Study	Platform / System	Main Contribution	Strengths	Limitations

Lee (2011)	Mobile collaborative learning conceptual framework	Proposed early conceptual model for mobile collaborative learning	Established theoretical foundation for MCL	Conceptual only; no implemented usable system
Cheong et al. (2012)	Android collaborative learning application	Developed mobile collaborative study application for students	Demonstrated feasibility of mobile academic collaboration	Limited functionality; outdated mobile interaction design
Treethong et al. (2020)	Mobile group chat platform	Investigated social interaction effects in team collaboration	Improved communication and social cohesion	Focused mainly on communication, lacking task management
Wang et al. (2022)	Mobile social applications	Examined impact of mobile social apps on collaborative learning satisfaction	Strong evidence for communication effectiveness	No integrated academic workflow management
Johnson et al. (2022)	Mobile educational app usability review	Reviewed usability practices in educational mobile applications	Strong usability evaluation recommendations	Did not propose a specific collaborative system
Saccardi et al. (2023)	Peer-support group work systems	Identified common student group work problems	Strong needs analysis insights	Focused on assessment support rather than collaboration platforms
Sergeeva et al. (2025)	Meta-analysis of MCL studies	Evaluated effectiveness of mobile-supported collaborative learning	Strong empirical evidence supporting MCL adoption	High contextual variability; lacks platform-specific guidance
Group4U Mobile Application	Mobile academic collaboration application	Integrates communication, task management, progress monitoring, and document sharing for university group assignments using a User-Centered Design approach	Domain-specific academic workflow; integrated collaboration functions; user-centered iterative development; usability evaluation	Currently evaluated within a single university with a limited sample; further large-scale technical and longitudinal evaluation is required

The comparative analysis in Table 1 indicates that existing studies have established important foundations for mobile-supported collaborative learning, but several gaps remain in translating these findings into an integrated, domain-specific academic collaboration platform. Early work by Lee (2011) established a conceptual foundation for mobile collaborative learning, while Cheong et al. (2012) demonstrated the feasibility of implementing mobile collaborative learning through an Android-based application. Subsequent studies have further emphasized the importance of communication, social interaction, usability, and collaborative learning effectiveness (Treethong et al., 2021; Wang et al., 2022; Johnson et al., 2022; Sergeeva et al., 2025). However, the existing body of work remains fragmented across conceptual frameworks, communication-oriented systems, usability investigations, and broader evaluations of mobile collaborative learning. In particular, the reviewed studies provide limited evidence of a unified mobile platform that integrates communication, task management, progress monitoring, and document sharing specifically around the workflow of university group assignments. This gap is further supported by Saccardi et al. (2023), who highlighted persistent challenges in student group work but focused primarily on assessment-related support rather than an integrated collaboration platform.

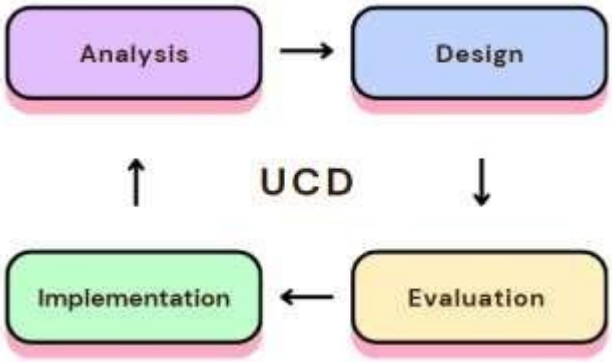
Against this background, the novelty of Group4U lies primarily in its domain-specific integration and user-centered design rather than in introducing entirely new individual technological functions. Group4U consolidates core academic collaboration activities such as including group communication, task management, progress monitoring, and document sharing within a single mobile environment specifically designed for university group assignments. Technically, this integrated approach addresses the fragmentation associated with using multiple general-purpose applications for different aspects of group work. From a pedagogical and educational perspective, Group4U is designed around the workflow of academic group assignments, enabling students to coordinate tasks, communicate with group members, monitor progress, and manage shared resources within a common environment. Furthermore, the application was developed using a User-Centered Design approach, in which user and expert feedback was incorporated through formative evaluation before the final usability evaluation. Therefore, the contribution of Group4U extends beyond the development of another mobile communication application by demonstrating how domain-specific requirements, integrated collaboration functions, and user-centered design principles can be combined to support a more structured academic group-work environment.

RESEARCH METHODOLOGY

The development of Group4U adopted the User-Centered Design (UCD) approach as the primary development methodology to ensure that the mobile application was closely aligned with the needs, expectations, and interaction behaviors of its intended users**.** UCD is a widely recognized design methodology that prioritizes end users throughout the system development lifecycle by emphasizing human factors, usability, and iterative feedback in the design process (Baxter et al., 2015). Rather than focusing solely on technical functionality, UCD ensures that system design decisions are grounded in real user requirements, usage contexts, and behavioral patterns. As a human-centered methodology, UCD involves active user participation across multiple development stages, including requirement elicitation, interface prototyping, usability evaluation, and iterative refinement. This approach enables developers to better understand user cognitive processes such as perception, problem-solving, memory, and interaction behavior, which directly influence how users engage with digital systems. By continuously incorporating user feedback, UCD reduces the risk of design mismatches between system functionality and actual user**.** The adoption of UCD was particularly appropriate for the development of Group4U, as academic collaboration applications require intuitive interaction, efficient workflow management, and seamless usability within mobile environments characterized by interface constraints and frequent user interaction. Given that university students often engage in dynamic collaborative activities involving communication, task coordination, and document sharing, a user-centered development process was essential to ensure that the proposed solution addressed practical collaboration challenges while maintaining usability and interaction efficiency expectations, ultimately improving usability, accessibility, and overall user experience (Still & Crane, 2017).

Figure 1

The Phases of UCD Methodology



Analysis

The analysis phase served as the initial stage of the User-Centered Design (UCD) process, focusing on the identification and interpretation of system requirements, user needs, and functional objectives for the proposed Group4U mobile application. This phase aimed to establish a clear understanding of the challenges associated with academic group collaboration and to define how the application could effectively support students in managing collaborative academic tasks. A key activity in this phase involved user requirement analysis, where the characteristics, expectations, and behavioral patterns of the target users were examined. Since the intended users of Group4U were university students engaged in collaborative academic projects, the analysis focused on understanding their existing collaboration practices, communication habits, task coordination challenges, and common workflow inefficiencies. This process enabled the identification of recurring pain points such as fragmented communication, weak task accountability, limited progress visibility, and inefficient document coordination. To further strengthen user understanding, persona development was employed as a user modeling technique to represent typical target users based on their needs, expectations, and interaction contexts. Personas helped translate abstract user requirements into concrete design considerations, ensuring that system functionality remained aligned with realistic academic usage scenarios. In addition, contextual inquiry and literature review were conducted to provide deeper insights into collaborative learning challenges and existing mobile collaboration practices. Informal interviews with relevant users were also undertaken to capture practical perspectives regarding current difficulties in managing academic group assignments. The findings from this analysis phase informed the formulation of functional and non-functional requirements, which served as the foundation for the subsequent design and development stages of the Group4U application.

Table 2

Functional and Non-Functional Requirements

No	Requirement ID (Functional)	Requirement Description	Priority
1.	FR_1	Features to-do lists, task reminders, & progress tracking.	M
2.	FR_2	Features sticky notes & discussion boards/forums.	M
3.	FR_3	Features file sharing, editing & document organization.	M

4.	FR_4	Features notifications deadlines alert.	M
5.	FR_5	Provide workspace sharing links to enable collaboration.	D
6.	FR_6	Multiple group assignment workspace.	D
7.	FR_7	Personal editable organize space.	O

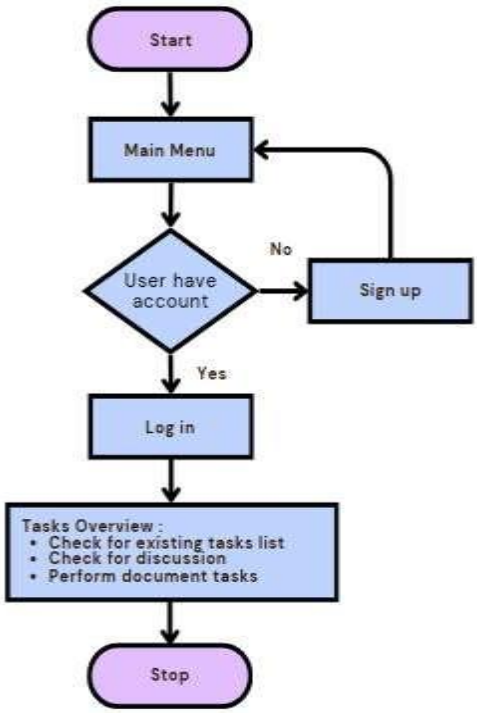
No	Requirement ID (Non-Functional)	Requirement Description	Priority
1.	NR_1	Users can create personal accounts.	M
2.	NR_2	Quick response times, even with high user activity	M
3.	NR_3	Support multiple user groups simultaneously.	M
4.	NR_4	Data encryption, user authentication, and privacy controls.	M
5.	NR_5	User friendly interface to enhance user experience.	D
6.	NR_6	The app shall be developed for the Android platform.	D
7.	NR_7	Regular updates shall be released to ensure compatibility.	O

Design

In the design phase, insights obtained from the analysis stage were translated into the application's interface structure, functional architecture, and interaction design. Based on the identified user requirements, the Group4U mobile application was designed to incorporate essential collaborative features while ensuring usability and workflow efficiency. The expected user interaction workflow was first modeled through a task flow diagram to illustrate the sequence of daily collaborative activities supported by the system, as presented in Figure 2. This workflow visualization helped define the logical structure of user interactions and core functional processes within the application.

Figure 2

User Requirement Analysis Process



Subsequently, low-fidelity wireframes and prototype interfaces were developed to visualize the application layout, navigation structure, and key functionalities before implementation, as shown in Figure 3. This iterative design process enabled early refinement of interface components and ensured alignment between usability expectations and system functionality prior to full application development (Almani & Alrwais, 2024). The Group4U application begins with the Login and Sign-Up interface, which serves as the initial access point for users to securely enter the platform. This interface was designed to provide a user-friendly and secure authentication process, ensuring convenient access without compromising system security. As illustrated in Figure 4, the interface offers two primary options: Login for existing users and Sign-Up for new users who wish to register for the platform. The login interface requires users to enter their registered email address and password, while the sign-up process guides new users through account creation by collecting essential information such as name, email address, and secure password credentials.

Figure 3

Low Fidelity Prototype



Figure 4

Login and Sign-up Interface of Group4U: Academic Collaboration Forum



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To enhance usability and onboarding experience, both interfaces were designed with a clean and intuitive layout, incorporating clear labels, responsive input fields, and appropriate system feedback for successful actions or input validation errors. Accessibility and user convenience were also considered through supportive interface features such as password visibility toggles, allowing users to interact with the authentication process more efficiently.

Figure 5

Profile, Group Menu, and User Settings interface

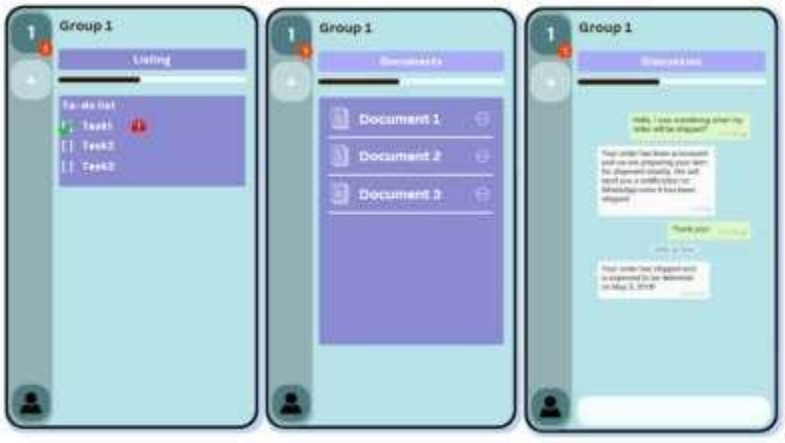


As illustrated in Figure 5, the *Profile, Group Menu, and User Settings* interfaces were designed to support efficient navigation and user management within the Group4U: Academic Collaboration Forum application. These interfaces provide users with access to key system functionalities, including profile management, collaborative tools, and group-related settings. The Profile interface allows users to view and manage their personal information, edit profile details, and securely log out of the application. The Group Menu interface serves as the central navigation hub, enabling users to access core collaborative features such as Task Listing, Document Sharing, and Discussion Channel, which support academic group coordination and communication.

Meanwhile, the User Settings interface provides administrative controls for managing group-related configurations and user preferences, allowing users to make necessary adjustments to support collaborative activities more effectively.

Figure 6

Tasks Listing, Document Sharing, and Discussion Channel interface



As illustrated in Figure 6, the *Tasks Listing, Document Sharing, and Discussion Channel* interfaces were designed to support the core collaborative functionalities of the Group4U: Academic Collaboration Forum application. These interfaces provide users with structured access to essential academic collaboration tools, enabling efficient task coordination, document management, and group communication. The Tasks Listing interface allows users to review, monitor, and update their assigned tasks, supporting better task organization and progress tracking within group projects. The Document Sharing interface enables users to access, manage, and edit shared documents, facilitating centralized file organization and collaborative resource management. Meanwhile, the Discussion Channel interface supports real-time communication among group members, allowing users to exchange messages and coordinate academic activities more effectively. Collectively, these interfaces were designed to provide an integrated collaborative environment that enhances workflow efficiency and group interaction.

Evaluation

Following the design phase, a formative evaluation was conducted to identify usability issues and obtain feedback before the implementation of the refined Group4U application. The formative evaluation involved six participants, comprising three multimedia experts and three university students representing the intended target users. The multimedia experts were selected based on their relevant experience in human-computer interaction, interface design, mobile application development, and usability evaluation, while the student participants were included to provide feedback from the perspective of actual university users engaged in academic group work. Participants were first briefed on the purpose, key features, and intended users of Group4U before interacting with the prototype. The evaluation was conducted through individual feedback sessions using semi-structured questions focusing on six areas: interface design, navigation, consistency, functionality, clarity of system feedback, and overall ease of use. The questions

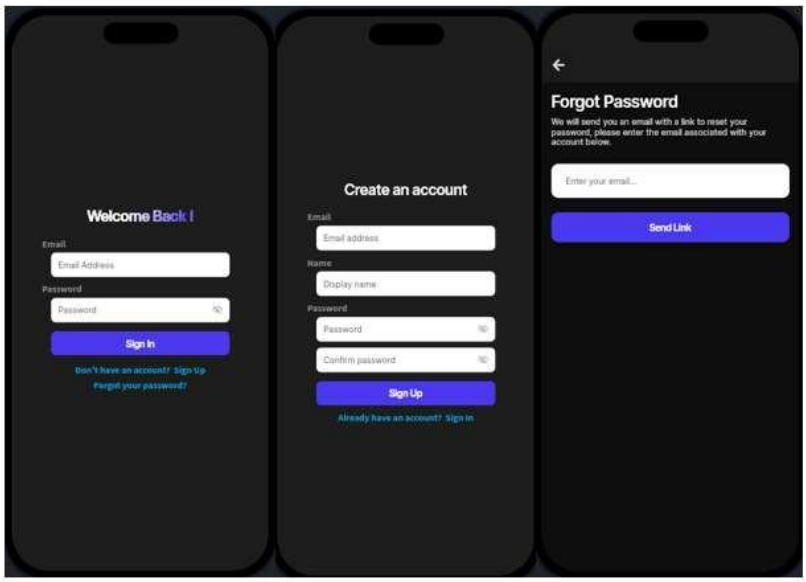
examined aspects such as visual layout, consistency of colours, icons and typography, ease of navigation, interaction patterns, functionality of core features, clarity of system feedback, and suggestions for improving the user experience. The feedback obtained from the formative evaluation was documented through notes and, where permitted, audio recording. The responses were reviewed and organized according to recurring usability themes and identified design issues. The findings were then summarized to identify the strengths, weaknesses, and improvement recommendations for the prototype. The feedback was subsequently used to guide the refinement of the next Group4U iteration. Key recommendations included clearer group identification, improved guidance for first-time users, multimedia file and image sharing in discussion channels, and accessibility-related enhancements such as a light theme option. This process ensured that the design decisions for the subsequent application iteration were informed by expert evaluation rather than solely by developer assumptions.

Implementation

In this phase, the validated Group4U prototype was transformed into a fully functional Android-based mobile application. The implementation process involved integrating the finalized interface design and core collaborative functionalities into an operational system that could be evaluated by the intended users. For this process, the Group4U mobile application was developed using Android Studio as the primary integrated development environment (IDE), with Firebase utilized to support backend services such as user authentication, real-time database synchronization, and cloud-based data management. These technologies were selected due to their compatibility with Android mobile application development, scalability, and support for real-time collaborative functionalities required by the proposed system. The chosen development environment enabled efficient integration of core features including user management, group communication, task coordination, and document sharing within a unified mobile platform. The developed application was introduced to the target users, including university students, as well as academic evaluators, to demonstrate its intended purpose, functionality, and usability within the context of academic group collaboration. Upon initial access, the application presents the Login and Sign-Up interface for secure user authentication, as illustrated in Figure 7. Existing users can log in using their registered credentials, while new users are guided through the registration process to create an account before accessing the platform's collaborative features. A Forgot Password function was also implemented to support account recovery, allowing users to reset their credentials when necessary. These authentication features were designed to ensure secure access while maintaining usability and convenience for users engaging in academic collaboration activities.

Figure 7

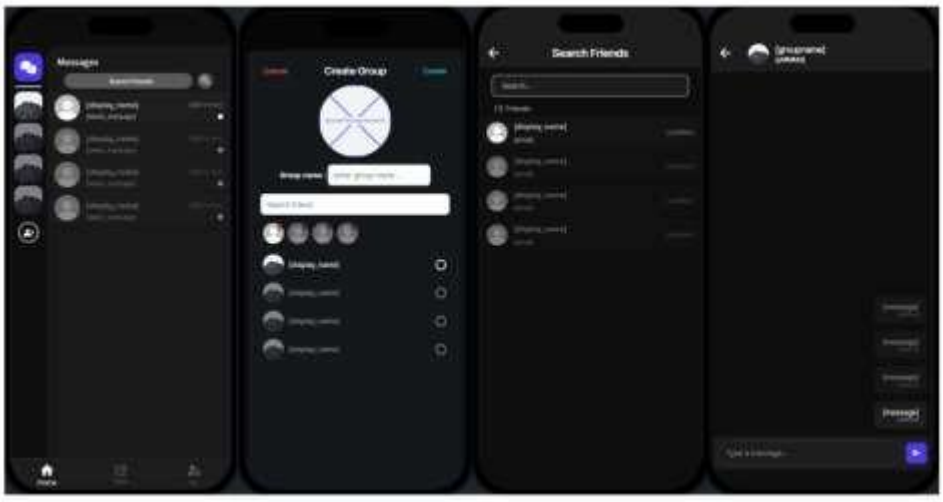
Login Interface, Sign-Up Interface and Forgot Password Interface



Following successful authentication, users are directed to the Home Interface of the Group4U mobile application, as illustrated in Figure 8. This interface serves as the primary interaction hub, providing users with access to essential collaborative features including discussion channels, friend management, group creation, task access, and profile navigation. Existing group conversations are displayed to allow users to quickly continue ongoing academic discussions and collaborative activities. The Home Interface also includes Add Friends and Search Friends functionalities, enabling users to efficiently locate and connect with other users within the platform. In addition, the Create Group function allows users to initiate new collaborative groups through a pop-up interface where group names can be defined and members selected. To support intuitive navigation, a bottom navigation bar provides direct access to the Home, Tasks, and Profile ("You") sections. Collectively, these features establish a centralized entry point for communication, task coordination, and collaborative group management within the academic collaboration environment.

Figure 8

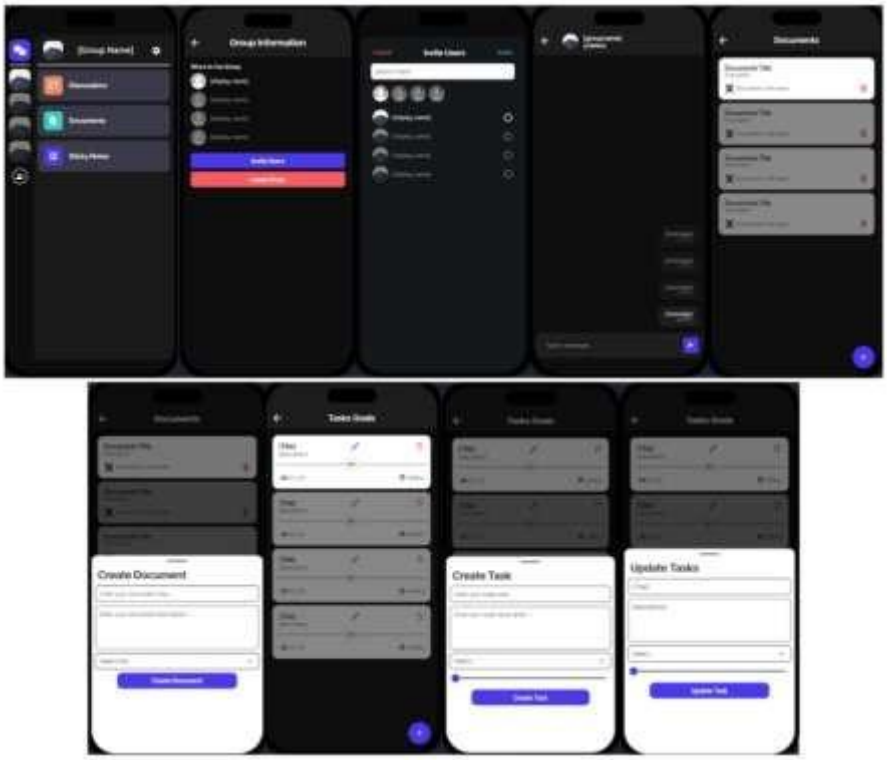
Home Interface, Create Group Pop-up Window, Search Friends and Messages Interface.



Following user login and group selection, users are directed to the Group Interface, which serves as the central collaboration hub within the selected academic group, as illustrated in Figure 9. This interface provides access to three core collaborative modules: Discussions, Documents, and Task Management, enabling users to efficiently coordinate academic activities within a unified environment. Group navigation is further supported through sidebar icons, allowing users to switch between active collaboration groups. The Group Info interface provides group management functionalities, allowing users to view current members, invite additional participants, or leave the group when necessary. The invitation feature includes a searchable pop-up interface to facilitate efficient member selection and group expansion. The Discussion module supports real-time communication among group members, enabling continuous academic interaction and coordination. The Document Sharing module allows users to upload, access, and manage shared academic resources through a centralized repository, improving collaborative file organization. Meanwhile, the Task Management module enables users to create, update, monitor, and delete academic tasks while tracking progress through visual indicators such as progress bars and deadline information. These integrated functionalities collectively enhance collaboration efficiency, communication, and academic workflow management within the Group4U platform.

Figure 9

Group Interface, Group Info Interface, Invite, Chat/Messages Interface, Documents Interface, and Tasks Goals Interface

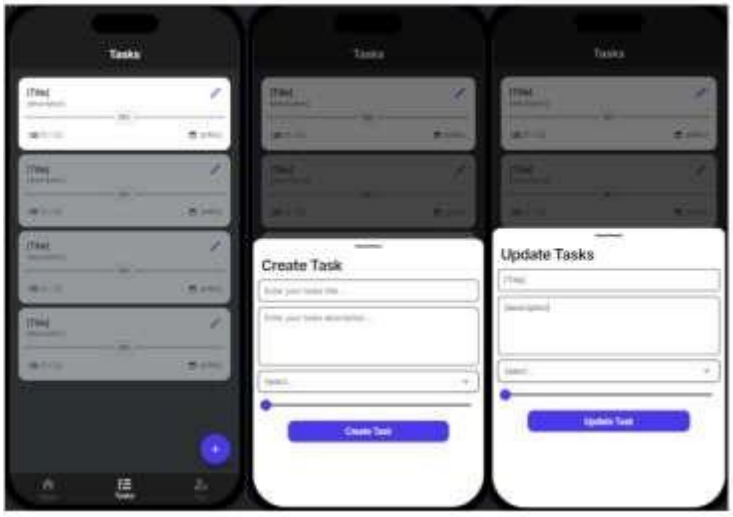


The Tasks module of the Group4U mobile application was designed to support structured academic task management within collaborative group assignments. As illustrated in Figure 10, the interface presents an organized overview of tasks, including key information such as task descriptions, assigned members, progress status, and deadlines. Users can create, update, and

manage tasks through dedicated interfaces that support efficient task coordination and progress monitoring. Visual progress indicators further enhance task visibility and accountability among group members. Collectively, these task management features promote clearer workflow organization, improved coordination, and more effective tracking of academic group activities.

Figure 10

All Tasks Interface, Create Task pop-up window, and Update Tasks pop-up window



EVALUATION OF GROUP4U MOBILE APPLICATION

The summative evaluation was conducted to assess the perceived usefulness, ease of use, and user satisfaction of the Group4U mobile application following the implementation and refinement of the prototype. The evaluation aimed to examine users' perceptions of the application in supporting academic group work, particularly in relation to communication, task coordination, progress monitoring, document sharing, and collaborative workflow management. An adapted version of the USE (Usefulness, Satisfaction, and Ease of Use) questionnaire developed by Lund (2001) was employed as the primary evaluation instrument. The questionnaire items were contextualized to reflect the functions and intended use of Group4U. The evaluation focused on three dimensions: usefulness, ease of use, and user satisfaction.

Respondents Demographic Background

A total of 32 respondents participated in the summative evaluation of the Group4U mobile application, representing the intended target users of the proposed academic collaboration platform. The participants primarily consisted of undergraduate students from Universiti Utara Malaysia (UUM) who were actively involved in collaborative academic group assignments. This respondent group was considered appropriate, as the application was specifically designed to support students in managing communication, task coordination, document sharing, and collaborative academic workflows. In terms of gender distribution, most respondents were female (75.0%, n = 24), while male respondents represented 25.0% (n = 8) of the total sample. Regarding age, most participants were within the 21 to 25 years category, accounting for 96.9% (n = 31) of

the respondents, while 3.1% (n = 1) were aged 26 years and above. No respondents were recorded in the 20 years and below category. This age distribution aligns with the intended user profile, as undergraduate students within this range frequently engage in academic group work and are generally familiar with mobile technologies for communication and task management. With respect to ethnicity, the respondent distribution consisted of Malay participants (68.8%, n = 22), followed by Chinese participants (28.1%, n = 9), and Indian participants (3.1%, n = 1). The inclusion of participants from diverse demographic backgrounds provides broader perspectives on collaborative learning practices, digital interaction experiences, and usability expectations.

Data Collection Procedure

The data collection process was conducted online using Google Forms. Before completing the questionnaire, participants were introduced to the purpose of the evaluation and were required to interact with the Group4U application to gain direct experience with its main functions. Participants then completed the evaluation questionnaire based on their experience using the application. The questionnaire included a participant consent statement, demographic questions, and usability evaluation items. The responses collected through Google Forms were subsequently organized for analysis. This procedure ensured that the evaluation responses were based on participants' direct interaction with the Group4U application rather than solely on their initial expectations of the system.

Evaluation Instrument

The evaluation instrument was adapted from the USE (Usefulness, Satisfaction, and Ease of Use) questionnaire developed by Lund (2001). Selected items were contextualized to reflect the functions and collaborative context of the Group4U application. The questionnaire consisted of 15 usability items divided equally into three dimensions: Usefulness, Ease of Use, and Satisfaction, with five items for each dimension. The Usefulness dimension examined users' perceptions of the application's usefulness, control over activities, task completion, time-saving benefits, and ability to meet their needs. The Ease-of-Use dimension assessed ease of use, user-friendliness, effortless interaction, the need for instructions, and interface consistency. The Satisfaction dimension examined overall satisfaction, willingness to recommend the application, perceived system performance, perceived need, and pleasantness of use. All usability items were measured using a five-point Likert scale ranging from 1 to 5, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. The five-point scale was used to capture the degree of participants' agreement with each statement regarding the usefulness, ease of use, and satisfaction of the Group4U application. On the other hand, the ethical clearance for the study was obtained from the relevant authority at the School of Multimedia Technology and Communication, Universiti Utara Malaysia, prior to data collection. Participants were informed about the purpose of the study and their participation was voluntary, with informed consent obtained before completing the evaluation.

Results of Usefulness, Satisfaction, and Ease of Use of the Group4U Mobile Application

The summative evaluation findings are presented according to the three dimensions of the USE framework: Usefulness, Ease of Use, and Satisfaction. To provide a clearer representation of the

findings, the percentage of positive responses for each evaluation item is presented together with its corresponding descriptive interpretation. For this study, percentage scores of 80–100% are interpreted as very high, while scores of 60–79.9% are interpreted as high.

Table 3

User feedback of Group4U Mobile Application (Usefulness)

Usefulness Dimension	Positive Response (%)	Interpretation
Meets users' collaboration needs	81.3	Very High
Supports task management	78.1	High
Simplifies collaborative work	78.1	High
Overall usefulness	75.1	High
Saves users' time	71.9	High

Table 3 shows that Group4U received generally high to very high perceptions across the usefulness dimension. The highest percentage was observed for the application's ability to meet users' collaboration needs (81.3%), indicating that participants generally perceived the functions provided by Group4U as relevant to their academic group work. The relatively high ratings for task management and simplification of collaborative work (78.1% each) further suggest that integrating academic collaboration functions within a single platform may provide a more structured approach to managing group activities. This finding is consistent with previous studies highlighting the role of mobile-supported platforms in facilitating communication, information sharing, and collaborative learning. In relation to the constructivist perspective underpinning this study, the findings suggest that digital environments that facilitate communication and shared task activities can support the social and collaborative processes involved in academic learning. However, the comparatively lower rating for time-saving benefits (71.9%) indicates that the availability of integrated functions does not necessarily translate directly into perceived efficiency. This may suggest that some workflows require further simplification or that users need additional familiarity with the application before experiencing its full efficiency benefits.

Table 4

User feedback of Group4U Mobile Application (Ease of Use)

Ease of Use Dimension	Positive Response (%)	Interpretation
User-friendly	78.1	High
Overall ease of use	78.1	High
Interface consistency	78.1	High
Effortless to use	75.0	High
Can be used without written instructions	71.8	High

Table 4 indicates that Group4U was generally perceived as easy to use, with all items receiving high levels of positive responses. User-friendliness, overall ease of use, and interface consistency recorded the highest ratings at 78.1%. These findings suggest that the application provided a relatively coherent interaction

experience and that users could understand and navigate its main functions without substantial difficulty. The finding is particularly relevant to the User-Centered Design approach adopted in this study, as the iterative design process emphasized alignment between system functionality and user requirements. Consistent interface structures may also help reduce unnecessary cognitive demands when users interact with different collaboration functions. However, the lowest rating within this dimension concerned the ability to use the application without written instructions (71.8%). This suggests that although the application was generally perceived as user-friendly, some users may still require initial guidance when interacting with certain features. Interestingly, this finding corresponds with the formative evaluation, where feedback highlighted the potential value of guided support for first-time users. Therefore, future iterations could incorporate clearer onboarding guidance, contextual instructions, or walkthrough features to improve first-time usability.

Table 5

User feedback of Group4U Mobile Application (Satisfaction)

Satisfaction Dimension	Positive Response (%)	Interpretation
Willingness to recommend	81.3	Very High
Pleasant to use	81.3	Very High
Overall satisfaction	75.0	High
Works as expected	75.0	High
Perceived necessity	71.9	High

Table 5 demonstrates that participants generally reported favourable satisfaction with Group4U. The highest ratings were observed for willingness to recommend and pleasantness of use, both at 81.3%, suggesting that participants generally had a positive experience when interacting with the application. The relatively high level of overall satisfaction and perceived system performance (75.0% each) further indicates that the application was broadly aligned with users' expectations. However, the comparatively lower rating for perceived necessity (71.9%) provides an important consideration. Although participants recognized the usefulness of Group4U, they may not yet perceive it as essential because they are already familiar with general-purpose communication, file-sharing, and productivity platforms. Therefore, positive satisfaction should not be interpreted as evidence of immediate adoption or replacement of existing tools. Instead, future development should strengthen the academic-specific value of Group4U by emphasizing functions and workflows that are not readily available in fragmented general-purpose applications. Overall, the findings demonstrate that Group4U was positively perceived across all three USE dimensions. Usefulness and satisfaction recorded positive response ranges of 71.9%–81.3%, while ease of use ranged from 71.8% to 78.1%. The findings indicate that users generally viewed the application as useful, easy to use, and satisfactory. Nevertheless, the results also reveal specific areas for further improvement, particularly perceived time-saving benefits, independent use without instructions, and perceived necessity. These findings suggest that future refinement should focus not only on adding functionality but also on simplifying workflows, strengthening onboarding, and establishing a clearer value proposition for academic collaboration.

LIMITATION OF STUDY

Despite these contributions, several limitations should be considered when interpreting the findings. First, the summative evaluation involved 32 participants from a single higher education institution, Universiti Utara Malaysia, which limits the generalizability of the findings to students from other universities, academic disciplines, and educational contexts. Furthermore, the respondent profile was highly concentrated within the 21–25 age group, with 31 of the 32 participants belonging to this category. Although this profile broadly corresponds with the intended undergraduate user group, the limited demographic variation restricts the extent to which the findings can represent users with different levels of digital experience, academic backgrounds, and user characteristics. Second, the evaluation focused primarily on perceived usability through usefulness, ease of use, and satisfaction rather than objectively measuring academic achievement, task completion efficiency, or actual improvements in group collaboration. Therefore, the favourable usability findings should be interpreted as evidence of positive user perceptions rather than definitive evidence that Group4U improves academic collaboration effectiveness. Third, from a technical development perspective, the current version of Group4U represents a functional mobile application developed within the scope and resources of the study. Consequently, the evaluation did not comprehensively examine longer-term technical performance aspects such as scalability under a larger number of concurrent users, extensive server or database load, cross-device compatibility, and long-term system stability. The current implementation was also primarily focused on the core academic collaboration functions rather than a comprehensive production-level deployment. These technical considerations may affect the application's performance when implemented on a larger scale and should therefore be addressed in subsequent development.

CONCLUSION

This study addressed the challenges associated with fragmented communication, task coordination, progress monitoring, and document management in university group assignments through the design and development of Group4U, a mobile academic collaboration application. The study specifically aimed to (1) design and develop Group4U based on the identified needs and requirements of university students engaged in academic group work, and (2) evaluate the usability of the application in terms of usefulness, ease of use, and user satisfaction. Guided by a User-Centered Design methodology, the development process incorporated user requirements analysis, interface and prototype design, formative evaluation, implementation, and summative usability evaluation. This iterative process enabled feedback from users and experts to be considered during the refinement of the application before the final usability evaluation.

The summative evaluation demonstrated generally favourable perceptions across the three dimensions of the adapted USE framework. Participants perceived Group4U as useful for supporting academic group activities, relatively easy to use, and satisfactory from an end-user perspective. The findings particularly indicate that integrating communication, task management, progress monitoring, and document-sharing functions within a single mobile environment can provide a more structured approach to managing academic group work. However, the findings also identified areas requiring further refinement, particularly in relation to perceived time-saving

benefits, first-time user guidance, and the perceived necessity of the application. These findings reinforce the importance of not only providing functional features but also ensuring that the interaction workflow and user experience are sufficiently intuitive and aligned with students' existing collaboration practices. From a research and development perspective, this study contributes to multimedia and mobile application development by demonstrating the application of User-Centered Design in the development of a domain-specific academic collaboration platform. Unlike general-purpose communication and productivity applications that typically provide fragmented functions across different platforms, Group4U integrates core academic collaboration activities within a unified mobile environment. The study also contributes empirical usability findings that provide practical insights into how usefulness, ease of use, and satisfaction can be considered when designing mobile applications for higher education group work. Unlike general-purpose communication and project management platforms that typically provide isolated collaboration functions, Group4U integrates communication, task management, progress monitoring, and document sharing within a unified workflow specifically structured around university group assignments. This domain-specific integration represents the primary practical novelty of the application and provides a more focused environment for managing academic group work. More importantly, the formative and summative evaluation stages demonstrate the value of incorporating user feedback throughout the development process rather than relying solely on developer-driven design decisions. Overall, the study provides a foundation for further development of user-centered mobile collaboration systems that are specifically tailored to the requirements and workflows of academic group assignments.

FUTURE WORK

Future research should address these limitations by conducting evaluations with larger and more diverse samples across multiple higher education institutions and academic disciplines. Such studies would provide greater variation in user characteristics and enable more meaningful examination of the application's applicability across different educational contexts. Future evaluation should also incorporate task-based and longitudinal approaches to examine actual changes in collaboration behaviour, task coordination, communication efficiency, and group task completion rather than relying solely on perceived usability measures. From a technical development perspective, future iterations should investigate system scalability, database and server performance, cross-device compatibility, security, and long-term system stability under larger user loads. Further enhancement of the application should also focus on improving onboarding and first-time user guidance, simplifying interaction workflows, and strengthening academic-specific collaboration features. These improvements would establish a stronger technical foundation and clearer value proposition for Group4U while providing a more robust basis for evaluating its effectiveness in supporting sustained academic collaboration.

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AUTHOR CONTRIBUTIONS

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by all authors.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Informed consent was obtained from all individual participants included in the study.

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